Chapter 3. Affected Environment and Environmental Consequences

Introduction

The primary purpose of chapter 3 is to present the scientific and analytical basis for comparing the alternatives presented in chapter 2.

This chapter describes the biological, physical, and social environments on the Shoshone and the surrounding area. These descriptions include such topics as plant and animal life, topography, climate, and current socio-economic conditions. The chapter is divided into three major environmental element categories:

- Biological and Physical Elements
- People and Communities
- Infrastructure and Land Uses

Each category is further subdivided. For example, Biological and Physical Elements is subdivided into various topics including: water and soil; air; vegetation, and others. For each topic, the applicable statutory requirements, and the affected environment and environmental consequences are discussed.

Many additional items were screened out of the analysis process. Reasons for eliminating them include the following:

- Analysis of the item was not considered important to the integrity of the Forest environment.
- Analysis of the item would not disclose direct or indirect effects of the Forest Plan to the environment.
- Analysis of the item was not acknowledged or required by law.

Environmental Consequences

This section describes the direct, indirect, and cumulative effects on the environment resulting from activities. It also describes estimated output levels for the alternatives. If a resource management activity has no direct or indirect effect on a particular environmental element under any of the alternatives, there is no discussion. Effects are discussed under the individual resource headings (e.g., Air Quality, Heritage, Wildlife, etc.) in this chapter. Cumulative effects are also summarized in table 20.

Direct environmental effects are those that occur at the same time and place as the initial action. An example would be on-site soil compaction from rubber-tired skidders harvesting timber.

Indirect environmental effects are caused by the action, but occur later in time or are spatially removed from the action. An example would be downwind effects of a power plant on air quality.

Cumulative effects are a combination of the effects of an alternative combined with the effects of past, present, and reasonably foreseeable future activities undertaken by either the Forest Service or other parties. In each resource section in this chapter, the cumulative effects discussion defines the cumulative effects analysis area for the resource and how each cumulative effects analysis is bounded in time. Unless a different time period is defined, reasonably foreseeable future actions are considered for the expected life of the revised Forest Plan (10 to 15 years into the future). Since the revised Forest Plan is a programmatic document, the reasonably foreseeable actions considered are also largely programmatic in nature.

The cumulative effects estimated in the FEIS are noted under each section with the variance by alternative noted. The cumulative effects boundary analyzed is discussed by section. The effects are summarized in table 20. Because of the different resources involved and different effects measurements, this is not a quantitative discussion, but a narrative of the revised Forest Plan's cumulative impact upon the environment.

Table 20. Past, present, and reasonably foreseeable actions for the cumulative effects analysis

Project/Action	Location	Description
Past Activities		
Vegetation changes	Forest-wide	The current condition of the forest resulting from past natural events and planned activities is described in the affected environment for vegetation. Past harvest volumes for the forest are described in the affected environment for timber. Past wildfire acres are described in the affected environment for fire and fuels. Table 21 displays the vegetation management activity for the past 10 years. Acres of timber stands impacted by bark beetles are described in the affected environment section for insects and disease. Impacts of white pine blister rust on white pines are described in the affected environment section for insects and disease.
Fire suppression	Forest-wide	Fire suppression activities have changed fire regimes and condition classes, particularly in some lower elevation vegetation types. This is described in the affected environment for fire and fuels.
Roads	Forest-wide	Changes in system roads miles since 1986 are described in the affected environment for roads.
Livestock Grazing	Forest-wide	Levels of past permitted livestock use are described in the affected environment for commercial livestock grazing.
Non-native species	Counties	Acres of invasive plants on the Forest are described in affected environment for invasive species. Areas of aquatic invasive species on or near the forest are described in affected environment for invasive species.
Predator management north western Wyoming	Forest-wide	Presence and expansion of large predators impacts livestock operations on the Forest.

Table 20. Past, present, and reasonably foreseeable actions for the cumulative effects analysis

Project/Action	Location	Description
Water quality and aquatic habitats	Forest-wide	Watershed conditions and assessments of those conditions are discussed in the affected environment for soil and water. The condition of riparian areas and influence of past management activities on that condition is described in the affected environment for riparian/wetlands.
Recreation	Forest-wide	Motorized recreation technology has changed and is changing use patterns and participation.
Development	Adjacent to Forest	Subdivisions and individual homes have been developed adjacent to the Forest.
Climate change	Regionally and Nationally	See discussion below
Present/Reasonably Foreseeable Actions		
Vegetation changes	Forest-wide	A large number of vegetation treatment projects have been planned on the forest and are scheduled to be completed over the next 5 to 10 years. Table 21 displays the project acres which are currently through NEPA or are in the NEPA process. The majority of these projects will be implemented during the planning period. The current bark beetle epidemic will continue. This is described in the affected environment for insects and disease. The white pine blister rust will continue. This is described in the affected environment for insects and disease. Wildfires will occur. Projections are described in the affected environment for fire and fuels.
County management plans	Area Counties	County plans provide a framework for lands within the county (e.g., zoning, community growth, county facilities)
Bureau of Land Management Plans	Adjacent to Forest	These plans guide management of BLM lands. The Lander RMP was finalized in 2013, and the Big Horn Basin RMP will be finalized in 2014. Specific actions on lands adjacent to the Shoshone that may have cumulative effects include: Travel management decisions that restrict use to designated routes. ACEC designation (Areas of Critical Environmental Concern) along Forest boundary. Identification of areas along the Forest boundary that are not open to oil and gas development. Wild and scenic rivers recommendations on rivers that enter BLM lands from the Forest.
Minerals	Forest-wide and region	One application for drilling was processed on the Forest. It is currently under review by the BLM. If the operation results in a discovery of recoverable oil or gas there could be additional interest in oil and gas leasing on the Forest. Many areas off the Forest are active in oil and gas development. These activities will impact air and other resources on the Forest.
Changing demographics of populations	Region and Nationally	Relevant to recreation. Use by an aging population is likely to increase proportionately faster than other demographic groups. Will likely lead to increase demand for recreation opportunities on the developed end of the recreation opportunity spectrum.

Table 20. Past, present, and reasonably foreseeable actions for the cumulative effects analysis

Project/Action	Location	Description
Yellowstone snowmobile use	Greater Yellowstone Area	Continued restrictions on snowmobile use in Yellowstone National Park could increase demand for snowmobile use on the Forest.
Timber harvest on adjacent lands	4-county area	Timber harvest on adjacent state, BLM, Wind River Reservation, Forest Service, and private lands will likely continue in response to the bark beetle epidemic and other scheduled timber harvest objectives.
Recreation	Forest-wide	Motorized recreation technology will change and influence use patterns and participation.
Development	Adjacent to Forest	Subdivisions and individual homes will continue to be developed adjacent to the Forest.
Non-native species	Counties	New infestations of invasive plants will become established on the Forest.

Table 21. Acres of vegetation treatments accomplished (2002–2011) and planned (pending implementation)

	Total acreage mechanical treatment and burning treatment	Mechanical treatments			Burning treatments	
		Commercial timber harvest	Timber stand improvement	Other mechanical	Prescribed fire	Burning of activity fuel piles
Accomplished 2002–2011	48,898	12,853	7,433	3,059	27,886	12,047
Planning complete, pending implementation	70,977	12,636	794	2,977	57,367	3,091

Climate Change

The mission of the Forest Service, U.S. Department of Agriculture (USDA), is to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations. Americans rely on their forests and grasslands for a wide range of benefits—for provisioning services such as water, wood, and wild foods; for regulating services such as erosion, flood, and climate control; and for cultural services such as outdoor recreation, spiritual renewal, and aesthetic enjoyment. These services are connected and sustained through the integrity of the ecosystems on these lands.

Climate change places those ecosystems at risk. Most of the urgent forest and grassland management challenges of the past 20 years, such as wildfires, changing water regimes, and expanding forest insect infestations, have been driven, in part, by a changing climate. Future impacts are projected to be even more severe. Managing America's forests and grasslands to adapt to changing climates will help ensure that they continue to produce the benefits that Americans need while helping to mitigate the effects of a changing climate and to compensate for fossil fuel emissions through carbon storage in healthy forests (USDA Forest Service 2010a).

The following information is excerpted from the publication *Climate Change on the Shoshone National Forest, Wyoming: A Synthesis of Past Climate, Climate Projections, and Ecosystem Implications* (Rice et al. 2012).[6]

Climate is defined as the average weather or, more rigorously, as the statistical description in terms of the mean and variability of relevant quantities (for example, temperature, precipitation, snow, and wind) over a period of time ranging from months to thousands or millions of years (IPCC 2007a). From the paleo (prehistoric) records, we know that climate is constantly changing and that these changes prompt ecosystems to adjust (Whitlock 1993, Lyford et al. 2003). As a natural process, this reactive adjustment is the adaptation that species and ecosystems make in response to environmental changes. Within human systems, adaptation refers to management actions and decisions that help ecological, social, and economic systems accommodate the challenges imposed or seek opportunities that arise from variations in climate and other disturbances (Joyce et al. 2008a).

The effects of climate change on ecosystem structure and function and the benefits humankind receives from natural ecosystem resources and processes (ecosystem services) are functions of the ecological sensitivity to variations in climate, the degree to which the climate changes, and the adaptability of plants and animals (Hassan et al. 2005, Brown et al. 2006, Joyce et al. 2008a). While knowledge of regional and local climates and their variations across the landscape is important for resource management decisions, even more important may be an understanding of the vulnerability and the adaptive capacity of plants, animals, and ecosystems facing a changing climate.

Climate change introduces a significant challenge for land managers and decision makers in the western United States, as climate-related changes of ecosystem behavior (e.g., glacier melt, snow cover, snowpack, beetle outbreaks, length of growing season, and wildfires) are already being documented (Ryan et al. 2008, EPA 2010). The rapid accumulation of scientific information of the effects of climate change over the last 20 years has been challenging for resource managers to effectively incorporate into on-the-ground management. While much information is available, it is difficult to extrapolate research results from other environments to the landscape of interest to resource managers. Also, many existing paradigms (e.g., historic range of variation) and tools (e.g., planting guidelines) assume long-term climate stability, which may no longer be viable.

The Shoshone’s diverse ecosystems and services they provide may experience changes in climate that may or may not be able to adapt. Ecosystem services (benefits we receive from ecosystems) that may be vulnerable to climate change include provisioning services such as water supply and food production, regulating services such as erosion or flood control and carbon storage, cultural services such as recreational benefits, and supporting services such as nutrient cycling that maintain conditions for life on Earth (MEA 2005, Smith 2011). In general, the overall trend indicates that the majority of ecosystem services values decreases as temperature increases (Esposito et al. 2011).

The Shoshone has undergone and adapted to large changes in climate that have spanned thousands of years. Twentieth century warming of 1.8 to 3.6 °F air temperature is expected to continue and accelerate in the next century. The expected changes in climate leave many questions as to how these ecosystems will adapt. Shoshone ecosystems are dynamic and unique components of the Greater Yellowstone Ecosystem whose higher elevations, cooler temperatures, and drier precipitation regime causes ecosystems to function differently than

[6] References in this section can be found in the Rice et al. (2012) report.

surrounding areas, such as Yellowstone National Park. Microclimate conditions in the high elevations of the Shoshone have, and will likely continue to provide, refugia for unique and sometimes rare ecologic components. These high elevations and environmental variability will likely offer opportunities for climate adaptation for some resources or species, while others may be vulnerable to undesirable effects from climate change.

Water resources are particularly vulnerable as warmer temperatures are projected to reduce snowpacks, increase evaporation, lengthen summer seasons, and start spring runoff earlier. Warmer temperatures are likely to lead to reduced streamflows, which are critical to habitat and reservoir storage for agricultural and human uses. However, the potential effects of warmer temperatures may be mitigated or exacerbated by future changes in precipitation, which are more uncertain. Annual precipitation has recently increased at the scale of the Greater Yellowstone Ecosystem, but has decreased at finer scales around the Shoshone. Winter precipitation is projected to increase 10 percent in the Greater Yellowstone Ecosystem and may help offset evaporative losses from higher temperatures and longer summers, but projected temperatures may negate any gains in precipitation. Summer precipitation trends remain uncertain, and future reductions (as projected for the Pacific Northwest) would intensify water shortages at a critical time. Shoshone glaciers are highly vulnerable to climate change, and are projected to disappear early to mid-century, reducing summer flow to glacial-fed streams, increasing sediment and stream temperatures. Shoshone landscapes may be more vulnerable to increased fire occurrence, magnitude, and severity as warmer temperatures cause drier conditions and longer fire seasons.

Shoshone habitats and wildlife that are particularly vulnerable to climate change are alpine ecosystems, wetlands, and species that are stressed, with lower adaptive ability to higher temperatures, or existing at the edge of an environmental tolerance (for example, cold water salmonid Yellowstone cutthroat trout, lynx, pika, aspen, and whitebark pine). The genetic adaptive capacity of these and other species on the Shoshone remains an area of limited information. Grasslands and sagebrush communities on the Shoshone may continue to be vulnerable to conifer encroachment in the short term until increased temperatures and moisture limitations inhibit conifer establishment, especially at lower elevations. Vegetation hosts of insect infestations are likely to remain vulnerable to future outbreaks under warmer temperatures. Shoshone terrestrial and aquatic habitats are expected to remain vulnerable to the spread of some invasive species. Local economic sectors such as agriculture may be vulnerable to the effects of reduced water supply.

Warmer temperatures and longer summers could increase summer tourism but could hinder winter tourism activities. Human activities will likely have a large influence on how Shoshone ecosystems respond in the future, especially regarding fire (fire suppression), nitrogen cycling (increase from oil and gas development), and land use (increasing fragmentation).

Biological and Physical Elements

Water and Soil

Introduction

Watershed condition is integral to all aspects of resource management and use. Good watershed management maintains the productive capacity of soils, protects water quality and quantity, sustains native species, provides beneficial uses, and reduces the threat of flood damage to Forest Service infrastructure and downstream values.

Legal and Administrative Framework

Laws

The **Organic Administration Act of 1897** recognized watersheds as systems to be managed with care to sustain their hydrologic function and secure favorable conditions of water flow.

The **Sustained Yield Forest Management Act of 1944 and the Multiple Use Sustained Yield Act of 1960** allow for the production of multiple quality goods and resources at sustained levels over time, including maintenance of water supplies.

The **Watershed Protection and Flood Prevention Act of 1954** allows for watershed improvement actions that conserve groundwater recharge areas, protect water quality, and work toward flood prevention.

The **Forest and Rangeland Renewable Resources Planning Act of 1974, as amended**, requires an assessment of present and potential productivity of the land. This act contains many references to suitability and capability of specific land areas, to maintenance of land productivity, and the need to protect and, where appropriate, improve the quality of soil and water resources. The act specifies that substantial and permanent impairment of productivity must be avoided and has far-reaching implications for watershed management on national forests.

The **Federal Land Policy and Management Act of 1976** requires that rights-of-way for water-related special uses must include environmental protection specifications.

The **National Forest Management Act of 1976** prevents watershed condition from being irreversibly damaged and protects streams and wetlands from detrimental impacts. Land productivity must be preserved. Fish habitat must support a minimum number of reproductive individuals and be well distributed to allow interaction between populations.

The **Clean Water Act of 1977** is a series of laws that were enacted to restore and maintain the chemical, biological, and physical integrity of the Nation’s waters. There are five required elements:

- Comply with Federal, State, and local water quality laws and rules;
- Control nonpoint source water pollution and meet water quality standards through best management practices;
- Sustain water quality such that it supports State-designated water uses;

- Federal agency leadership in controlling nonpoint sources pollution from managed lands; and
- Rigorous criteria for controlling discharge of pollutants into the Nation's waters.

The **Safe Drinking Water Act Amendments of 1996** provides states with more resources and authority to enact the Safe Drinking Water Act of 1977 and establishes standards for drinking water systems.

Executive Orders

Executive Order 11988 directs Federal agencies to provide leadership and take action on Federal lands to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains. Agencies are required to avoid development on floodplains whenever there are reasonable alternatives and evaluate the potential effects of any proposed action on floodplains.

Executive Order 11990 requires Federal agencies exercising statutory authority and leadership over Federal lands to avoid to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands. Where it is practicable, new construction in wetlands should be avoided. Federal agencies are required to preserve and enhance the natural and beneficial values of wetlands.

Regulation and Policies

Regulations and policies have been passed in support of these laws and require the following:

- Protection of surface resources and productivity from all natural resource management activities (36 CFR 219).
- Limitations on land management activities to protect watershed condition. Forest Service Manual (FSM) 2500 and Forest Service Handbook (FSH) 2500 state policy and direction regarding watershed management.
- Watershed analysis is a part of all planning activities (36 CFR 219, FSM 2500).

Resource Protection Measures

Management activities are guided by Forest Service Handbook 2509.25, Region 2 Watershed Conservation Practices Handbook (WCPH) and Forest Service National Best Management Practice Directives (collectively referred to as: Forest Service Regional and National BMP Directives). The management practices are important parts of meeting desired conditions for soil, aquatic, and riparian resources. Field reviews of the application of best management practices provide information on effectiveness. A summary of the management measures and design criteria included in the WCPH is included in Appendix G.

Activities are also guided by memoranda of understanding with the Wyoming Department of Environmental Quality and the Wyoming State Engineer's Office, and by the Final Phase II Decree covering the United States' Non-Indian Claims in the General Adjudication of All Rights to Use Water in the Big Horn River System and All Other Sources, State of Wyoming.

Monitoring is a part of project planning and implementation. A key part of monitoring is to determine if the mitigations are working and protecting the intended resources. If monitoring shows that designated best management practices aren't adequately protecting the resource, supplemental direction is provided.

Methodology

The Watershed Condition Framework is used to evaluate current conditions and identify watersheds of concern. This model is used in the analysis of alternative effects (USDA Forest Service 2011). Water yield is discussed in general terms.

Spatial and Temporal Context for Effects Analysis

The primary spatial context used for watershed effects analysis is the 6th-level hydrologic unit code[7] (HUC) boundaries. The Forest boundary is used for soil effects analysis. The timeframe of the analysis is 15 years or the life of the revised Forest Plan.

Affected Environment

Water

The condition of a watershed is defined by the biophysical characteristics and processes that affect both the soil and hydrologic functions in a watershed. The condition can range from pristine to severely impaired. The term healthy watershed is often synonymous with functioning properly, and indicates that the watershed is able to capture, store, and release water, sediment, wood, and nutrients within a range of natural variability. They create and sustain habitats that support diverse populations (USDA Forest Service 2011).

The Forest Service Manual (FSM) uses three classes to describe watershed condition and they are relative to the potential natural condition (USDA Forest Service 2004a, FSM 2521.1):

Class 1 watersheds exhibit high geomorphic, hydrologic, and biotic integrity. Class 2 watersheds exhibit moderate geomorphic, hydrologic, and biotic integrity. Class 3 watersheds exhibit low geomorphic, hydrologic, and biotic integrity. Geomorphic integrity can be defined in terms of slope stability, soil erosion, channel morphology, and other upslope, riparian, and aquatic habitat characteristics. Hydrologic integrity relates primarily to flow, sediment, and water-quality attributes. Biotic integrity is defined by the characteristics that influence the diversity and abundance of aquatic species, terrestrial vegetation, and soil productivity. In each case, integrity is evaluated in the context of the natural disturbance regime, geo-climatic setting, and other important factors within the context of a watershed (USDA Forest Service 2011).

There are 147 6th-level hydrologic unit code watersheds that are all or partially on the Shoshone, and based on the above classification. Most of these (89 percent) are considered Class 1 or functioning properly. Of those watersheds functioning properly, typically those in wilderness provide the best reference conditions or attributes of healthy watersheds. Eleven percent are considered functioning at risk, and concerns relate mostly to historic uses such as heavy grazing or roads associated with timber harvest and motorized recreation. Additional background on the watersheds classified as functioning at risk is included in appendix G. These watersheds are generally on an improving trend due to ongoing management actions. There are no impaired watersheds on the Shoshone. There are about 4,150 miles of perennial streams on the Shoshone (map 66). Overall, stream conditions on the Shoshone are improving or remaining stable and meeting or moving toward desired conditions.

[7]A hydrologic unit code (HUC) is a geographic area representing all or part of a surface drainage basin or distinct hydrologic feature. A 6th-level hydrologic unit boundary ranges in size from 10,000 to 40,000 acres and is named and coded with 12 digits.

Changes in water quantity, timing, and quality are expected to become increasingly important issues with the changing patterns of precipitation projected under a changing climate.

Surface Water

Waters originating on the Shoshone National Forest are headwaters to the Upper Missouri River basin watershed as subdivided by the Upper Yellowstone, Big Horn, and North Platte river basins. The principal rivers on Forest include the Clarks Fork, North Fork of the Shoshone, South Fork of the Shoshone, Greybull, Wind, and Popo Agie.

Streamflow regimes are critical to maintaining stream processes and habitat for aquatic life. Managers work to protect streamflow-dependent water uses and improve conditions in perennial streams where stream flow regimes have been altered. Streamflow protection may be a condition of authorizing occupancy and use of National Forest System (NFS) lands. Cooperation with water users and others is necessary to ensure appropriate resource protection while meeting the needs of people who have existing water rights. State instream flow programs will be used where possible when they meet NFS needs. Channel maintenance flows are established on many of the streams on the Shoshone in an effort to maintain the physical characteristics of channel. The flows are of sufficient magnitude, duration, frequency, and timing to maintain channel morphology, so that the capacity of the channel to convey natural flows is unimpaired over the long term (Potyondy 2007).

Annual runoff is driven by spring snowmelt with peak flows typically occurring in mid-June. Winter flows are primarily supported by groundwater and shallow alluvial aquifers. Numerous lakes, ponds, and wetland areas occupy upper elevations of the Beartooth Plateau and Wind River Range. Active glaciers are located along the Continental Divide in the Wind River Mountains.

The Wyoming Department of Environmental Quality (WYDEQ) identifies streams which do not meet designated beneficial uses due to water quality impairment. Impaired stream segments are described in the Wyoming Water Quality Assessment and Impaired Waters List (Integrated 305(b) and 303(d) Report). Within the Forest boundary, there is currently only one stream segment, which has been identified as impaired—the Clarks Fork of the Yellowstone. The source of the impairment is from past mining activities in the New World Mine area in Montana. However, remediation is taking place, and total maximum daily loads (TMDLs) have been established to address the Wyoming water quality impairments.

Surface water from the Shoshone is used on and off-Forest, both consumptively and non-consumptively. Non-consumptive uses include recreation, wildlife, fisheries, channel maintenance, and the aesthetic and spiritual quality of the resource. Consumptive uses meet Forest Service administrative needs (campgrounds, firefighting, administrative sites), permitted activities on the Forest (livestock watering facilities, summer home wells, snowmaking at ski areas), and off-Forest activities (irrigation, municipal water supplies) with permitted water diversion, transmission, and storage facilities on the Forest.

Groundwater

Groundwater is generally provided by shallow alluvial aquifers along major stream courses. Although water-bearing formations can be found on the north side of the Wind River District, South Fork of the Shoshone River, and in selected areas of the Clarks Fork District. This is likely due to water-bearing structures such as the Madison and the Tensleep formations, which extend and surface on the Forest.

With the limited supply and lack of development opportunities, beneficial use of Forest groundwater is low. Consumption is limited to livestock-water facilities, spring developments, special-use permits, and Forest Service campgrounds and administrative sites with domestic wells. Off-Forest, groundwater is used extensively for pump irrigation and drinking water wells.

Water Developments

Development and use of Forest water resources can affect water quality and quantity. Water developments on the Shoshone can be classified into one of three groups: (1) non-livestock, (2) livestock uses where the point of diversion and point/s of use are on the Forest, and (3) off-Forest permitted uses where the point of diversion is on the Forest but the point/s of use are not. Non-livestock uses include wells and conveyance lines for administrative facilities, campgrounds, permitted lodges and recreation residences, and other permitted uses on the Forest. Livestock or agricultural uses typically relate to small reservoirs, springs, diversions, pipelines, storage tanks, and other uses of this nature. There are numerous permitted water developments that supply off-Forest uses, but due to the nature of the permitting process have not been investigated to the same extent as those on-Forest. Further analysis is needed to comprehensively quantify the total amount of water from points of diversion on the Shoshone National Forest.

Development of springs and diversion structures can directly impact areas by altering the natural system including hydrologic regime, soil condition, and plant associations. Developed springs often lose their unique hydrologic characteristics, and may be transformed to upland habitat in extreme situations (Winters et al. 2004). Irrigation water diversions tend to be simple head gate designs and open, earthen canals to transmit water. Most of the agricultural water uses divert water off the Forest only during the summer months. Municipal water diversions take place year-round and tend to be sophisticated, with multiple diversion structures feeding into larger and larger canals and pipelines and typically include use of reservoirs to store water.

Water Rights

Water is a limited resource on the Shoshone and to lands and communities surrounding the Forest. Protection and management of existing water rights and uses are crucial to sustainable management of the Shoshone and sustaining local communities.

Given the increasing demand for water uses and potential climate change effects, it is likely that water storage proposals, diversions, and changes to water rights will be proposed by local governments and others in the coming years. In response to such proposals, the Forest Service will work with local governments and state agencies to help move forward in ways that best protect existing water rights, community interests, and public land resources. The resource and socioeconomic effects of water storage projects could include issues ranging from Yellowstone cutthroat trout, wild and scenic rivers, recreation, water rights, and downstream interests, among others. The issues and impacts would be dependent on the proposed project and its location. To determine whether water storage is the best use for a particular area, a full environmental analysis would be conducted.

Work relative to the filing of water right claims with the Wyoming State Engineer's Office, per agreement under the Big Horn adjudication interlocutory decree, has been completed. The Shoshone provided detailed surveys of non-livestock-related discrete water uses listed in the decree. Livestock-related discrete water uses will be validated over time as staffing and funding permit. Final location and volume information on instream flow for quantification points for channel maintenance flows were provided as well.

As such, all non-livestock water uses on the Shoshone associated with the decree have been documented in both electronic and paper formats (coordinated with the Wyoming State Engineer's Office). These adjudicated water uses, points of diversion and use, and transmission lines in between (if appropriate) are digitally mapped. The same will be completed for livestock uses as funding and work force allow.

Adjudicated water rights not necessary for the management of reserved or acquired NFS land will be transferred, exchanged, used for augmentation purposes, or disposed of.

Water Quantity

Water quantity is an issue that has been raised by the public and local governments who would like to see water yields from the Shoshone increase. In the current forest plan, there is direction to manage vegetation to increase water yield. Based on experience from the first round of forest planning, and updated research, Region 2 no longer emphasizes water yield increases through specific management in forest plan revisions.

The rationale for this approach is based upon the most current information. Two recent research studies focused on the North Platte River basin shed new light on this subject:

- Troendle, C.A., J.M. Nankervis, and L.S. Porth. 2003. The impact of Forest Service activities on the stream flow regime in the Platte River. Report submitted to U.S. Forest Service, Rocky Mountain Region, May 2003. 50 pp.

  > *The major factor that affects water yield from national forests is the precipitation from year to year. Natural changes in forests due to growth, mortality, fire, and insects have a substantial effect on long-term trends in water yield. Forest management has a much smaller effect.*
  >
  > *Trees use water by intercepting rain and snow and by pumping moisture from the soil. As trees grow to maturity, they use more water until the forest fully occupies the site. Forest disturbance like timber harvest, fire, or insect attack reduces this water use and increases water yield.*
  >
  > *In the snow zone, increased water yield due to forest disturbance occurs only in May and June. The largest increases occur in the wettest years. The smallest increases occur in the driest years.*
  >
  > *Patch cuts or partial cuts increase water yield. Increases in small watersheds are highest when 40% or more of the basal area is cut. Even these maximum increases cannot be detected very far downstream as they are "swallowed up" by natural flow variations.*
  >
  > *After the initial increase following forest disturbance, water yield gradually declines to its original range. It can take from 70 to over 100 years for this recovery to be complete.*
  >
  > *Forest management can achieve real increases in water yield. The amount of increase from any management program that is fiscally, environmentally, and socially feasible will be modest, will not be detectable at the national forest boundary, and will be dwarfed by natural forest processes like growth, mortality, fire, and insects.*
  >
  > *The best way to achieve optimum long-term water yield is to sustain healthy forests and watersheds.*

The primary influence on water yield in large basins is precipitation, which is variable in the short term, but relatively constant in the long term. Although cutting trees increases water yield from forested watersheds, similar changes to water yield occur from other natural disturbances such as wildfire or insect and disease outbreaks that reduce the density of vegetation cover in a watershed. As real as these increases are, they are such a small increment of total water yield that they can rarely be measured in larger watersheds. Any increases are constant over the hydrograph. This means droughts will remain droughts and floods will be augmented. In most water-short areas, reservoirs are operated to maximize storage and are, thus, unable to capture and store the significant yield increases associated with high runoff (flood) years. Annual climate variations are much more important. Healthy forests and watershed conditions result in the best optimum long-term water yield, water quality, magnitude and timing of flows, and healthy aquatic and terrestrial ecosystems.

There is mounting evidence the Earth is experiencing a warming trend. This trend or change in climate may affect the weather and stream systems across the Shoshone. If realized, effects could include altered precipitation patterns and changes to the quantity, quality, and timing of snowmelt and river flows from the Forest. Total annual streamflow volume could decrease and the annual snowmelt period could begin weeks earlier in the season. There could also be increased summer thunderstorm activity with more flooding due to greater rainfall amounts at higher intensities. Five anticipated impacts that may directly threaten water quality include rising stream temperatures, an increase in extreme water-related events, reductions in available drinking water, water boundary movement, and the displacement of aquatic communities as water temperatures change.

There is a growing demand for water within and downstream of the Shoshone. Municipalities, agriculture, industry, and recreation demands continue to grow. Water availability may decrease from climate change and is likely to decrease as a result of increasing development. Water users within and downstream of the Shoshone could be affected (USDA Forest Service 2011b).

Municipal Watersheds

A legal requirement listed under 36 CFR 251.9 states that “The Forest Service shall manage National Forest watersheds that supply municipal water under multiple use prescriptions in Forest Plans.” While all water that originates on the Shoshone could be used for municipal supply at some point downstream, only public water supply intakes within 15 miles of the Forest are considered per the Safe Drinking Water Act. Watershed protection is provided for municipal supply watersheds through FSH 2509.25. Additional direction is provided under 36 CFR 251.9(a) which states that in order for a municipal water supply to receive additional protection measures, a “municipality must apply to the Forest Service for consideration of these needs.”

There are four inventoried municipal watersheds on the Shoshone National Forest (table 22 and map 65).

Table 22. Watersheds serving municipal water systems

Watershed name	Community served	Ranger district
North Fork Shoshone River	Cody, WY	Wapiti
South Fork Shoshone River	Cody, WY	Wapiti
Wood River	Meeteetse, WY	Greybull
Middle Popo Agie River	Lander, WY	Lander

The municipality of Cody receives water from the Shoshone Municipal Pipeline, which is linked to Buffalo Bill Reservoir. It is managed by the Shoshone Municipal Water Joint Powers Board (SMWJPB). The reservoir is fed by the North Fork and South Fork Shoshone River drainages, so they are considered municipal supply watersheds. Additionally, Cody is not the only recipient of water from the reservoir and Pipeline. SMWJPB infrastructure beyond the 15 miles also serves the communities of Powell, Lovell, Byron, Deaver, Frannie, and the Northwest Rural Water District, which provides drinking water to rural homes in the vicinity of the above listed communities.

Meeteetse collects and diverts water from seepage from the base of the Lower Sunshine Reservoir dam. The reservoir is fed by major diversions from the Wood and Greybull River, and watershed area above the reservoir, i.e., the Sunshine Creek watershed, which includes Upper Sunshine Reservoir.

Lander utilizes water from the Middle Popo Agie River and the Sawmill Creek drainage, a major tributary to the Middle Popo Agie River.

There are no other public water supply diversions within 15 miles of the Shoshone National Forest, so communities like Riverton, Fort Washakie, and Hudson are not included in this report. Dubois is not included either because it uses groundwater from four quaternary aquifer wells near the town.

Watershed models

The science of wildland watershed management has evolved considerably since the 1986 Forest Plan as amended was developed. The evolution of the science and the results of plan monitoring are reflected in annual monitoring reports and certain amendments to the plan, specifically the oil and gas leasing (USDA Forest Service 1996) and allowable sale quantity (USDA Forest Service 1994) amendments. Other methodologies for determining watershed condition include the Inland West Water Initiative, and the most recent Watershed Condition Framework.

Forest Plan Related

The oil and gas leasing and allowable sale quantity (for timber harvest) efforts incorporated a first-generation watershed cumulative effects analysis screening process using best available information at that time. Model assumptions and weaknesses were identified as part of the process. Modeling results were presented in tabular form because spatial presentation opportunities were limited. The results identified watersheds of concern where impacts reached a level of disturbance at which watershed condition and stream health were degraded beyond their abilities to recover in the short term. These identifications led to monitoring and inventory of watershed condition across the Shoshone and to implementation of watershed improvement projects in targeted areas.

Watershed Condition Framework

The Watershed Condition Framework is the latest model implemented nationally within the Forest Service in 2011. The framework is a comprehensive national approach for classifying watershed condition. This is an interdisciplinary process that ranks watersheds according to three watershed condition classes directly related to the degree or level of watershed functionality or integrity, and therefore, the above mentioned watershed condition classes: Class 1, 2, and 3 which equate to Functioning Properly (Good), Functioning at Risk (Fair), and Impaired Function (Poor). Ranking is based on four categories that represent terrestrial, riparian, and aquatic ecosystem processes or mechanisms by which management actions can affect the condition of watersheds and associated resources. From this, priority watersheds are selected for restoration (USDA Forest Service 2011). This framework has been implemented across the Greater Yellowstone Area, including those units that are not Forest Service, in an effort to consistently manage at the ecosystem level. Data from this analysis can be accessed at http://WWW.fs.fed.us/publications/watershed/.

On the Shoshone, 16 watersheds (11 percent) are considered class 2, functioning at risk (see table 23), and the remaining 131 watersheds were functioning properly (USDA Forest Service 2011). The reasons for functioning at risk include water quality, sediment loading, algal blooms, water diversions, aquatic biota, riparian and rangeland vegetation condition, roads and trails, wildfire, invasive plants, and forest health issues (see Appendix H for additional background). There are no impaired watersheds on the Shoshone.

Table 23. Shoshone watersheds functioning at risk

Watershed code	Watershedname	Total watershed area (acres)	Watershed area on Forest (acres)
100700060504	Upper Pat O'Hara Creek	25,070	12,040
100800010107	Wind RiverCrooked Creek	14,800	5,580
100800010108	West Fork Long Creek	14,700	11,400
100800010112	Lower Warm Spring Creek	15,500	13,900
100800010202	Middle Horse Creek-Wind River	20,100	19,800
100800010203	Lower Horse Creek	13,300	2,200
100800010204	Little Horse Creek	11,500	3,280
100800010205	Tappan Creek	12,000	2,140
100800030109	Willow Creek-Little Popo Agie River	18,900	2,570
100800030202	Middle North Popo Agie River	27,400	12,900
100800030203	Sand Creek-Popo Agie River	15,700	14,500
100800030207	Lower Middle Popo Agie River	21,500	6,780
100800030208	Roaring Fork Creek	18,600	17,100
100800010105	Wind River Lava Creek	10,800	10,000
100700060106	Clarks Fork Yellowstone River – Squaw Creek	22,730	21,800
100800010104	Brooks Lake Creek	23,200	23,200

Restoration of the 16 watersheds at risk to improve watershed conditions will be a result of combinations of better recreation management, improved road and trail systems, practicing good grazing guidelines, active fire management, invasive plant control efforts, road decommissioning, timber management, and implementing appropriate watershed best management practices. Analysis of changing watershed condition classes is part of the Forest Monitoring Plan.

Soil

Soil is a fundamental component of the environment. It is the growing medium for most plants. Soil absorbs and stores water, releasing it slowly over time. It supplies nutrients for vegetation, which in turn supplies habitat for wildlife and other resources. All renewable resources of the Shoshone are dependent upon soil. Soil is considered a nonrenewable resource because of the time required for its formation.

Conceptually, the quality or health of a soil can be viewed as “its capacity to function.” More explicitly, the Soil Science Society of America defines soil quality as, “The capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance soil quality, everyone must recognize that the soil resource affects the health, functioning, and total productivity of all ecosystems.”

The Shoshone staff recognizes the importance of soils information as an integral part of land management planning and began soil resource inventory efforts in the 1980s. In 2007, a soil resource inventory, also known as a soil survey, was correlated by the National Resources Conservation Service for the entire Forest. Soil data are utilized so management activities may be blended with the ecological capabilities and potentials of the land. Soils information is both used and analyzed at the project and forest planning level. When projects are proposed, more site-specific soil analysis occurs, and mitigation is based on the potential, capability, and limitation of the soils at the site.

Soil Productivity

The primary goal of soil management is to maintain or enhance long-term site productivity. Soil productivity varies widely due to varying characteristics such as soil depth, available water-holding capacity, nutrient status, and site characteristics, including elevation, slope, and aspect. The most productive soils are found in valley bottoms, toe slopes, and benches. The concept of productivity includes both the ability to grow vegetation as well as the maintenance of slope stability. Soil productivity is the principal area of concern on the Shoshone, because it can be affected by management activities. The effects of management practices will influence the future of soil productivity. The demand for many forest resources, which are dependent on soil productivity, is expected in the future.

Five categories of soil disturbance have been found to affect soil productivity. They include: erosion (including mass movement), soil compaction (including rutting and displacement), fertility (nutrient removal), soil heating, and re-vegetation (tree regeneration) potential.

Riparian/Wetlands

Riparian areas are places where water-dependent vegetation lives and grows on the banks of stream, lakes, and rivers and includes the water courses themselves. Wetlands, such as swamps, bogs, marshes, and wet meadows, are areas that are frequently saturated or inundated by surface water or groundwater, which is sufficient to support a variety of characteristic plant or animal communities. Wetland plant and animal communities typically require saturated or seasonally saturated soils to survive. Most riparian areas are obvious because of their unique vegetation. In drier parts of the Shoshone, ribbons of dense vegetation flank streams and rivers, in distinct contrast to the surrounding uplands and valley bottoms. For the purposes of this discussion, riparian ecosystems, wetlands, lakeside zones, springs, and floodplains will be referred to collectively as riparian ecosystems or areas.

There is substantial variability in the size and vegetative complexity of riparian areas on the Shoshone. Ecological drivers such as geology, climate, precipitation, glaciation, and stream gradient all influence the type, complexity, quantity, and distribution of these ecosystems.

Riparian ecosystems cover a very small portion of the Shoshone; but their ecological significance far exceeds their limited physical area (map 67). These ecosystems are an important component of the overall landscape and represent some of the most dynamic and ecologically rich areas across the landscape. Riparian ecosystems are highly responsive to both natural and human-caused disturbances.

Although riparian areas occupy only a small part of the Shoshone, they are a critical source of diversity within ecosystems. Healthy riparian areas, with an abundance of trees, shrubs and other native vegetation, slow flood waters and reduce the likelihood of downstream flooding. Riparian areas help improve water quality by filtering runoff, sediment, and nutrients from flood flows and adjacent upland slopes. Healthy riparian areas act like sponges; they absorb water readily during periods of excess precipitation. Water slowed by riparian areas enters the groundwater where it is released at a later time. Riparian areas produce stream cover and shade, which helps keep water temperatures at desired levels for fish and water-dependent animals adapted to these environments. Fish also depend on healthy riparian and stream for stable channels and habitat, sustained water supplies, clean water, food, and cover. Other benefits include food, cover, and nesting habitat for a variety of wildlife and migration corridors to other habitats. Riparian areas are also attractive and inviting to humans because of the aesthetic and recreational attributes they provide.

Maintaining the natural hydrologic regime is important for maintaining the integrity of riparian plant communities. Streamside riparian ecosystems are tied to the hydrologic, sediment, and disturbance regime of flowing waters and many riparian plant species reproduce only after flood disturbances. Changes in sediment load in stream channels may lead to down-cutting or lateral erosion, altering floodplains and water table relationships. Non-streamside riparian areas occur in sites with seasonally or permanently high water tables, as well as on the margins of ponds and lakes. Wetlands can be easily dewatered, which can allow for a conversion to upland plant community types and/or facilitate exotic plant invasion.

Factors that can lead to a decrease in riparian area and function are: improper commercial and or recreational livestock grazing, timber harvest, road development, under-sized stream crossings, water diversions, and disturbances associated with excessive recreational use. Improper past livestock grazing has been a primary factor leading to some of the degraded riparian areas on the Shoshone. Improper livestock grazing can lead to bank damage from trampling; wide, shallow stream channels; riparian plant community conversions; and excessive sedimentation beyond natural levels. On forested landscapes, some past silviculture practices, road building, and fire suppression practices have contributed to altered riparian conditions by changing flow regimes and altering channel morphology. When disturbances to the riparian area are significant, they may modify the interaction between the floodplain, water table, and the stream channel. Adverse long-term impacts to the riparian area can lead to a decrease in the function and associated habitats provided by a healthy riparian area.

Long-term benefits to riparian habitat and the biota that use them occur when land management activities help create a diversity of habitats, a mix of vegetative seral stages and prevent large-scale, catastrophic fires outside the natural range of variability.

The conditions of riparian areas along with other attributes can be used as an indicator of ecosystem quality. To determine riparian condition, we used an integrated approach including a cross section of Forest and District resource specialists that were familiar with on the ground riparian conditions in 1999. This included fish and wildlife biologists, range conservationists, hydrologists, engineers, and recreation specialists. Available information included detailed surveys, monitoring information and/or most recent ocular observations. Using a mapping exercise, specialists used this information to determine riparian condition for individual riparian polygons that were greater than about 160 feet wide and intercepted perennial streams on NFS lands. The Proper Functioning Condition (PFC) methodology guidelines (USDI BLM 1998) were used to determine riparian condition. At that time, most riparian habitat was in proper functioning condition with a few localized areas functioning at risk or not functioning. The functioning at risk and non-functioning condition ratings were primarily due to past commercial livestock management and inadequate road design or location. Since 1999, riparian and stream habitat conditions on the Shoshone have further improved or remained stable. This was primarily due to improved commercial livestock grazing practices, better dispersal of recreational livestock at dispersed campsites, improved road drainage, correcting fish passage barriers at road crossings, and implementing various stream habitat enhancement projects. Since 1999, the range allotments addressed in those environmental assessments were reevaluated for riparian condition and updated. As a result, the most current riparian condition ratings from 2010 are included in table 24 (USDA Forest Service 2010b). About 89 percent of the riparian acres were in proper functioning condition, about 9 percent were functioning at risk, and less than 1 percent was non-functioning.

Table 24. Shoshone National Forest riparian condition (2010)

Riparian condition	Acres	Percentage of total acres
Proper functioning condition (Good)	61,127	89
Functioning at risk (Fair)	6,221	9
Non-functioning (Poor)	192	<1
Unknown (Not sampled recently)	1,145	2
TOTAL	68,685	100

The bark beetle epidemic is having some effect on water yield because of decreased transpiration and interception. To estimate the impacts of this effect, a comparative analysis was run using FVS-WRENSS post processor and the timber yield tables developed for the timber analysis (Havis 2012).

Climate Change

Predicted effects of climate change on watershed processes on the Shoshone National Forest are described in detail by Rice et al. (2012). Potential for climate change to affect soil and water resources include: decreased water quantity; changes in timing of flows; potential reduction of water quality; loss or reduction in size of glaciers; loss or reduction in wetlands; increasing numbers of invasive species; and increasing effects on watershed from wildfire. Combinations of all the above may have the potential to change watershed condition classes.

Desired Condition

Watersheds are characterized as having high geomorphic, hydrologic, and biotic integrity relative to natural potential. Vegetation and ground cover maintain good hydrologic function. Soils are maintained or improved to productive conditions. Productive soils and sustainable ecosystems are maintained when soil impacts, such as erosion, displacement, compaction, burning, and nutrient drains, are managed by best management practices.

Watersheds support favorable conditions of water flow to support multiple uses, biological resources, and a range of flows that transport sediment and maintain natural channel dimensions. Base flows support riparian vegetation and in stream needs.

Streams are in dynamic equilibrium with their water and sediment supplies. Stream systems retain their ability to transport sediment, they neither aggrade nor degrade, and the floodplain is accessible to flood waters when stream flows are above bankfull level.

Periodic floods are the primary disturbance factor shaping stream channel structure and riparian vegetation patterns. Flood timing and duration follow expected patterns based on amount of precipitation, season, aspect, elevation, and upland vegetation condition. High flows exceed bankfull discharge for a short number of days at least every two years and provide for flood-dependent vegetation and channel maintenance. Floodplains dissipate floods and sustain water tables and the natural timing and variability of water levels in riparian, wetland, and meadow habitats.

Environmental Consequences

This section presents an overview of the alternatives' general effects on the soil and water resources. The focus of the discussion is on soils because soil productivity is the primary direct and indirect element that affects water quality, through the five elements erosion, heating, fertility, compaction, and revegetation. Other impacts to water quality from chemicals and other pollution are generally not addressed, because they are minor and are not expected to vary by alternative. Water quantity is not discussed here. Water quantity is discussed in the affected environment and any changes are projected to be similar for all alternatives. When projects are proposed, more site-specific analysis occurs, and mitigation is based on the potential, capability, and limitations of the site.

Most effects from management activities are limited by the proper application of Forest Service Regional and National BMP directives.

Soil Erosion and resulting productivity declines due to erosion caused by management activities is one of the primary concerns of the soil program. Timber harvesting, site preparation, fuels treatment, and road and trail construction remove or rearrange organic matter, which may change erosion rates. Surface erosion rates depend on such factors as soil erodibility, steepness of slope, slope length, and amount of bare ground. Erosion rates may be calculated at project levels, but not at the forest scale. The 1986 Forest Plan as amended states "Soil losses shall not exceed tolerance levels as determined by SRI interpretations and monitoring." Since the 1986 Forest Plan as amended, the Forest Service erosion modeling changed from the universal soil loss equation model to using the Rocky Mountain Research Station's water erosion prediction project models. The National Resources Conservation Service still uses tolerance levels for erosion, but use is focused on agricultural lands. Water erosion prediction project models have more direct application to erosion estimates relating to forest management activities. This modeling has been used on Shoshone projects involving land disturbance for the last eight years. Water erosion prediction project model runs and qualitative monitoring show that management-induced upland erosion is not a significant factor. This is primarily due to application of best management practices. The greatest sediment movement is from road systems and even this is relatively minor. The major cause of sediment entry into stream systems on the Shoshone is from naturally occurring debris flow processes that dominate in the Absaroka volcanic substrates. This natural process eclipses erosion resulting from disturbance caused by management activities. Excessive sediment can have adverse effects on water quality and fish habitat.

Mass movements include slumping, slope failure, debris flow, and earthflow. Various types of slope instability, or potential of mass movement dictate management practices and mitigation measures which are appropriate for the site. Slopes on the Shoshone that are generally greater than 40 percent strongly influence both soil loss and mass movement processes.

Most Shoshone soils are stable, thus no special measures are needed. Lands with moderately stable soils require more work in layout and design of roads and increased road construction cost. Generally, areas with unstable soils should be avoided because the risk of resource damage is higher than the benefit of wood fiber production. Vegetation plays a major role in the complex interactions of slope stability, as well as erosion. It acts to intercept and store significant amounts of precipitation, thereby buffering the effects of storm events. The roots of vegetation physically bind soil particles together; the strength of roots adds strength to the soil; and the roots may grow to bedrock, forming an effective anchor system. Once precipitation enters the soil, it becomes available for the vegetation to remove it through evapotranspiration, which decreases the amount of destabilizing groundwater.

Soil Compaction can significantly reduce long-term soil productivity; therefore it is important to prevent unnecessary compaction. Compaction often occurs as a result of management activities, thus it is important to stay within acceptable standards to minimize the overall effect. The Soil Management Handbook (FSH 2509.18 R2) defines detrimental compaction as a greater than 15 percent increase in the average undisturbed soil bulk density. It is believed that an increase of 15 percent or more would represent a significant loss in soil productivity.

Some soils are more easily compacted than others, and most soils are more easily compacted by the use of ground skidding equipment or equipment used to pile the residue after timber harvest. Each trip across the same location with a piece of machinery or a log or logs will cause some compaction. The effects are cumulative, with each succeeding trip increasing the compaction. Because it reduces soil productivity in terms of the amount of timber and forage that land can produce, compaction is not desirable for the Forest in general.

Soil Fertility includes site-retention of soil organic matter and/or coarse woody material. Organic matter content and related nutrient availability is an important component of soil productivity. Soil organic matter affects both water- and nutrient-holding capacity and reduces the erosion hazard. Organic matter holds many times its weight in water and has a high cation exchange capacity that increases the soil’s ability to retain nutrients for plants. As soil organic matter (grasses, leaves, needles, and twigs) decomposes, it releases nutrients, in soils. Nutrient losses are of concern because if nutrient levels are allowed to decline, the productivity of the site is reduced. These losses most often occur as a result of erosion of the surface horizon, volatilization by fire, grazing, or timber harvesting.

Coarse or large woody material (greater than 3-inch diameter) in forested systems supports the life cycle of symbiotic soil fungi (ecto-mycorrhizae), which attach to conifer roots, and greatly increase the tree’s ability to take up nutrients and water. Duff and litter on the soil’s surface also act as mulch and reduce soil erosion due to rainfall impact. Fine root mats in the surface soil bind the soil together, reducing down-slope soil creep and washing. Some forest soils have accumulated very little organic matter and are considered sensitive to any organic matter removal by management. These soils generally occur in higher elevations where the colder climate and short growing season do not generate a large amount of annual vegetative growth.

Soil Heating is caused by severe fires that occur when humus and large fuels are dry and large fuels are consumed near the ground. Soil heating can alter soil physics, consume organic matter, and remove much of the site's nutrients. Wildfire, prescribed fire, and burning of slash piles can all have some level of detrimental effect on the soil resource. Where fire is used to perpetuate an ecosystem, it is done in a way that accomplishes resource objectives without unnecessarily risking or jeopardizing the site’s ability to sustain native plant communities and their corresponding soils. In the last 10 years, cheatgrass invasion on burn sites has decreased soil productivity by out-competing native vegetation. This is particularly a problem in low precipitation areas where Wyoming big sagebrush, basin big sagebrush, and black sagebrush occur.

Tree Regeneration may be impeded on marginal sites due to seedling mortality, plant competition, and other factors. Harvested lands must be restocked within 5 years after final harvest. Seedling mortality refers to the probability of the death of naturally occurring or planted tree seedlings, as influenced by kinds of soil or topographic conditions. Seedling mortality is caused mainly by too much water (soil wetness) or too little water (soil droughtiness). Most Shoshone mechanical treatment units meet the 5-year regeneration standards. This analysis is done on a project by project level and by tree regeneration monitoring. Units with aspen treatment successfully regenerate if browsing pressure is limited. Observations and regeneration surveys within past timber sales and aspen regeneration projects on Forest lands show adequate natural regeneration.

Direct and Indirect Effects

Effects from Timber Harvesting: Timber harvesting affects the soil and water resources in many ways. Project design criteria are developed to limit impacts. Activities such as skidding, decking, site preparation, and machine piling of slash results in various degrees of soil displacement, soil compaction, and disturbance to vegetative ground cover. Within a cutting unit, regardless of silvicultural prescription, skid trails can lead to erosion and gullying if not properly located, constructed, and mitigated.

When individual projects are planned, site-specific soil characteristics are taken into consideration. Some soil characteristics will restrict where timber harvesting can be done. Soil characteristics may also require specialized harvesting methods. Where soils are highly erosive or unstable, care must be taken to keep soils in place. Slash should be lopped and scattered on some soil types to maintain nutrients and organic material.

Timber harvest can affect the soil productivity through heavy equipment compaction to the soil and through the removal of nutrients in the form of tree boles, limbs, and branches. The effects of equipment operation can result in varying degrees of disturbance or removal of the existing vegetation, litter, and humus from the surface of the soil. Heavy equipment operation on forested sites can result in detrimental puddling, compaction, erosion, and displacement. In addition to these direct effects, damaged soil can lead to increased runoff from the lower infiltration rates, sedimentation, lower permeability, and reduced site productivity. Increased timber harvesting due to insects and disease has resulted in larger than normal burn piles. Restoration of these areas of severely burned soils will improve long-term soil productivity.

The amount of soil erosion occurring within a timber sale depends on the amount of bare soil, slope steepness, slope length, inherent erodibility, and rainfall intensity. Slash and logging debris that remains after a timber sale reduces erosion because it protects the soil from raindrop impact and presents physical barriers to soil movement. If logging activities expose too much soil, then erosion becomes excessive and site productivity is reduced or impaired.

Road building activities associated with timber management can impact the soil and water resources. Road construction and reconstruction require that the soil be excavated, cut through, and reshaped by heavy equipment. When the vegetation is removed and bare soil is exposed, chances increase for erosion to take place. In some cases, road reconstruction may be beneficial, particularly if it corrects drainage problems. In many cases, road reconstruction removes vegetation and reshapes the road surface. For these reasons, road reconstruction is considered a detrimental short-term effect to soil and water resources even though there may be long-term beneficial effects.

In considering the various alternatives, alternatives F and E are expected to have the greatest potential amount of disturbance from mechanical activities, and alternatives C and D the least. Alternatives A, B, and G would be between the extremes and be fairly similar to their effects on soil and water resources. There are little or no negative effects to soil and water resources from timber harvesting if design criteria from the watershed conservation practices are followed for any of the alternatives.

Effects from Roads and Trails Management: Since vegetation is removed from trails and compaction occurs, either during construction or by use, trails increase the potential for erosion. Where trails descend or ascend steep slopes, gullying may occur. Proper trail reconstruction, proper cross-drainage, barriers, and interpretive signing can mitigate effects. Some indirect adverse impacts can result from trail construction. For example, as access increases, so does off-trail hiking and biking on previously undisturbed areas. This can increase soil erosion, gullying, and compaction. Interpretive signing and barriers are examples of mitigation that can help reduce the amounts of off-trail use.

Roads have the potential to affect watersheds through several direct and indirect pathways and to modify natural drainage patterns which often lead to accelerated erosion of road surfaces and associated cut and fill slopes. This can lead to increased sediment delivery to streams. Roads can affect stream channels directly if they are located on active floodplains or directly adjacent to stream channels. For example, a road located adjacent to a stream can be a chronic source of sediment. If the road changes the morphological characteristics of the stream, this can set forth a chain reaction of channel adjustments that can result in accelerated bed and bank erosion, which produces excessive sediment.

Roads can result in changes in channel morphology, especially at road crossing locations. Poorly placed roads can encroach on stream channel and floodplain areas. Native and gravel-surfaced roads are a common source of sediment to streams on NFS lands. Excessive sediment loading may lead to changes in channel morphology because of pool filling, widening of the channel, and making the channel shallower. These types of changes in channel morphology are reflected in changes in width to depth ratios, number of pools, pool depth, bank angle, and amount of undercut bank. Roads can permanently affect wetlands by interrupting natural flow paths and reducing vegetation.

Roads result in a form of semi-permanent vegetation removal. Roads in riparian areas create a loss of riparian vegetation which can influence the amount of solar radiation and water temperature regimes and amount of wood available for recruitment into the stream ecosystem. These changes can ultimately lead to shifts in dissolved oxygen and pH. In addition, removal of riparian vegetation can increase nitrate levels which can increase the biological activity in water. Greater temperature fluctuations (diurnal and seasonal) can also occur when riparian vegetation is removed or decreased. The addition of nutrients in the stream ecosystem and reduced wood recruitment can affect the physical processes.

Unauthorized user-created routes exist on the Shoshone, and are generally concentrated around areas of high use, resulting from the recreating public. These routes are not part of the Forest road system and have not been designed or authorized for motorized use. Decommissioning unauthorized routes will have a beneficial effect on long-term soil productivity. All alternatives propose the same emphasis on the decommissioning unauthorized routes. Subsequently, there is no difference among alternatives regarding road decommissioning.

In considering the various alternatives, alternatives F and E are expected to have the greatest potential amount of disturbance from road and trail mechanical activities, and alternatives C and D the least. Alternatives A, B, and G would be between the extremes and be fairly similar to their effects. There are little or no negative effects to soil and water resources from road activities if design criteria from the Forest Service Regional and National BMP Directives are followed for any of the alternatives.

Effects from Disturbance Processes (fires/fuels management): Use of wildland fire for multiple objectives and prescribed fire can affect flow regimes by reducing evapotranspiration, interception, and snow accumulation patterns, and by increasing soil moisture and surface runoff. In the short term, 2 to 3 years, prescribed fire can reduce vegetation upstream and around wetlands. This can cause delivery of sediment and nutrients from burned areas, as well as recruitment of woody material. Project design criteria are developed for prescribed burns to limit impacts. Prescribed fire can also reduce the evapotranspiration demands and make more water available for wetlands. Over the long term, greater than 2 to 3 years, prescribed fire is expected to improve riparian condition, if applied to meet site-specific riparian management objectives.

Riparian vegetation removal influences channel morphology through increased potential sediment delivery to waterbodies, reduced large wood recruitment, and subsequent changes in pool depth and complexity. Fire along streambanks and shorelines can result in variable amounts and distribution of ground exposure. Moderate to light severity fires generally have little influence on riparian vegetation and ground litter removal, and subsequent surface erosion. Severe fires may remove virtually all riparian vegetation and ground cover, and result in soil erosion and sedimentation to nearby waterbodies and loss of important transitional habitats for aquatic species such as amphibians and insects. Loss of riparian vegetation can influence the amount of solar radiation reaching a waterbody and increase water temperatures. Greater temperature fluctuations (diurnal and seasonal) can also occur when riparian vegetation is removed or decreased.

Long-term fire suppression causes forest successional processes to continue, which can increase evapotranspiration and interception, potentially resulting in less water available for wetlands. In many cases, lack of fire can lead to the encroachment of woody species (primarily shrubs) into peatland habitats, which could lead to competitive exclusion of herbaceous species. Suppression of natural fire regimes causes fuel loads to accumulate. When wildfire does occur, the intensity and severity are often higher than they would be with more natural levels of fuel. This can result in higher rates of fuel consumption and availability of ash and nutrients that can be delivered to aquatic environments. Suppression of natural fire regimes results in forests that have more trees and associated leaf area. This results in higher evapotranspiration and interception levels, which leaves decreased amounts of water available for surface and sub-surface flow. In addition, fire suppression can allow fuels to accumulate above natural levels, which can cause wildfires to burn more severely. This process can change infiltration characteristics of the soil and change hydrologic characteristics. Fire suppression activities, such as retardant use and drafting water from streams, can also affect riparian and aquatic resources.

In considering the various alternatives, all are similar with relative little difference. Alternatives F and E are expected to have more prescribed and wildfire management activities, and alternatives C and D potentially the least. Alternatives A, B, and G would be between the extremes and be fairly similar to their effects on soil and water resources. There are little or no negative effects to soil and water resources from disturbance processes if design criteria from the Forest Service Regional and National BMP Directives are followed for any of the alternatives.

Effects from Livestock Grazing and Big Game : Livestock and big game grazing can cause trailing and soil displacement along streambanks, collapse of undercut banks, an increase in bank angle, loss of bank cover, and stream widening along the entire stream reach, as well as deteriorated water quality. Over long periods of time, excessive grazing pressure can lead to the entire channel becoming down-cut to the point that a gully forms and a new channel is formed at the bottom of the gully. This type and extent of down-cutting results in an entire channel type change. Trampling and hoof chiseling along streambanks can increase ground exposure, surface erosion, and sedimentation, and lower the water table. Concentrated waste can cause eutrophication of lakes and ponds. Grazing directly in wetlands or immediately adjacent to them can cause soil compaction, hummocking, and loss of vegetation. This ultimately inhibits sub-surface water flow.

Cattle use of alpine vegetation may have detrimental effects to soil productivity due to hoof action on thin surface horizons. This is particularly true in sensitive alpine wetland environments.

Under a properly managed grazing system, livestock are well distributed, grasses are grazed to a preferred use, and trailing is minimized, leaving adequate vegetation for soil protection through surface cover. Proper utilization levels need to account for both livestock and big game needs. If grazing systems are not properly managed, riparian areas may be heavily grazed and streambanks become raw and erosive. If too much forage utilization occurs, upland soils may become compacted and the loss of vegetation can result in increased erosion. Erosion takes place on livestock trails to watering sites or favored crossings, such as over roads, bridges, and streams. In some areas, overgrazing has resulted in soil compaction. Excess trailing can also result in rilling, which reduces ecosystem integrity.

In considering the alternatives, alternatives F and E are expected to have the greatest amount of livestock use, and alternatives A, B, C, D, and G the least, and are all similar to their effects on soil and water resources. There are little or no negative effects to soil and water resources from livestock grazing if design criteria from the Forest Service Regional and National BMP Directives are followed for any of the alternatives.

Effects from Recreation: Overuse of campsites can cause soil compaction and deterioration of the vegetation. Both the compaction and vegetation deterioration can lead to increased surface-water runoff and gully formation. This situation presently occurs in some developed recreation sites or at frequently used, dispersed recreation sites, such as campsites near streams. These effects are expected to be similar under all alternatives. Effects can be mitigated by surface treatments, such as applying gravel or paving heavily used footpaths or by closing areas to dispersed camping. Mitigation would be applied under all alternatives.

Off-road motorized recreation has the potential for heavy impacts to the soil and water resources. When use is heavy or concentrated along corridors, ground cover tends to be damaged without the opportunity to recover. Soils are compacted and, in some instances, the topsoil layer is lost.

Heavy use on unstable soils or steep slopes has caused soil erosion, permanent loss of ground cover, and gully formation.

Dispersed motorized recreation can damage soil and water resources. In general, the impacts occur when users do not comply with existing regulations; for example, off-road vehicle use occurring off designated travelways. Incorporating the Forest Service Regional and National BMP Directives will further mitigate effects.

In considering the alternatives, alternatives C and D are expected to have the least amount of potential impacts from motorized recreation and alternatives E and F, the most potential impacts. Alternatives A, B, and G would be between the extremes and be fairly similar to their effects on soil and water resources. There are little or no negative effects to soil and water resources from recreation activities if design criteria from the Forest Service Regional and National BMP Directives are followed for any of the alternatives.

Effects from Invasive Species: Maintaining an effective invasive plant and aquatic invasive species early detection and rapid response program leads to less use of chemicals, which may potentially affect water and long-term soil productivity.

Restoration by herbicide treatment and replanting of native species on cheatgrass-dominated areas that are a result of vegetative management activity will lead to positive changes in long-term soil productivity.

In considering the alternatives, alternatives F and E are expected to have the greatest amount of ground disturbance activities which lead to potential noxious weed spread, and alternatives C and D, the least. Alternatives A, B, and G would be between the extremes and be fairly similar to their effects soil and water resources. There are little or no negative effects to soil and water resources from invasive plant management if design criteria from the Forest Service Regional and National BMP Directives are followed for any of the alternatives.

Effects from Mineral and Energy Development: Mining directly adjacent to wetlands, or within streams or floodplains that are connected to wetlands, can reduce water availability/flow, increase sedimentation, and/or pollution. Mining of the stream channel causes direct increases of sediment. As equipment dredges stream channels, water flow immediately transports material downstream. In addition, placer mining can cause bank erosion from equipment use and loss of riparian vegetation. Loss of riparian vegetation through mining activities can influence the amount of solar radiation and water temperature regimes. These changes can ultimately lead to shifts in dissolved oxygen and pH. In addition, removal of riparian vegetation can increase nitrate levels, which can increase the biological production in water.

In considering the various alternatives, reasonably foreseeable mineral and energy development activities are minor and similar across alternatives. Consequently, effects to soil and water resources are the same across alternatives. There are little or no negative effects to soil and water resources from mineral and energy development if design criteria from the Forest Service Regional and National BMP Directives are followed for any of the alternatives.

Effects from Oil and Gas Development: Road development and site disturbance have the potential to affect long-term soil productivity and increase the potential to add sediment to streams.

In considering the various alternatives, reasonably foreseeable oil and gas development activities are minor and similar across alternatives. Consequently, effects to soil and water resources are the same across alternatives. There are little or no negative effects to soil and water resources from oil and gas development if design criteria from the Forest Service Regional and National BMP Directives are followed for any of the alternatives.

Effects from Riparian and Wetland Management: Restoration of willow habitat by burning or mechanical treatments has short-term soil effects, but is beneficial in the long term to soil and water resources. In considering the various alternatives, reasonably foreseeable vegetative management activity in riparian and wetland habitat are similar across alternatives. Consequently, effects to soil and water resources are the same across alternatives. There are little or no negative effects to soil and water resources from riparian and wetland management if design criteria from the Forest Service Regional and National BMP Directives are followed for any of the alternatives.

Effects from Wildlife Habitat Management: Prescribed fire on wildlife winter ranges may result in conversion to cheatgrass-dominated systems. This potential change in vegetation type would result in a loss of site soil productivity. In considering the various alternatives, reasonably foreseeable wildlife management activity in bighorn sheep habitat are similar across alternatives. Consequently, effects to soil and water resources are the same across alternatives. There are little or no negative effects to soil and water resources from wildlife habitat management if design criteria from the Forest Service Regional and National BMP Directives are followed for any of the alternatives.

Summary of Effects to Resource

In considering the various alternatives to water, soil, and riparian area effects, alternatives F and E are expected to have the greatest amount of land disturbance, and alternatives C and D, the least. Alternatives A, B, and G would be between the extremes and be fairly similar to their effects on water, soil and riparian resources. Overall, there would be little or no negative effects to soil and water resources from forest management activities if design criteria from the Forest Service Regional and National BMP Directives are followed for any of the alternatives.

Cumulative Effects

Water, soil, and riparian resources are greatly influenced by all activities occurring within the Forest boundaries and can be a good indicator of large-scale cumulative effects. Nearly all vegetative and land management activities have the potential to affect these resources. Land management activities that disturb the soil surface have the greatest potential for, and risk, of adverse effects. Risk increases with proximity or connectivity to the stream network and riparian habitats. Mitigation of the cumulative effects to soil and water resources is controlled through management direction provided for in the revised Plan and also through the use of best management practices and other Forest Service Regional and National BMP Directives at the project level. These practices would minimize the risk for ground-disturbing activities to have far-reaching impacts to soil and water resources by controlling the timing and location of these activities. Management activities on the Shoshone that may cumulatively affect watershed condition are: roads, timber management, wildlife habitat improvement, prescribed and wild fire, motorized recreation, commercial and recreational livestock grazing, and mineral (including oil and gas) development.

The bark beetle mortality effects on transpiration can be seen in the increase in water yield from 4 inches per year prior to the epidemic to 4.3 inches per year in year 5. The increase to a high of

4.4 inches per year in year 10 reflects the combined effects of tree mortality and the reduction in interception by the live canopy. After year 10, water yield starts to decline with stand growth and regeneration. At the end of the 100-year simulation, the difference in water yield between the base and the bark beetle simulation is only 0.1 inch per year. Over the Shoshone National Forest lands, a 0.1-inch per year difference amounts to about 10,000 acre-feet per year of water yield. The largest difference in water yield of about 66,000 acre-feet per year occurs in year 10. The comparative analysis illustrates that the effects from the bark beetle epidemic would be masked by the annual fluctuations that occur in precipitation. The comparative analysis does not provide an indication of actual changes in water yield, but is useful for assessing the relative magnitude of any changes.

The presence and handling of beetle-killed trees has the potential to impact public water supplies if it leads to organic loading of area waterbodies that are sources of drinking water. Organic matter interacts with disinfectants used in the drinking water treatment process to form disinfection byproducts, which are a human health concern. Organic loading may also decrease oxygen levels, leading to the release of metals such as arsenic, manganese, and iron from sediments (Mikkelson et al. 2012). Rhoades et al. (2013) also show the potential for increases in nitrate concentrations in streams influenced by beetle-killed forests. The increased acreage in management area 5.1 direction in alternatives B and G compared to current conditions (alternative A) is not a significant change.

Air Quality

Introduction

This section discloses the affected environment and environmental consequences to air quality that would result from implementing different programmatic level management strategies for the Shoshone National Forest. In general, air quality is good over the Forest, but increasing development may impact air quality in the region. The discussion below details laws and regulations related to air quality, the current status of air resources in the forest, and potential impacts to air quality that may result from activities on as well as outside of the Forest. The primary goal of air quality management is to protect air quality within, and outside of, the planning area.

Air quality is measured by the concentration of substances that are harmful to human health, and terrestrial and aquatic organisms. These also include substances that can reduce visibility (such as fine particulates) as well as particles that contribute to acid deposition. Criteria pollutants of concern are: sulfur dioxide (SO_2), nitrogen oxides (this includes NO and NO_2 and is abbreviated as NOx), carbon monoxide (CO), lead (Pb), ozone (O_3), and particulate matter. Particulate matter includes suspended particles less than 10 micrometers in diameter (PM_{10}) and particles less than 2.5 micrometers in diameter ($PM_{2.5}$). Of these criteria pollutants, Pb and CO are generally not a concern for the forest. Other pollutants of concern include mercury (Hg) and hazardous air pollutants.

Legal and Administrative Framework

Laws

In 1970, the U.S. Congress passed the Clean Air Act, which was later amended in 1977 and 1990. The purpose of the act is to protect and enhance the quality of the nation’s air resources so as to promote public health and welfare. It requires cooperation among Federal departments and agencies having functions relating to the prevention and control of air pollution. Though the Clean Air Act provides the legal and regulatory framework for protecting National Forest lands, it is up to Federal land managers to determine exactly how the lands are to be managed. This act requires that the Forest Service comply with all Federal, state, or local air control regulations.

The Clean Air Act requires the Environmental Protection Agency (EPA) to set standards for air pollutants to protect the public health and welfare. The standards, known as National Ambient Air Quality Standards (table 25), limit the amount of these pollutants that can be present in the atmosphere anywhere in the United States. The EPA has set standards for six “criteria” air pollutants—ozone (O_3), particulate matter (PM), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), lead (Pb), and carbon monoxide (CO). There are standards for two categories of particulate matter—one for suspended particles less than 10 micrometers in diameter (PM_{10}) and one for fine particles less than 2.5 micrometers in diameter ($PM_{2.5}$). Primary standards are designed to protect public health, while secondary standards are designed to protect public welfare. The standards are shown in the table below. Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb) by volume, and micrograms per cubic meter of air ($\mu g/m^3$).

Ozone is not emitted to the atmosphere directly; it is formed when nitrogen oxides and volatile organic compounds react in the presence of sunlight. In general, ozone concentrations in the lower atmosphere are highest during warmer months and lower in the cooler months. Ozone in the lower atmosphere is harmful to human health and vegetation.

Table 25. National ambient air quality standards

Pollutant [final rule cite]		Primary/ secondary	Averaging time	Level	Form
Carbon Monoxide [76 FR 54294, Aug 31, 2011]		primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead [73 FR 66964, Nov 12, 2008]		primary and secondary	Rolling 3 month average	0.15 μg/m^3 (1)	Not to be exceeded
Nitrogen Dioxide [75 FR 6474, Feb 9, 2010] [61 FR 52852, Oct 8, 1996]		primary	1-hour	100 ppb	98th percentile, averaged over 3 years
		primary and secondary	Annual	53 ppb (2)	Annual Mean
Ozone [73 FR 16436, Mar 27, 2008]		primary and secondary	8-hour	0.075 ppm (3)	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particle Pollution [71 FR 61144, Oct 17, 2006]	$PM_{2.5}$	primary and secondary	Annual	15 μg/m^3	annual mean, averaged over 3 years
			24-hour	35 μg/m^3	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24-hour	150 μg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide [75 FR 35520, Jun 22, 2010] [38 FR 25678, Sept 14, 1973]		primary	1-hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

(1) Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m^3 as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

(2) The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.

(3) Final rule signed March 12, 2008. The 1997 ozone standard (0.08 ppm, annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years) and related implementation rules remain in place. In 1997, EPA revoked the 1-hour ozone standard (0.12 ppm, not to be exceeded more than once per year) in all areas, although some areas have continued obligations under that standard (“anti-backsliding”). The 1-hour ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than or equal to 1.

(4) Final rule signed June 2, 2010. The 1971 annual and 24-hour SO_2 standards were revoked in that same rulemaking. However, these standards remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.

The Clean Air Act declared as one of its purposes to preserve, protect, and enhance the air quality in national parks, wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, or historic value. It established mandatory Federal “Class I” areas consisting of wilderness areas over 5,000 acres in size and national parks over 6,000 acres in size that were in existence in 1977. These areas receive special protection under the Clean Air Act. All other parks and wilderness areas are designated as Class II areas. The act also established as a national goal “prevention of any future, and the remedying of any existing, impairment of visibility in mandatory class I Federal areas which impairment results from manmade air pollution." The act gives Federal land managers the affirmative responsibility to protect the air quality-related values of Class I areas, including visibility.

The basic authority to protect national forest lands was delegated to the Forest Service by the Organic Act of 1897. Unlike the national parks, which were created primarily to preserve natural beauty and unique outdoor recreation opportunities, the founders of early national forests envisioned them as working forests with multiple objectives. The Organic Administration Act of 1897, under which most national forests were established, states: "No national forest shall be established, except to improve and protect the forest within the boundaries, or for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States…."

The Wilderness Act of 1964 (16 U.S.C. 1131) established a system of public land preserves. The Code of Federal Regulations developed to implement it (36 CFR 293) provide the Forest Service the responsibility to manage wilderness areas to preserve and protect the wilderness character, and restore as necessary the natural wilderness condition. The Wilderness Act and implementing regulations do not specifically address air pollution impacts; however, they do specify what should be protected ("the earth and its community of life") and the degree of protection ("preserve its natural condition").

Regulation and Policies

The overriding objective of the Forest Service management program is to ensure that the national forests are managed in an ecologically sustainable manner. The national forests were originally envisioned as working forests with multiple objectives: to improve and protect the forest, to secure favorable watershed conditions, and to furnish a continuous supply of timber for the use of citizens of the United States. Forest management objectives have since expanded and evolved to include ecological restoration and protection, research and product development, fire hazard reduction, and the maintenance of healthy forests.

The role of the Forest Service in air quality management is to coordinate national forest activities with state and Federal air quality control efforts. This is done by properly managing and/or mitigating the sources of air pollution created by Forest Service activities, such as prescribed fire, the construction and use of roads, and the operation of various facilities.

The Forest Service establishes pollution impact monitoring efforts in wilderness areas to understand the condition of resources of concern, such as tundra or sensitive lakes. The Forest Service is dedicated to its stewardship role under the Organic Act and to its responsibility under the Clean Air Act to protect and enhance air quality related values in designated Class I Wilderness Areas.

The Forest Service policy for air resource management in wilderness is set forth in the Forest Service Manual (http://www.fs.fed.us/im/directives/fsm). Section 2300 – Recreation, Wilderness, and Related Resource Management – established general criteria for wilderness management under authority of the Clean Air Act. The objectives set forth in Section 2320.2 include direction to "Gather information and carry out research in a manner compatible with preserving the wilderness environment to increase understanding of wilderness ecology, wilderness uses, management opportunities, and visitor behavior." More specific policies are outlined in Section 2323.6, Management of Air Resources:

- Protect air quality and related values, including visibility, on wilderness land designated Class I by the Clean Air Act as amended in 1977.
- Protect air quality in wilderness areas not qualifying as class I under the same objectives as those for other NFS lands.
- Define air quality-related values and initiate action to protect those values.
- For each air quality related value, select sensitive indicators, monitor, and establish the acceptable level of protection needed to prevent adverse impacts.
- Determine the potential impacts of proposed facilities in coordination with state air quality management agencies. Make appropriate recommendations in the permitting process following established Prevention of Significant Deterioration application review procedures for major emission sources. Requests to air quality management agencies for consideration of Class II values in the permit process are appropriate.
- Manage smoke from management-ignited prescribed fires occurring in or adjacent to class I wilderness areas in a manner that causes the least impact on air quality related values.

Forest Service Manual Section 2580 – Air Resource Management – provides further direction:

- Cooperate with air regulatory authorities to prevent significant adverse effects of air pollutants and atmospheric deposition on forest and rangeland resources.
- Integrate air resource management objectives into all resource planning and management activities.
- Protect current condition of air quality related values within Class I areas.
- Monitor the effects of air pollution and atmospheric deposition on forest resources.

Methodology

The analysis of air quality effects considers activities that may potentially be authorized under different alternatives. Alternatives with a greater potential for activities that emit air pollutants are considered more likely to result in air pollution. As there are no specific projects or activities authorized at this time, potential air pollutant emissions cannot be quantified. Alternatives will therefore be compared in terms of their relative potential for emissions.

Spatial and Temporal Context for Effects Analysis

Air quality is affected by emissions of air pollutants and meteorology. Air pollutants can travel very long distances (hundreds or even thousands of miles) under favorable meteorological conditions. In general, however, emissions that occur on a local or regional scale are likely to have the greatest impact on an area’s air quality. For the purposes of this discussion, the area of interest for air quality encompasses central and northwestern Wyoming and portions of southern Montana. This area is predominantly rural and sparsely populated, but is undergoing increasing industrial development, particularly for oil and gas extraction, that has the potential to affect air quality conditions on the Shoshone. The expected lifetime of this plan is 15 years.

Affected Environment

Air Resources

Air quality on the Shoshone is generally good, but Forest resources and air quality related values are affected by air pollutants. The Shoshone’s distance from large urban areas helps to limit the amount of nearby emissions, but some types of development in the region are increasing, particularly oil and gas extraction. Air pollutants can also reach the Shoshone after travelling long distances.

Sources of air pollutants include: industrial facilities such as power plants, oil and gas extraction facilities, waste incinerators, and manufacturing facilities; windblown dust from fields and unpaved roads; mobile sources such as cars, trucks, buses, airplanes, trains, farm and construction equipment, and off road vehicles; mining activities; household chemicals such as sprays, paints, paint thinners, and various solvents; agricultural sources such as fertilizers and waste holding ponds; and smoke from naturally occurring and prescribed wild fire. Sources may be classified as stationary, area (sources that are spread across an area), or mobile. The types of air pollutants emitted include volatile organic compounds, nitrogen oxides, sulfur dioxide, particulate matter, carbon monoxide, mercury, and hazardous air pollutants. Ozone, a criteria pollutant of concern, is not emitted directly but is formed from the combination of nitrogen oxides and volatile organic compounds in the presence of sunlight.

The area around the Shoshone National Forest contains no large urban areas. The Shoshone lies in or near Fremont, Hot Springs, Park, Teton, Sublette, and Washakie counties in Wyoming; these counties have a combined population of approximately 113,000 people (http://quickfacts.census.gov/qfd/states/56000.html). Combined area, stationary, and mobile emissions sources for these counties as well as neighboring counties in Montana for the year 2005 (the most recent year with complete emissions inventory data) are shown in table 26 (Western Regional Air Partnership, http://www.wrapedms.org/).

Table 26. Total point, area, and mobile source emissions for counties near the Shoshone National Forest for 2005 (tons)

State	County	Volatile organic compounds	Nitrogen oxides	Sulfur dioxide (SO_2)	Particulate matter (PM_{10})	Particulate matter ($PM_{2.5}$)	Carbon monoxide
Montana	Carbon	1,160	729	70	5,930	982	6,766
	Park	1,370	1,070	107	5,587	882	8,379
	Stillwater	6,038	950	206	7,161	2,593	28,045
	Sweet Grass	1,441	692	82	2,741	709	7,592
Wyoming	Big Horn	2,150	1,289	289	26,262	3,281	12,165
	Fremont	4,099	2,338	510	41,679	5,104	23,689
	Hot Springs	631	337	59	4,148	537	2,513
	Park	3,589	1,611	467	26,071	3,382	17,642
	Sublette	1,468	711	107	12,165	1,501	7,876
	Teton	2,889	1,109	399	17,463	2,253	14,311
	Washakie	748	679	220	7,159	882	3,493

Source: WRAP 2005 inventory, http://www.wrapedms.org/reports.aspx.

Areas that meet Federal ambient air quality standards are classified as being in attainment, while areas not meeting standards are classified as being in nonattainment. There are several nonattainment areas in Montana, but none are located in Carbon, Park, Stillwater, or Sweet Grass counties (http://www.epa.gov/airquality/greenbook/ancl.html#Montana). The closest nonattainment area in Montana is located near Laurel, approximately 52 miles northeast of the Shoshone. The Laurel area is listed as nonattainment for SO_2. There is currently one nonattainment area in Wyoming for the city of Sheridan for PM_{10}. Sheridan is approximately 113 miles to the east of the Shoshone.

On April 30, 2012, the EPA finalized its ozone nonattainment designations with respect to the 2008 ozone standard (http://www.epa.gov/airquality/ozonepollution/designations/2008standards/final/region8f.htm). The EPA designated the Upper Green River Basin in Wyoming as a marginal nonattainment area for ozone. This nonattainment area includes all of Sublette County, and portions of Lincoln and Sweetwater counties. The eastern boundary of the nonattainment area runs along the Continental Divide at the western edge of the southern portion of the Shoshone (*State of Wyoming Technical Support Document I For Recommended 8-Hour Ozone Designation for the Upper Green River Basin, Wyoming*, Wyoming Department of Environmental Quality Air Quality Division, March 26, 2009).

The revised Forest Plan only identifies the types of activities that may be authorized in different areas of the Forest, and thus does not specifically authorize any new development at this time. The Forest is aware that any new development activity that might be authorized within the Upper Green River ozone nonattainment area will need to be evaluated to determine if there is a need for a conformity analysis. A general conformity analysis is required for Federal actions occurring within nonattainment areas to ensure they conform with the state's plan to meet ambient air quality standards. A general conformity analysis is required unless the action affects cars and buses, causes only a small amount of emissions (below de minimis levels), is presumed to conform, or is otherwise exempt. If an action is not exempt and has the potential to emit ozone precursors (nitrogen oxides and volatile organic compounds) in excess of de minimis thresholds, the Forest will conduct a general conformity analysis as required by 40 CFR 93. Any conformity analysis will be completed in consultation with the State of Wyoming, the Environmental Protection Agency, and other interested parties.

The Forest has identified those areas that overlap the Upper Green River Basin nonattainment area (see figure 10). Only two areas of the Forest are located within the boundaries of the nonattainment area. These areas include parts of management areas 1.1, 1.2, 1.3, 3.3A, and 5.1, and cover a total of approximately 9,700 acres. Of these, 8,848 acres are designated as wilderness (management area 1.1) and not available for development. The remaining 829 areas fall within management areas 1.2, 1.3, 3.3A, and 5.1 (see table 27).

Table 27. Management area acres by alternative within ozone nonattainment area

MA	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
1.1	8,848	8,848	8,848	8,848	8,848	8,848	8,848
1.2			829				
1.3	829			623			
3.3A		829		206	829		829
5.1						829	
Total	9,677	9,677	9,677	9,677	9,677	9,677	9,677

There is limited potential for activities to occur within the 829 acres of the nonattainment area that fall outside of designated wilderness. Oil and gas development is allowed under alternatives A, B, E, F and G, but none is currently projected. Winter motorized use is allowed under alternatives A, B, E, F, and G. New summer motorized trails are allowed on some or all of these areas under alternatives B, D, E, F, and G. Prescribed fire is permitted under all alternatives. Incidental timber harvest (for purposes of habitat improvement and fuels treatment) is permitted under all alternatives; timber harvest for the production of forest products is projected only under alternative F. Based upon this analysis, the potential for development projects in areas of the Forest within the Upper Green River Basin ozone nonattainment area appears to be quite low.

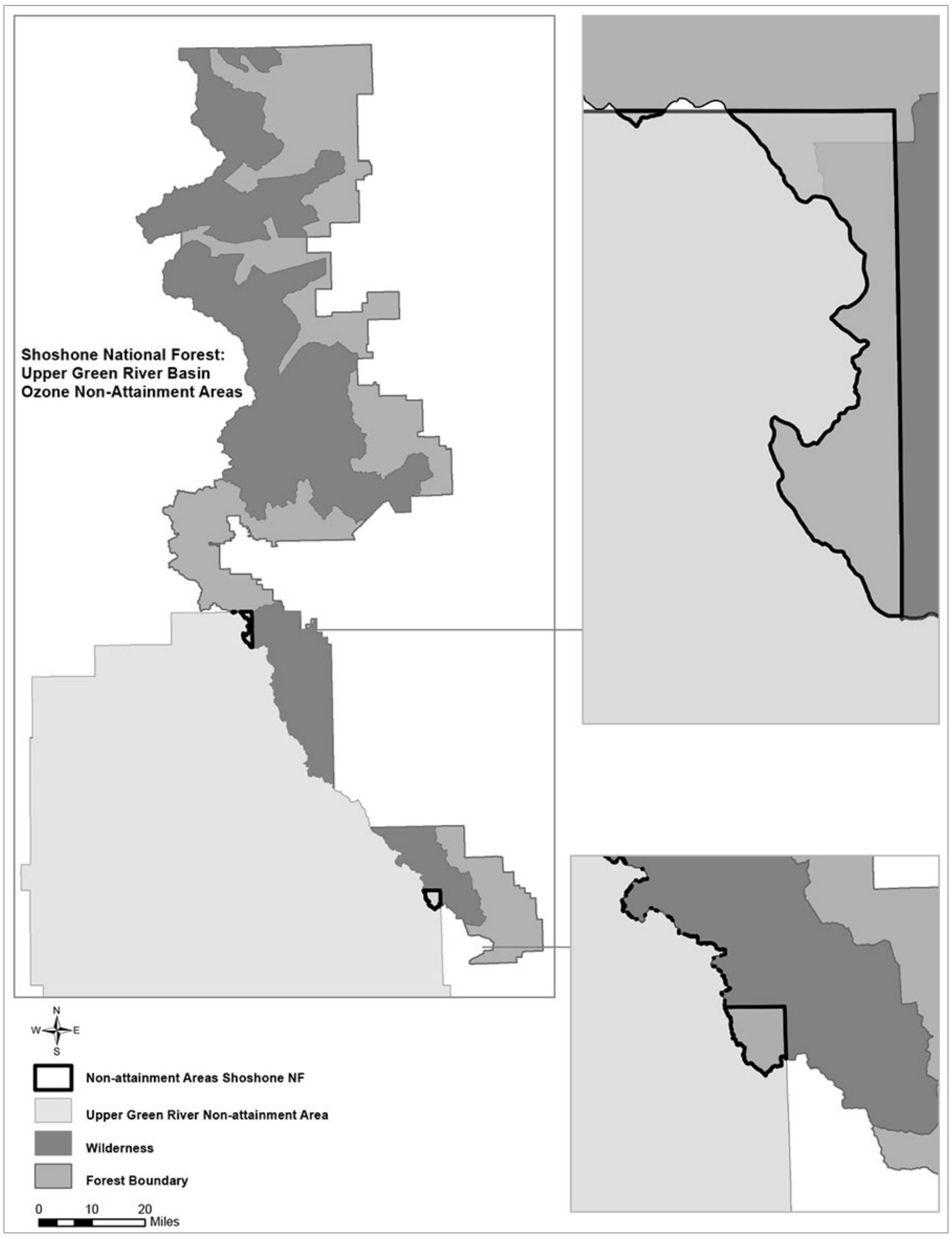


Figure 10. Areas that overlap the Upper Green River Basin nonattainment area

The Upper Green River Basin is an area of active oil and gas development. High ozone values occur in this area primarily during the months of January through March, and are associated with very light low-level winds, sunshine, and snow cover, in conjunction with a strong low-level surface-based temperature inversion (EPA 2012). A temperature inversion occurs when warmer air lies above a layer of colder air, preventing the air in the lower layers from rising. This is different from most areas of the country that experience elevated ozone values, where high ozone concentrations normally occur during warmer months. Analysis by the Wyoming Air Quality Division indicates that elevated ozone at the monitor near Boulder, Wyoming, is primarily due to local emissions from oil and gas development activities, including drilling, production, storage, transport and treatment of oil and natural gas (EPA 2012). Additional oil and gas development is occurring to the south of the Shoshone, although no elevated ozone levels have yet been reported in that region. Some oil and gas development is also occurring to the east of the Shoshone, in the vicinity of the Wind RiverReservation, primarily in older oil and gas fields. Levels of oil and gas development to the east of the Shoshone are lower than in the Upper Green River Basin.

As shown in table 25, the ozone standard is written in terms of the 3-year average of the annual 4th-highest daily maximum 8-hour ozone average. This means that for each year, the highest 8-hour ozone average is computed for each day and the 4th-highest such average for each year is selected. The 3-year average of these values is then computed and compared to the ambient air quality standard. If that value is higher than 0.075 parts per million (ppm), then there is a violation of an ozone standard. Each individual daily maximum 8-hour ozone average over 0.075 ppm is termed an exceedance. Since a violation of the standard only occurs when the annual 4th-highest daily maximum 8-hour values are averaged over three years and found to be over 0.075 ppm, an individual exceedance does not necessarily indicate a violation of the standard.

Table 28 shows available data from ozone monitors near the Shoshone for the period 2009 through 2011 (only years with 75 percent data completeness were used). As can be seen from the table, several monitors reported exceedances of the ozone standard during this 3-year period. The highest values were reported at the Boulder monitor. The Pinedale Clean Air Status and Trends Network (CASTNET) monitor, which is closer to the Shoshone than the Boulder monitor, did not violate the standard, but did record exceedances in 2011. However, EPA has indicated a desire to re-evaluate the ozone standard in 2013, and may lower it to somewhere in the range of 0.060 to 0.070 ppm. If this were to occur, then it is possible that ozone concentrations measured by the Pinedale CASTNET monitor could exceed the new standard. The closest monitor to the Shoshone is located at South Pass, just south of the Forest’s southern border. This monitor did not report exceedances of the ozone standard during the period 2009 through 2011. As high ozone values normally occur in the Upper Green River Basin during periods when cold air is trapped near the surface of the basin at lower elevations, and the southern portion of the Shoshone lies on the east side of the Continental Divide, it is not presently anticipated that high winter ozone concentrations will affect the Shoshone.

Wyoming maintains a network of monitors for other criteria pollutants, as well as ozone. Table 29 shows monitored values of criteria air pollutants for counties near the Shoshone for the period 2009 through 2011. Not every county in the area has monitoring, and counties that do have monitors do not necessarily have monitoring for all criteria pollutants. While these monitors cannot provide information regarding air quality within the forest boundaries, they do provide insight into regional air quality conditions. The only violation of ambient air quality standards indicated on the table is a violation of the ozone standard for Sublette County (recorded at the Boulder monitor).

As mentioned earlier, Federal land managers have an affirmative responsibility under the Clean Air Act to protect air quality related values on the lands they manage. An air quality related value is defined as a resource that may be adversely affected by a change in air quality. The land managers determine the specific resources for their areas, which may include visibility or a specific scenic, cultural, physical, biological, ecological, or recreational resource identified for a particular area. “These values include visibility and those scenic, cultural, biological, and recreation resources of an area that are affected by air quality” (43 Fed. Reg. 15016).

Table 28. Ozone monitoring results near the Shoshone National Forest, 2009–2011

County	Monitoring location	Year	Highest daily maximum 8-hour ozone concentration (ppm)	Fourth highest daily maximum 8-hour ozone concentration (ppm)	Number of exceedances*
Fremont	Pavillion	2011	0.075	0.061	0
	South Pass	2009	0.067	0.065	0
		2010	0.074	0.068	0
		2011	0.075	0.067	0
	Spring Creek	2009	0.061	0.059	0
		2010	0.069	0.061	0
		2011	0.072	0.066	0
Sublette	Wyoming Range	2011	0.083	0.072	3
	Boulder	2009	0.070	0.066	0
		2010	0.072	0.067	0
		2011	0.123	0.103	8
	Daniel South	2009	0.067	0.062	0
		2010	0.073	0.062	0
		2011	0.084	0.075	3
	Pinedale Gaseous	2010	0.074	0.062	0
		2011	0.089	0.076	4
	Pinedale CASTNET**	2009	0.066	0.062	0
		2010	0.073	0.065	0
		2011	0.077	0.070	3
	Big Piney	2011	0.072	0.064	0
	Juel Spring	2010	0.073	0.064	0
		2011	0.094	0.076	4
Teton	Yellowstone National Park	2009	0.067	0.062	0
		2010	0.067	0.065	0
		2011	0.067	0.066	0

* An exceedance occurs when a daily maximum 8-hour ozone concentration greater than the level of the standard (0.075 ppm or 75 ppb) is recorded. An exceedance does not necessarily indicate a violation of the standard.

** CASTNET stands for Clean Air Status and Trends Network (http://epa.gov/castnet/javaweb/index.html).
(Source: http://java.epa.gov/castnet/downloadprogress.do, http://www.epa.gov/airdata/ad_rep_mon.html)

Table 29. Criteria pollutant monitoring in Wyoming counties near the Shoshone

County	Year	CO 2nd max 1-hr (ppm)	CO 2nd max 8-hr (ppm)	NO_2 98th percentile 1-hr (ppb)	Ozone 2nd max 1-hr (ppm)	Ozone 4th max 8-hr (ppm)	SO_2 99th percentile 1-hr (ppb)	SO_2 2nd max 24-hr (ppb)	$PM_{2.5}$ 98th percentile 24-hr (µg/m^3)	$PM_{2.5}$ weighted mean 24-hr (µg/m^3)	PM_{10} 2nd max 24-hr (µg/m^3)	PM_{10} mean 24-hr (µg/m^3)
Fremont	2009			6	0.07	0.065	4	1	35	8.3	47	18
	2010			7	0.07	0.068			32	9.3	56	20
	2011			12	0.08	0.067			30	7.8	74	16
Park	2009								10	4.3	26	11
	2010								11	4.5	27	12
	2011								12	4.4	35	12
Sublette	2009			46	0.08	0.066			17	5.5	35	9
	2010			39	0.08	0.067			18	6	40	9
	2011			49	0.15	0.103*			21	5.7	53	9
Teton	2009	1.8	0.8		0.07	0.062			13	4.7	44	16
	2010	1.9	0.5		0.07	0.065			9	4.3	45	13
	2011	0.7	0.4		0.07	0.066			12	4.6	39	12

Source: http://www.epa.gov/airdata/ad_rep_con.html.

*An exceedance occurs when a daily maximum 8-hour ozone concentration greater than the level of the standard (0.075 ppm or 75 ppb) is recorded. An exceedance does not necessarily indicate a violation of the standard.

The Shoshone includes three Class I wilderness areas (the Washakie, Fitzpatrick, and North Absaroka Wildernesses) and two Class II wilderness areas (the Absaroka-Beartooth and Popo Agie Wildernesses). Air quality related values identified for these areas include surface waters and visibility (http://www.fs.fed.us/air/wy.htm). The sensitive receptor for surface waters is acid-neutralizing capacity, which is a measure of a waterbody's ability to neutralize added acid. Lakes and streams become acidic when the water itself and the surrounding soil cannot buffer deposited acidic compounds enough to neutralize them. In areas where buffering capacity is low, acid rain releases aluminum from soils into lakes and streams; aluminum is highly toxic to many species of aquatic organisms. Atmospheric nitrogen and sulfur can be deposited to the surface through precipitation and dry settling processes and lead to acidification of surface waterbodies. Acidification of surface waters can negatively affect aquatic organisms such as zooplankton, algae, diatoms, invertebrates, amphibians, and fish. Lakes with acid neutralizing capacity of 100 meq or less are considered to be sensitive to additional inputs of acidic compounds. The Forest has set limits of acceptable change at no more than a 10 percent change for surface waters with a base acid-neutralizing capacity of greater than 25 μeq/l, and no more than 1 μeq/l for those surface waters with a base acid neutralizing capacity of less than 25 μeq/l.

Nitrogen can cause other ecosystem impacts by fertilizing both soils and water. These excess inputs of nitrogen can disrupt the natural flora and fauna by allowing certain species that would not naturally occur in abundance to out compete those that thrive in pristine nitrogen-limited systems. The end result is an unnatural shift in species composition for sensitive species, which may have a subsequent impact on other components of the ecosystem.

Monitoring of precipitation chemistry, snowpack chemistry, and lake water chemistry occurs on the Shoshone to provide data needed to protect the Forest's air quality related values. Two lakes on the Shoshone, Ross Lake in the Fitzpatrick Wilderness and Lower Saddlebag Lake in the Popo Agie Wilderness, have been continuously monitored for a sufficient length of time to permit trend analysis of lake chemistry parameters. A recent study by the U.S. Geological Survey (USGS) examined trends in lake chemistry at selected wildernesses along the Rocky Mountains in Colorado, Idaho, Utah, and Wyoming (Mast and Ingersoll 2011). Trends over the period 1993 to 2009 showed a statistically significant (p is less than 0.01) increase in acid neutralizing capacity at Lower Saddleback Lake, and no trend at Ross Lake. Trends at both lakes showed small but statistically significant increasing trends in pH.

The chemistry of wet precipitation (rain and snow) is monitored by the National Atmospheric Deposition Program, an interagency organization that maintains a network of samplers located across the country. There are two National Atmospheric Deposition Program monitors located on or adjacent to the Shoshone, at South Pass City and Sinks Canyon, in the southern portion of the Forest. The USGS examined trends in monthly precipitation-weighted mean concentrations at these locations (Mast and Ingersoll 2011). The analysis indicated increasing trends (p is less than 0.01) in ammonium concentrations in wet precipitation at both monitors over the period 1988 through 2008. Sulfate concentrations showed a statistically significant decrease (p is less than 0.01) at Sinks Canyon and South Pass City (p is less than 0.05). No trends in nitrate concentration were observed at either location.

The USGS also collects yearly snowpack samples from a network of sites located near the Continental Divide. Snowpack samples are usually collected in spring, when the snowpack reaches its maximum depth. Snowpack sampling is beneficial because these sites are located at higher elevations than most National Atmospheric Deposition Program sites, and therefore, generally receive higher annual precipitation. In addition, the snowpack collects dry as well as wet deposition over the course of the winter season. Dry deposition is estimated to contribute as much as 25 percent of total annual sulfur and nitrogen deposition (Mast and Ingersoll 2011). The USGS examined snowpack data from 48 different sites located in Colorado, Wyoming, and Montana during the period 1993 through 2008 and calculated trends in chemical composition both for individual sites and sub-regional groupings of sites. Two snowpack sites are located on the Shoshone National Forest, at Togwotee Pass and South Pass. Analysis of trends in snowpack chemistry at these two locations revealed no statistically significant trends in ammonium, nitrate, or sulfate at either location. However, regional trends including data from 24 different sites located in the central Rocky Mountains suggested that sulfate concentrations in the snowpack decreased across the region over the period, while concentrations of ammonium increased.

To meet the goal set by Congress in the Clean Air Act of remedying existing manmade visibility impairment in mandatory Federal Class I areas, the EPA promulgated the Regional Haze Rule in 1999. This rule requires states to develop plans to reduce manmade pollution in Class I areas. Visibility impairment is caused by small particles suspended in the atmosphere that scatter or absorb light as it travels toward an observer. Visibility impairment affects not only how far one can see, but how well one can distinguish features of the landscape such as form, color, and texture. The Interagency Monitoring of Protected Visual Environments (IMPROVE) program has been established to monitor visibility conditions at Class I areas and provide information on the causes of visibility impairment. This network of monitors includes 110 particulate samplers located near Class I areas that provide estimates of visibility for using in tracking progress toward meeting the national visibility goal.

There are three Class I areas on the Shoshone. The North Absaroka IMPROVE monitor, located on the Forest, is used to track visibility progress for the North Absaroka and Washakie Class I wilderness areas. The Bridger site, located just west of the Shoshone on the Bridger-Teton National Forest, is used to track visibility for the Fitzpatrick Wilderness Area. Under the Regional Haze Rule, visibility is tracked on the clearest and haziest days. The clearest days are defined as the clearest 20 percent of days in each year, and the haziest days are defined as the haziest 20 percent of days in each year. The mean of the haziest 20 percent and clearest 20 percent from the North Absaroka and Bridger IMPROVE monitoring sites are plotted in figure 11 through figure 14. Visibility impairment is measured in terms of a haze index called the deciview (dv). The deciview value increases as visibility impairment increases. The plots also show the estimated mean annual deciview that would be expected to occur at both locations during clear and hazy days under natural conditions (i.e., in the absence of manmade pollution). It can be seen from the plots that visibility conditions are worse than estimated natural conditions, particularly on the haziest days. Trends of the annual mean deciview on clear days for the Bridger monitor show a statistically significant (p is less than 0.05) decrease over the period 1988 through 2010, indicating improving visibility. No trend was observed on the haziest days. The available period of record for the North Absaroka monitor is 2002 through 2008; no statistically significant trends were observed on either the clearest or haziest days.

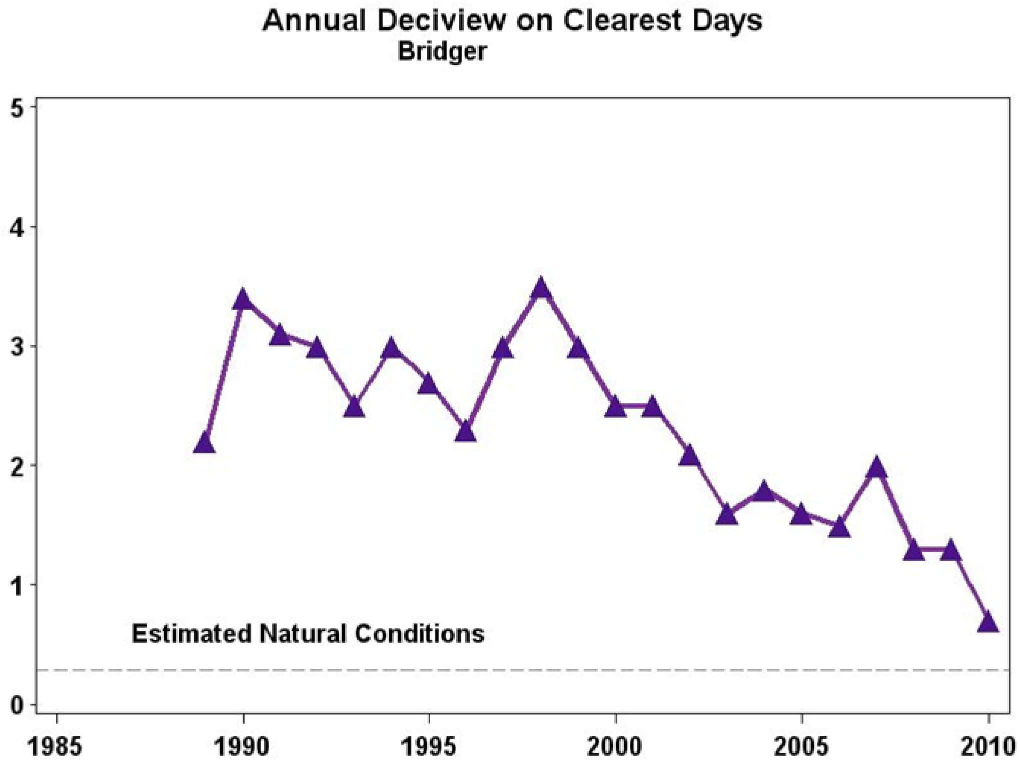


Figure 11. Annual deciview on clearest days, Bridger IMPROVE monitor

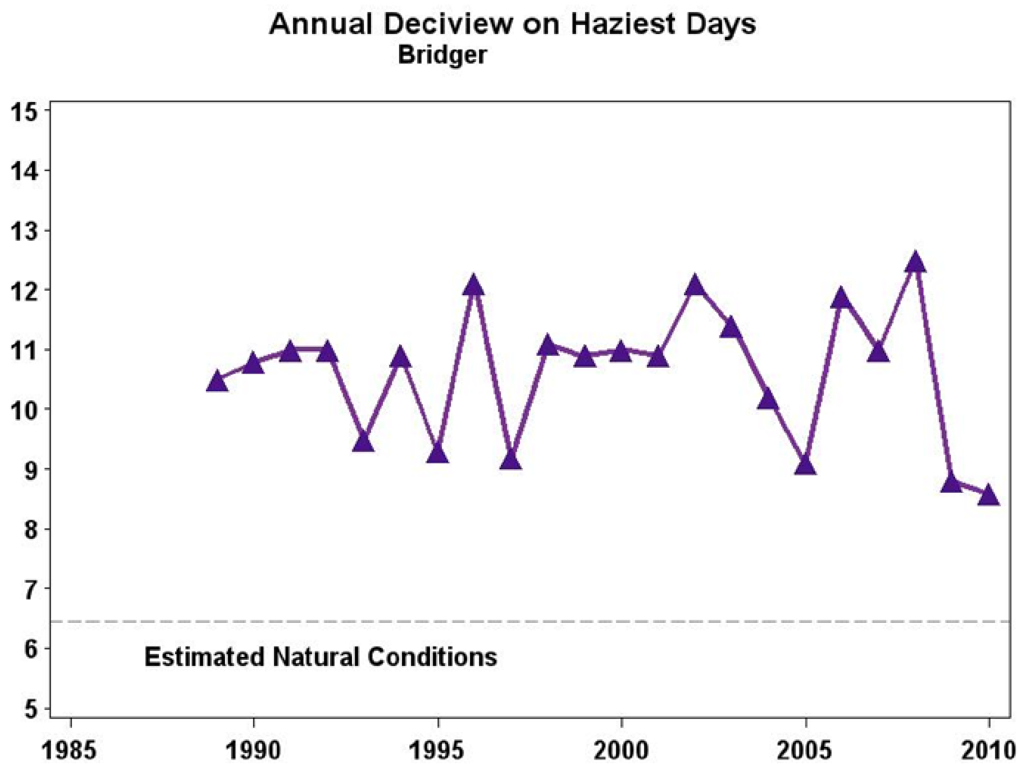


Figure 12. Annual deciview on haziest days, Bridger IMPROVE monitor

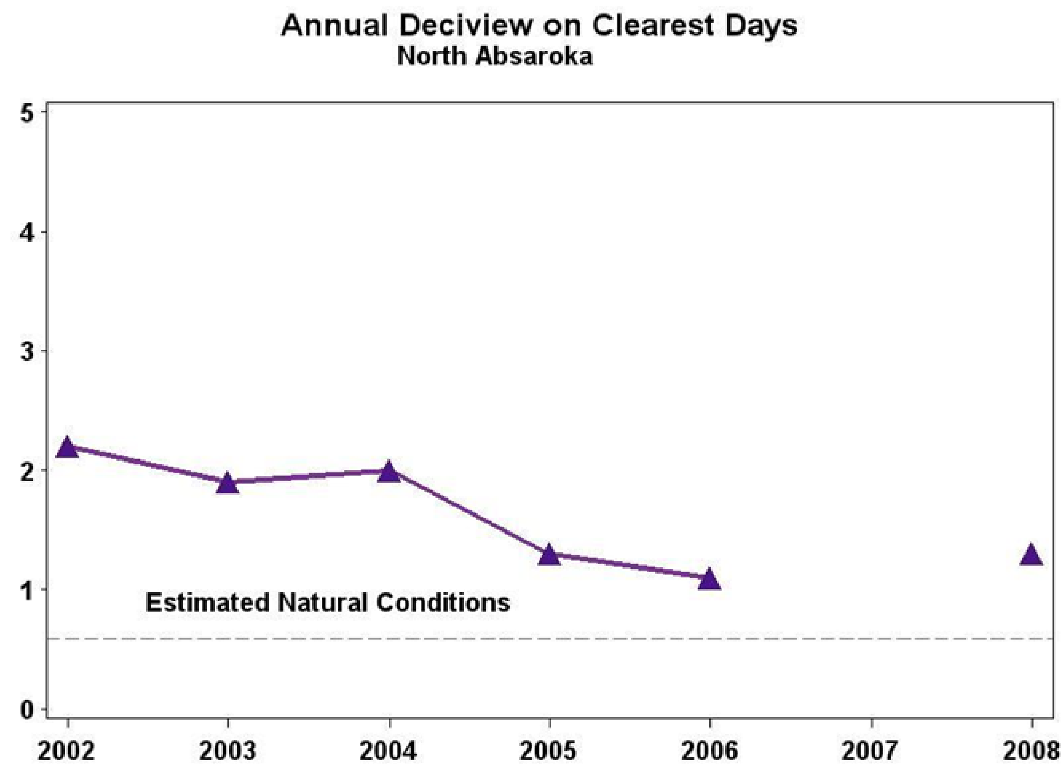


Figure 13. Annual deciview on clearest days, North Absaroka IMPROVE monitor

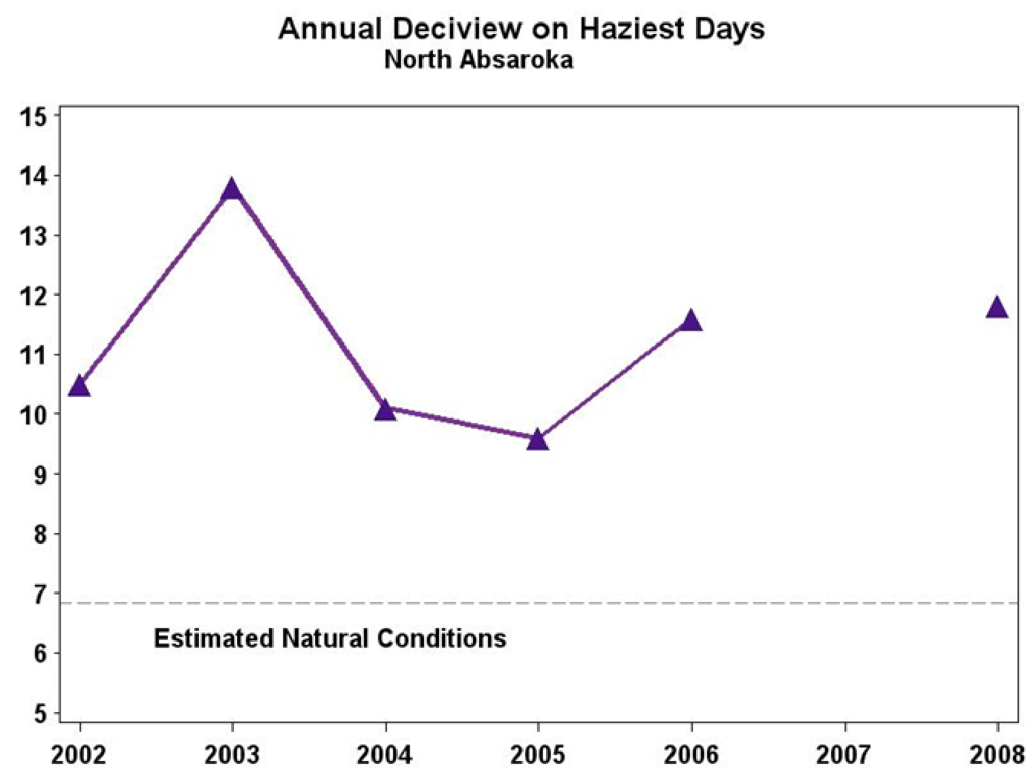


Figure 14. Annual deciview on haziest days, North Absaroka IMPROVE monitor

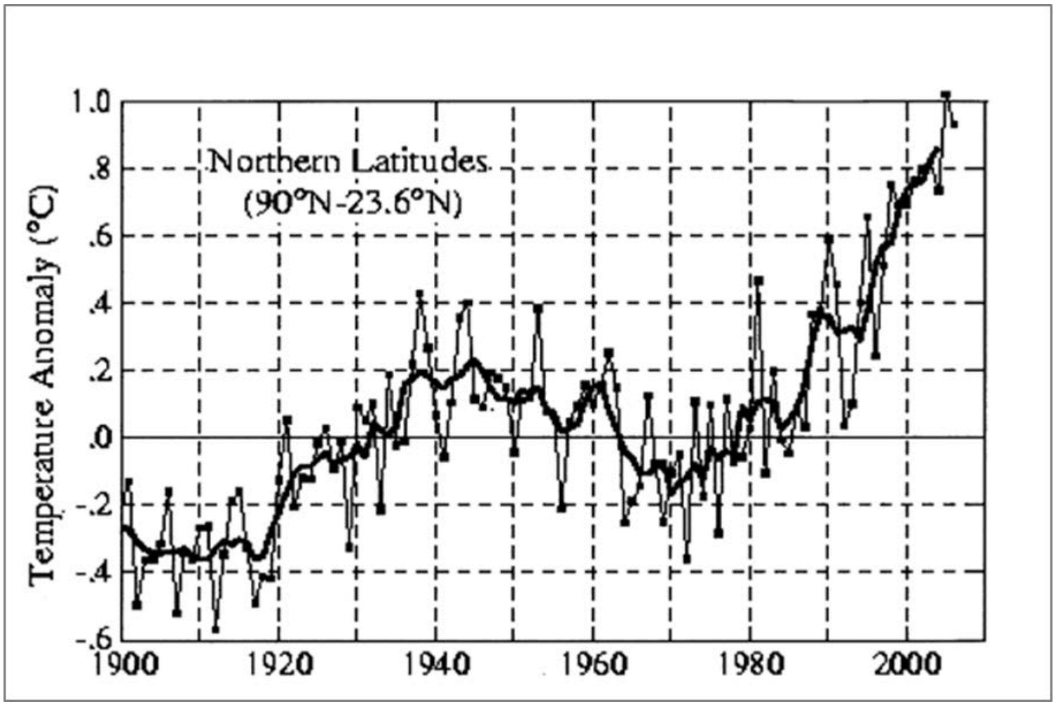
Climate Change and Greenhouse Gas Emissions

Ongoing scientific research has identified the potential impacts of greenhouse gas emissions (including carbon dioxide (CO_2), methane, nitrous oxide, water vapor, and several trace gasses) on global climate. Through complex interactions on a regional and global scale, these greenhouse gas emissions cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the Earth back into space. Although greenhouse levels have varied for millennia (along with corresponding variations in climatic conditions), recent industrialization and burning of fossil carbon sources have caused CO_2 concentrations to increase dramatically, and are likely to contribute to overall climatic changes. Increasing CO_2 concentrations also lead to preferential fertilization and growth of specific plant species.

The assessment of greenhouse gas emissions and climate change is in its formative phase. It is not yet possible to know with confidence the net impact to climate. Observed climatic changes may be caused by greenhouse gas emissions, or they may reflect natural fluctuations. However, the Intergovernmental Panel on Climate Change (IPCC 2007) recently concluded that "warming of the climate system is unequivocal" and that "most of the observed increase in globally average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic [manmade] greenhouse gas concentrations." Global mean surface temperatures have increased nearly 1.0 °C (1.8 °F) from 1890 to 2006 (Goddard Institute for Space Studies, 2007). However, observations and predictive models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Figure 15 demonstrates that northern latitudes (above 24° N) have exhibited temperature increases of nearly 1.2 °C (2.1 °F) since 1900, with nearly a 1.0 °C (1.8 °F) increase since 1970 alone. Without additional meteorological monitoring systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions, but increasing concentrations of greenhouse gases are likely to accelerate the rate of climate change.

In 2001, the IPCC indicated that by the year 2100, global average surface temperatures would increase 1.4 to 5.8 °C (2.5 to 10.4 °F) above 1990 levels (IPCC 2001). The National Academy of Sciences (2008) has confirmed these findings, but also indicated that there are uncertainties regarding how climate change may affect different regions. Computer model predictions indicate that increases in temperature will not be equally distributed, but are likely to be accentuated at higher latitudes. Warming during the winter months is expected to be higher than during the summer.

The lack of scientific tools to predict climate change on regional or local scales limits the ability to quantify potential future impacts. Potential impacts on air quality due to climate change are likely to be varied. For example, if global climate change should result in a warmer and drier climate in western Wyoming, increased particulate matter air impacts could occur because of increased windblown dust from drier and less stable soils. Cool season plant species' ranges are predicted to move north and to higher elevations, and extinction of native vegetation may be accelerated; these changes in vegetation may further affect air quality.



Source: Goddard Institute for Space Studies (2007)

Figure 15. Annual mean temperature change for northern latitudes (24 to 90° N)

Monitoring

The affected environment discussion for air quality presented results of monitoring occurring on the Shoshone, as well as some monitoring results from nearby areas outside the planning area. A summary of air quality-related monitoring is included in the monitoring table (table 29). The Shoshone maintains a wilderness air quality monitoring plan (USDA Forest Service 2010c). Monitoring of visibility, lake chemistry data, ozone, and wet precipitation is expected to continue. Air quality monitoring activities include:

- weekly monitoring of the South Pass National Atmospheric Deposition Program site;
- thrice-yearly monitoring of Ross and Saddlebag Lakes, which are part of a national long-term lake monitoring program;
- support to State of Wyoming monitoring of the North Absaroka IMPROVE visibility monitoring site; and
- support to State of Wyoming monitoring of air quality in the South Pass area of the Washakie Ranger District.

In addition, Shoshone National Forest staff will continue to monitor regional air quality conditions and participate in other air quality management activities. These activities include:

- coordination with other Shoshone programs, such as fire, to ensure protection of air quality and air quality related values;
- intra- and interagency coordination, particularly with the Bridger-Teton National Forest and Wyoming Department of Environmental Quality, Air Quality Division;
- participation in the Greater Yellowstone Area Clean Air Partnership and the Greater Yellowstone-Teton Clean Cities Coalition; and

- reviews of air quality permit applications and industrial mining and energy development environmental documents being prepared by other agencies.

Desired Condition

Forest air quality complies with national and State Ambient Air Quality Standards and State Air Quality Management Plans and does not trend toward thresholds for noncompliance. Air quality (including visibility) in wilderness areas is protected as prescribed by the Clean Air Act and the Wilderness Act, which give the Forest Service the affirmative responsibility to maintain or enhance air quality related values in these areas (including visibility).

Environmental Consequences

This programmatic planning decision does not authorize any activities or actions. Any future activities or actions will undergo the appropriate level of additional NEPA review and might require additional analysis for air quality impacts. The types of activities that could occur under the alternatives considered and the types of emissions associated with these activities are listed below.

In general, activities that could potentially occur on the Shoshone under the various alternatives that would have the potential to emit air pollutants include motorized travel, construction (primarily road construction), timber harvesting, oil and gas development, and fires (both prescribed and wild fire). Emissions from activities could include criteria pollutants, hazardous air pollutants, mercury, and carbon dioxide. Although carbon dioxide is not a regulated pollutant, it is an important greenhouse gas. In addition, areas of exposed soil resulting from disturbance or unpaved roads have the potential to emit windblown dust.

Direct and Indirect Effects

For each of the resource areas described below, the environmental consequences for air resources are compared by alternative, based on key indicators of disturbance for each type of activity. In general, alternatives that propose greater levels of disturbance activities for various resource uses are more likely to result in emissions of air pollutants. Potential impacts from various activities that could occur under the different alternatives and the relative likelihood of the different alternatives to impact air quality are discussed below by activity type. Please note, however, that comparisons among the different types of activities cannot be made. For example, it is not possible to discern the relative potential for air pollution emissions between recreation and oil and gas development from this discussion.

Effects from Timber Harvesting: Timber harvest could potentially result in limited road construction activities and surface disturbance, with the associated emissions described below. Any additional road construction due to timber harvesting is expected to be minimal under any alternative. In addition, gas- and diesel-powered equipment used to cut and remove trees would result in emissions typically found in gas and diesel exhaust, including sulfur dioxide, particulates, volatile organic compounds, carbon dioxide, and nitrogen oxides.

Acres available for timber harvesting are expected to be greatest under alternative F, followed by alternatives E, A, B and G, D, and C in decreasing order. It is expected that impacts to air quality due to timber harvesting would also be greatest under alternative F, followed by alternatives E, A, B and G, D, and C. Air quality impacts due to timber harvesting are not expected to be large under any alternative.

Effects from Roads and Trails Management: In general, road construction would result in emissions of fine particles (dust) from the disturbance to the ground surface and processing of road construction materials such as crushed rock, sand, and gravel, as well as volatile organic compounds, soot, nitrogen oxides, sulfur dioxide, particulates, carbon dioxide, and carbon monoxide from vehicle and construction equipment engines. Construction of paved roads could lead to additional emissions of volatile organic compounds from the processing and application of asphalt to the road surface. Once construction is complete, vehicles travelling along the roads would emit, through their exhaust systems, volatile organic compounds, nitrogen oxides, sulfur dioxide, particulates, carbon dioxide, and carbon monoxide. Post-construction travel by vehicles along unpaved roads would result in additional emissions of fine particles from the surface of the roads. There would also be some emissions of particulates from unpaved roads resulting from windblown dust even in the absence of vehicles.

The primary uses of the transportation network include recreation, administrative use, and administrative/land use activities (including timber harvesting, grazing, and fuels and fire management). The amount of dust generated would be largely dependent upon the season of use, the amount of traffic, rainfall patterns, and materials selected for road construction. Dust issues would tend to be greatest where conditions are typically dry, and/or where roads are constructed from fine-grained materials and do not have a paved or gravel surface.

Recreational use of the transportation system can occur at varying levels of intensity throughout the drier summer and fall months, when dust can be problematic. Recreational use can occur on any open road. Dust abatement measures are not applied on most system roads due to budget priorities. Dust generated from recreational activities may vary from low to high in the long term. Impacts would likely not be mitigated, except on roads with the greatest traffic and/or safety issues.

Road use associated with mineral development, oil and gas development, timber harvesting, and, in some instances, fire and fuels management may require dust-abatement measures. Implementation of dust-abatement measures would reduce or eliminate impacts to air quality from dust.

Miles of roads available for travel are expected to be essentially the same for alternatives A, B, D, E, F, and G and thus, impacts to air quality due to construction and travel on roads would be similar under these alternatives. There would be fewer miles of roads under alternative C, resulting in slightly lower impacts to air quality under this alternative.

Similar types of emissions would be expected for travel along motorized trails. Available miles of motorized trails are expected to be greatest under alternative F, followed by alternatives E, B and G, D, A, and C. Impacts to air quality due to travel along motorized trails are similarly expected to be highest under alternative F, followed by alternatives E, B and G, D, A, and C in descending order.

Effects from Fires/Fuels Management: Prescribed fires and slash burning would result in emissions typically associated with wood combustion, particularly volatile organic compounds, nitrogen oxides, soot, particulates, carbon dioxide, and carbon monoxide. Fires could also emit hazardous air pollutants, such as polynuclear aromatic hydrocarbons, and aldehydes (such as formaldehyde). Since prescribed fires and slash burning are conducted under controlled conditions, are usually less intense than wildfires, and are generally much smaller in size than wildfires, it can be reasonably expected that the emissions resulting from these fires would be considerably lower than those from uncontrolled wildfires that could occur if fuel loads were left in place.

Prescribed fire has the potential to produce smoke that may impact the public. Receptors such as nursing homes, hospitals, and other populations that are sensitive to temporary air pollution would be important considerations for smoke management. The impacts of smoke on the highly valued scenic vistas within the planning area would also be a concern. Smoke would be managed in conjunction with the State of Wyoming (through burning permits) and would address local concerns, visibility, and safety.

Periodic prescribed burns are a necessary tool designed to prevent heavy fuel accumulation—accumulations that may send larger amounts of smoke into the air should an uncontrolled wildfire occur. Wildfires and prescribed burns within the planning area may produce temporary, but major, amounts of particulates, carbon monoxide, nitrogen oxides, organic compounds, and hydrocarbons. These pollutants may be a threat to human health and may reduce visibility.

Although producing smoke is an unavoidable part of prescribed burns, strategies to limit smoke would be an important part of every burn plan. For each burning project within the planning area, a burn prescription would be written. The burn would be conducted in a manner that minimized emissions as well as smoke-related impacts to visibility and human health. The burn prescription would show the measures that would be used to mitigate the adverse impacts of smoke, and would carefully consider smoke-sensitive individuals or populations. Permits for prescribed burns are required by the State of Wyoming. High smoke risk burns may require a public comment period.

Although prescribed burns would increase short-term air pollution emissions, these burns may help to decrease the very large emissions from catastrophic wildfires by reducing fuel loading over the long term. Smoke-related impacts from prescribed burns may range from minor to moderate, depending upon proximity to smoke-sensitive individuals or population centers. Impacts may also be short-term, lasting from a few hours to a week.

Smoke impacts from wildfire to sensitive individuals, population centers, and/or to visibility would be highly dependent upon the location of the fire and the burning conditions. Smoke management for wildfires would include daily assessment of fire behavior and smoke. Public notice, education, and public input, as well as the input from the State, regarding smoke is one of many factors considered in fire management decisions.

Fuel treatments could potentially result in limited road construction activities and surface disturbance, with the associated emissions described above. In addition, gas- and diesel-powered equipment used to cut and remove trees would result in emissions typically found in diesel exhaust, including sulfur dioxide, particulates, volatile organic compounds, carbon dioxide, and nitrogen oxides. Similarly, mechanical treatment activities would produce small amounts of air pollution from equipment and machinery exhaust. Pollutants include PM_{10}, $PM_{2.5}$, nitrogen oxides, sulfur oxides (from diesel fuel-fired engines), volatile organic compounds, carbon monoxide, and carbon dioxide.

In general, alternatives that provide greater access and development will provide more opportunities for hazardous fuel reduction, and therefore, may result in higher emissions due to prescribed fire. Projected acres of hazardous fuels reduction over the next 10 years do not vary greatly by alternative. Alternative F provides the greatest opportunity for hazardous fuels reduction, following by alternatives E, A, B and G, D, and C.

Conversely, alternatives that provide greater opportunity for hazardous fuels reduction may be less likely to result in wildfires, and thus, may be reasonably expected to have lower emissions due to those fires. Projected acres of wildfire over the next 10 years are greatest under alternative A, followed by alternatives C, D, B and G, E, and F. Differences in projected wildfire acres are not large on a percentage basis, particularly among alternatives A through D and G.

Effects from Recreation: Impacts to air quality from recreation result primarily from motorized use. Recreational use of the transportation system can occur at varying levels of intensity throughout the drier summer and fall months, when dust can be problematic. Recreational use can occur on any open road or motorized trail. Dust abatement measures are not applied on most system roads due to budget priorities, and would not occur on any non-system road. Dust generated from recreation activities may vary from low to high in the long term. Impacts would likely not be mitigated, except on roads with the greatest traffic and/or safety issues. Exhaust from vehicles travelling on roads and motorized trails for recreational purposes will result in emissions normally found in gasoline and diesel engine exhaust, including nitrogen oxides, volatile organic compounds, sulfur dioxide, particulate matter, carbon monoxide, and small amounts of hazardous air pollutants. Motorized winter travel (e.g., travel by snowmobile) would also result in emissions of these pollutants, but would not likely result in dust emissions.

In general, alternatives that provide greater opportunities for motorized recreational travel may be reasonably expected to result in higher emissions of air pollutants. Acres permitting summer motorized recreation are greatest under alternative F, followed by alternatives E, B, A, G, D, and C in descending order. Alternative A has the greatest number of acres of winter motorized access, followed by alternatives F, G, E, B, D, and C.

Effects from Oil and Gas Development: Oil and gas extraction activities would result in emissions associated with drilling, production, processing, storage, and transport of oil and gas products. These emissions would include nitrogen oxides, particulate matter, carbon dioxide, carbon monoxide, volatile organic compounds, and possibly sulfur dioxide. The sources of these emissions could include drilling equipment, venting and flaring of gas, storage tanks, pipe fittings and valves, pumps, dehydrators, compression engines, and diesel engines found in heavy equipment and vehicles used to transport of people, equipment, and oil and gas products. Particulate matter in the form of fugitive dust could also be emitted as a result of vehicle movement and ground-disturbing activities. In terms of fluid-minerals development, wellhead engines, compressor stations, gas plants, and refineries are primary sources of these pollutants. Emissions are also associated with fluid-minerals exploration and production activities (including drilling, flaring, and transportation).

Oil and gas well development would likely require infrastructure, new road construction, increased traffic on existing unpaved roads, and the construction of new compressor stations, pipelines, and well pads. Dust (particulate matter) would be the primary pollutant associated with road construction and road traffic. Impacts related to dust would be dependent upon the amount of road traffic, as well as on weather conditions. Air quality impacts related to dust would tend to be periodic; however, they would be chronic unless dust-abatement measures were applied to the road surface and the roads were properly maintained. If dust-abatement measures were not used, fugitive dust pollution may be chronic and short-term during active construction and drilling periods, and, at a reduced level, long-term as service trucks access well sites.

This programmatic-level planning decision does not authorize any leasing or ground-disturbing activities. Before any actual development could occur, additional project-specific NEPA analyses would be performed, and the applicable air quality regulatory agencies would review specific preconstruction permit applications (which examine potential project-wide air quality impacts). As part of these permits (depending upon source size), the air quality regulatory agencies may require additional air quality impacts analyses or mitigation measures. Thus, before development occurs, additional site-specific air quality analyses, based on actual facility engineering data, would be performed to ensure the protection of air quality. Air quality impacts may occur during construction (due to surface disturbance by earth-moving equipment, vehicle traffic fugitive dust, well testing, and drilling rig and vehicle engine exhaust) and production (including natural gas separation and dehydration heaters, and small well-head engine exhaust).

The greatest area available for surface development associated with oil and gas extraction occurs under alternative A, followed by alternatives F, E, B, D, C and G in descending order. Oil and gas development potential is expected to be low to very low under all alternatives.

Effects from Activity-generated Emissions: For any of the activities listed above that may occur on the Shoshone, there would be accompanying emissions of carbon dioxide. Carbon dioxide is generated by combustion processes, including fire and the use of internal combustion engines. Carbon dioxide is not a criteria pollutant or threat to human health, but it is a greenhouse gas. The increase in atmospheric carbon dioxide concentrations caused by human activity is believed to be linked to observed changes in global climate (Intergovernmental Panel on Climate Change 2007). In addition, any of the above activities that would emit either nitrogen oxides or volatile organic compounds has the potential to affect ozone concentrations in the atmosphere, depending upon the time of year and meteorological conditions. This could occur because, as noted above, ozone is not emitted directly but is formed in the atmosphere when nitrogen oxides and volatile organic compounds exist in the presence of sunlight. Ozone concentrations could be affected not only in the vicinity of potential activities, but also some distance away, as nitrogen oxides or volatile organic compounds could be transported by winds to areas where conditions are more favorable for ozone production. Ozone production is normally more likely during warmer months than in cooler ones, and is dependent upon a number of weather-related factors such as wind speed, wind direction, relative humidity, and cloud cover. However, relatively high concentrations of ozone have been observed during winter months near some areas of dense oil and gas field development, including the Upper Green River Basin in Wyoming. This area is located west of the southern section of the Shoshone. Wintertime ozone formation is undergoing study by State and Federal agencies to better understand its causes and to better predict and mitigate future events.

Finally, any of the activities listed above that have the potential to emit nitrogen oxides or sulfur dioxide could possibly impact $PM_{2.5}$ concentrations through secondary particulate formation. Secondary pollutants are not emitted directly, but are formed in the atmosphere when nitrogen oxides or sulfur dioxide react with ammonium to form ammonium nitrate or ammonium sulfate particles.

Summary of Effects to Air Quality

With respect to air quality, there would not be significant differences among the alternatives. The desired condition is to maintain and/or improve air quality conditions within the planning area (including in the Class I airsheds). Strategies and design criteria implemented under any of the alternatives would reduce the amount of air pollution emissions generated from activities such as oil and gas development. Cumulatively, permitted and currently leased fluid-minerals development near the planning area, combined with large sources of air pollution close to, but outside of the planning area, may result in overall air quality degradation.

Cumulative Effects

This cumulative effects analysis considered the effects from past, ongoing, and reasonably foreseeable future activities that could cumulatively affect air quality when combined with effects described for each alternative. If any of the listed activities are authorized, through future decisions and accompanying NEPA analysis, under any of the alternatives, the emissions from those activities would contribute to the levels of pollutants already present in the atmosphere from other sources. The relative contribution of emissions from potential activities to the air pollution already occurring from other sources is expected to be small. The primary activities that would have ongoing or future effects on air quality include smoke from prescribed burning and residential wood-burning stoves, dust emissions arising from activities such as from driving unpaved forest roads, increases in greenhouse gases from numerous sources that are changing regional climate patterns, emissions from nearby power plants and other industrial facilities, oil and gas development emissions, and increases in other emissions caused by increasing population trends.

Fire

Wildland fires would continue to occur within and outside the planning area and would have the greatest potential to produce smoke and associated pollutants that would affect public health and safety, scenic quality, and adjacent Class I areas. Smoke from wildland fires could affect sensitive smoke receptors such as nursing homes, hospitals, schools, and smoke-sensitive residents in communities just outside the planning area. Smoke from prescribed burning on NFS lands would not likely accumulate in large amounts in smoke-sensitive areas, and fires are managed to minimize impacts to the extent that the health and safety of the general public would not be affected. Prescribed burning, in conjunction with thinning treatments, would reduce hazardous fuel loads, and thus, reduce the potential for very large smoke emissions from high-intensity wildland fires.

Overall, there would be few if any noticeable cumulative air quality effects from prescribed burning, because the emissions would not typically occur on the same days within the same airspace. Smoke from residential wood burning could potentially combine with smoke from prescribed burns, although State and Federal agencies avoid burning during air inversions where wood-burning smoke has accumulated in a given airshed and conditions are not favorable to dispersing the smoke.

Dust

Dust would be a very minor contributor to potential cumulative effects for air quality, because the magnitude of dust emissions that would occur in the same place at the same time would be quite small and of short duration. Dust emissions do not typically travel long distances in comparison to smoke emissions. The use of system roads may contribute additional dust emissions that could potentially combine with dust generated from activities in other areas.

Power Plant Emissions

Although no coal-fired power plants exist in the planning area, there are several power plants that exist or are planned for construction within atmospheric transport distance of the Shoshone. Coal-burning power plants are major, long-term sources of nitrogen oxides, sulfur dioxide, mercury, particulates, greenhouse gases, and other pollutants that affect air quality related values, such as visibility, water quality, and high-elevation flora and fauna ecosystems. The Forest Service is an active participant in the permitting process for large emission sources, including power plant projects. Using this process, mitigation measures to prevent air quality impacts would be implemented where indicated by site-specific analysis. Activities that may occur in the planning area would generally be small, localized, and of short duration. Therefore, these activities would not substantially interact with power plant emissions, nor would they likely add to cumulative effects.

Oil and Gas-related Emissions

New wells are occurring on Federal, State, and private lands in and around the planning area, particularly to the south of the Shoshone and in the Green River Basin area of Wyoming. The cumulative effects of existing emission sources are evaluated through air quality modeling for specific oil and gas projects, but would be similar for all alternatives. Cumulatively, oil and gas development and other large sources of air pollution could potentially degrade air quality. Mitigation measures and project design criteria for Forest Service-authorized projects would continue to minimize adverse air pollution emissions generated from authorized activities. Overall, the additional amount of oil- and-gas-related pollutants associated with any alternative would be relatively very small compared to other cumulative sources of pollution such as existing oil and gas emissions, and therefore, would not likely add significantly to cumulative effects.

Methane emissions that would be released during natural gas operations would contribute to greenhouse gases that add to climate change trends (U.S. Climate Change Science Program 2011, EPA 1999). The eventual combustion of natural gas will contribute greenhouse gases to the atmosphere primarily in the form of carbon dioxide.

Emission Increases from Population Growth

Air quality protection issues continue to challenge management of national forests and protected airsheds. This is especially true in areas where large new resort towns are constructed within a few miles of a Class I area. Wood- and coal-heating emissions, road dust, vehicle emissions, and other mobile and stationary sources are all common pollution sources that potentially affect air quality. Regional development is not affected by any of the alternatives and does not vary by alternative.

Summary of Cumulative Effects

With respect to effects on air quality, there is no substantial difference among the alternatives. None of the alternatives is likely to have a measurable adverse impact on air quality, compared to current conditions and trends, as previously described under direct and indirect effects. Air quality in the Class I areas and airsheds is expected to remain in compliance with all State and Federal Clean Air Act standards. Other sources of emissions and air quality pollution sources described in this cumulative effects section would be the dominant air quality issues in and around the Shoshone. Forest planning alternatives would not make any noticeable contribution to the overall regional haze situation or air quality trends in Wyoming; however, any air pollution emissions occurring on NFS lands would add, even if negligibly, to cumulative levels of pollution from all sources.

Vegetation

Introduction

The ecosystems and vegetation of the Shoshone National Forest are dynamic. The processes of succession and disturbance patterns have produced the current vegetative conditions. These natural processes, both part of and necessary for ecosystem function, will continue to produce changes in the future. Therefore, the following descriptions of current vegetation represent only one point in time. Some of the changes will be generally predictable, others less so. Accordingly, any description of future vegetation will be a prediction subject to uncertainty. The level of uncertainty depends on the degree to which natural processes are allowed to operate. Natural disturbance events such as fire, windstorms, landslides, and insect and disease outbreaks are generally difficult to predict. On the other hand, changes associated with succession and human-caused disturbance such as logging and prescribed burning are fairly predictable. Although the Shoshone will experience natural disturbance events, the degree to which they occur will influence the ability to predict future vegetative conditions.

Legal and Administrative Framework

Laws

The **Endangered Species Act (ESA) of 1973**: Requires Federal agencies to conserve threatened and endangered species.

The **Forest and Rangelands Renewable Resources Planning Act of 1974**: Provides for maintenance of land productivity and the need to protect and improve the soil and water resources.

Federal Noxious Weed Act of 1974: Authorizes the Secretary to cooperate with other Federal and state agencies and individuals in carrying out measures to eradicate, suppress, control or prevent the spread of noxious weeds.

The National Forest Management Act (NFMA) of 1976: “It is the policy of the congress that all forested lands in the NFS shall be maintained in appropriate forest cover with species of trees, degree of stocking, rate of growth, and conditions of stand designed to secure the maximum benefits of multiple use sustained yields. Plans developed shall provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet the overall multiple-use objectives, and within the multiple-use objective.”

Executive Orders

Executive Order 13112: Directs Federal agencies whose actions may affect the status of invasive species to (1) prevent the introduction of invasive species, (2) detect and respond rapidly to and control populations of such species in a cost effective and environmentally sound manner, as appropriations allow.

Regulation and Policies

Code of Federal Regulations (CFRs) 36.217 Requesting Review of National Forest Plans and Project Planning

Code of Federal Regulations (CFRs) 36.219 Planning

Code of Federal Regulations (CFRs) 36.221 Timber Management Planning

Code of Federal Regulations (CFRs) 36.222 Range Management

Code of Federal Regulations (CFRs) 36.241 Fish and Wildlife

Policy direction from the Forest Service Directives System in Forest Service Manuals (FSM) 2400 Timber Sale Management, 2200 Range Management, and 2600 Wildlife Management, and in Forest Service Handbooks (FSH) are listed here but not limited to:

- R-2 Rangeland Analysis and Management Training Guide
- Timber Resource Planning Handbook
- Timber Management Information System Handbook
- Timber Sale Administration Handbook
- Silviculture Practices Handbook
- Timber Sale Preparation Handbook
- R-2 2409.26 Silvicultural Practice Handbook

Resource Protection Measures

There are numerous Forest-wide and management area prescription standards and guidelines that apply to vegetation. All alternatives provide for satisfactory regeneration of logged areas, for treatment of activity-related fuels, management of insects and diseases, and various wildland fire management strategies.

Methodology

We assessed vegetation composition and structure using two primary sources of data: a spatial map source and an inventory source.

The spatial map source used in analyzing vegetation was the R2 Veg corporate database. This mapping project provides a geospatial database of vegetation and land covers. These datasets provide basic information on existing vegetation in a common format using standard terms, definitions, and measurements. The vegetation unit layer is consistent throughout the Rocky Mountain Region and is compatible with Forest Service National systems. This data set was initially completed in 2004, and is periodically updated to incorporate changes that are constantly occurring to vegetation.

The inventory source used in analysis was data from the National Forest Inventory and Analysis (FIA), a program that provides a congressionally mandated, statistically based, continuous inventory of the forest resources of the United States. Since 1930, the FIA program has been administered through the Research and Development branch of the Forest Service, which makes it administratively independent from the NFS.

The FIA program collects, analyzes, and reports information on the status and trends of America’s forests (i.e., how much forest exists, where it exists, who owns it, and how it is changing), providing data related to the changing conditions of trees and other forest vegetation. The FIA program combines this information with related data on insects, diseases, and other types of forest damages and stressors to assess the health and potential future risks to forests. The FIA program also projects these trends through the next 50 years and displays how various management scenarios would affect forest vegetation through time.

The FIA data used for forest planning were collected from 1998 to 1999. The FIA data were used to quantify species and size class at the forest scales, and to develop growth and yield tables for the vegetation modeling.

The broad vegetative management approach that is being used in the draft forest plan is one of providing ecological components, patterns, and processes at multiple scales on the landscape, and thereby, providing the full spectrum of habitats and conditions needed for all of the biological organisms associated with the various ecosystems. This general strategy is often called the “coarse-filter” approach to ecosystem management.

To understand the various ecosystems on the Shoshone and sustain the biodiversity within them, it is necessary to have some reference for understanding the natural diversity of the relevant ecosystems, and what processes sustain this productivity and diversity. Historic range of variability concepts were developed in part to better understand how disturbance, vegetation, and other ecosystem components interact, and in turn, how interaction affects biophysical characteristics such as plants, animals, fish, and soil and water resources. Historical perspectives increase our understanding of the dynamic nature of landscapes and provide a frame of reference for assessing current patterns and processes.

The historic range of variability analysis focuses on forest composition, structure, landscape pattern, and processes (disturbance and succession). Not only was the historic range of variability considered in revising forest plan direction, but the potential impacts that climate change might have on the future range of variability was contemplated. In summary, this approach is designed to provide insights into how ecosystems have changed, as well as how they may change in the future. The knowledge gained from this approach can then be used to “inform” management decisions regarding how climate change may affect future landscape conditions (Keane et al. 2008). Given these insights, climate change adaptive strategies such as fostering “resistance” and “resiliency” in the forest ecosystems can be considered.

Spatial and Temporal Context for Effects Analysis

The affected area for direct and indirect effects to vegetation is the lands administered by the Shoshone. This area represents the NFS lands where changes may occur to vegetation as a result of management activities or natural events.

The affected area for cumulative effects to terrestrial vegetation includes the lands administered by the Shoshone, as well as the lands of other ownership both within and adjacent to the Shoshone boundaries.

The timeframe addressed is the 15 years for the anticipated life of the revised Forest Plan.

Incomplete and Unavailable Information

Shoshone personnel do not believe the current inventory accurately portrays the age class distribution for aspen. Given the small number of aspen acres on the Shoshone, we do not think the inventory has provided an adequate sample. The inventory indicates that stands are young with few stands over 80 years of age. Field observations and photo typing indicate the opposite condition is the norm, with more stands in older age classes and fewer in the youngest age classes.

Affected Environment

Selected ecosystem characteristics of the Shoshone are important to ecosystem diversity, have been influenced by past management or disturbances, and may be influenced by future management or disturbances.

The key ecosystem characteristics of cover types, age class distribution, patch size and edge, snag size and density, and coarse woody debris were evaluated. We selected these characteristics for their importance to the ecosystem and our ability to monitor or track them. In addition, we evaluated riparian and rare communities[8] because of their contributions to ecosystem diversity.

We describe current conditions and trends for each ecosystem characteristic. In addition, characteristics are compared to the historic range of variation. This comparison provides additional information on vegetation characteristics and an understanding of past conditions and trends. Rare and unique characteristics that are susceptible to loss or change are also highlighted.

The majority of the information on historic variability in this report is based on *Historic Variability for the Upland Vegetation of the Shoshone National Forest, Wyoming* (Meyer et al. 2006).

Historic range of variability

The reference period for the Shoshone's historic range of variability is the period from 1600 to 1860 (Meyer et al. 2006). This period is defined as the spatial and temporal period when the influences of European Americans were minimal and some form of scientific information could be obtained.

It should be noted that historic range of variability analyses are based on professional judgment, which is based on relatively limited data. Historic range of variability analyses are not a step toward restoring ecosystems to a pristine state, but a tool to establish a base for assessing future management options.

For the purposes of forest plan revision, we're using the historic range of variability as a point of comparison and not to establish desired conditions. As changing climate impacts vegetation distribution and patterns, historic range of variability as portrayed in this discussion is not suitable as the primary guide for desired conditions. The historic range of variability will be one consideration in developing desired conditions, but will not be the main factor considered. In developing desired conditions, we will consider public input, cost of restoration, sustainability of current conditions, changed circumstances, and potential impacts of climate change.

Climate change

The potential effects of a changing climate are likely to influence vegetation conditions in the future. Under a changing climate (increasing temperatures; changes in rainfall intensity; and greater occurrence of extreme events, such as drought, flooding, etc.), efforts to achieve a particular desired forest structure, composition, and function based on an understanding of ecosystem dynamics as captured in historical references or baselines may no longer be appropriate. Ecosystem composition, structure, and function will change as species respond to these changes in climate. Thus, as climate change interacts with other stressors to alter ecosystems, it will be important to focus as much on maintaining and enhancing ecosystem processes as on achieving a particular composition (Joyce et al. 2008).

[8] Rare communities include fens, peatbeds, and springs.

Plant species distributions have been changing for thousands of years and likely will continue to change in the future. The pollen record shows that the relative abundance and distribution of lodgepole pine, Engelmann spruce, and subalpine fir at both the stand and landscape scales have shifted due to climate changes (Fall 1997, Whitlock 1993).

Carbon sequestration

Forests are an important part of the global carbon (C) cycle as they help slow the rising of atmospheric CO_2 concentration by storing C in forest biomass and soils, as well as in some forest products. Carbon fluxes between the atmosphere and forests are complex and vary spatially and temporally. The Shoshone stores and sequesters about 9.5 percent of the total Rocky Mountain Region carbon and CO_2. Some evidence suggests that climate, changing disturbance regimes, and land use may cause C stocks in the Shoshone area to shift from regional C sinks to C sources. Fire and bark beetle outbreaks disturbance plays a large role in regional C balances. Carbon storage potential may also be further reduced by more frequent fires, thereby influencing the fire regime, and by decreasing forested area with development. How the complex interactions between climate, fire, and insect outbreaks will affect the C cycle on the Shoshone is challenging to quantify with any certainty because the science is beginning to develop in this area).

Rangeland

Rangeland utilization, condition, and trend-monitoring data are collected by agency personnel, contractors, and permittees. The Cooperative Permittee Monitoring program was established in 1998, with assistance from the University of Wyoming and the Wyoming Agricultural Extension Service. Currently, 28 permittees collect some level of monitoring data on 33 allotments.

Vegetation utilization and resource impacts from both commercial and recreational livestock and wildlife are measured by various methods, including those in the *Wyoming Rangeland Monitoring Guide* (Wyoming Rangeland Service Team 2008), *Rangeland Analysis Management Training Guide* (USDA Forest Service 1996), and the *Sampling Vegetation Attributes Interagency Technical Reference* (Cooperative Extension Service et al. 1996). A combination of methods is used as appropriate to monitor resource condition and trend and annual use by commercial and recreational livestock and wildlife. The most common grazing management systems on the Shoshone are multiple pasture deferred rotation or rest rotation. Under this system, grazing is delayed, not used at all, or rested following grazing to allow plant development, reproduction, recovery, and establishment of new plants.

Analysis of the data, reports, and photographs indicates that the overwhelming majority of rangeland conditions are generally meeting condition objectives or improving (see figure 16). Where plant composition was determined, the data displayed a static or positive trend toward the desired condition (see figure 17). Rangeland that was currently in desired condition showed the least change and those changes were attributed to natural succession. Across the Shoshone, with a few exceptions, range vegetation conditions are either at or moving toward the desired conditions as outlined in the forest plan and/or the associated allotment management plan.

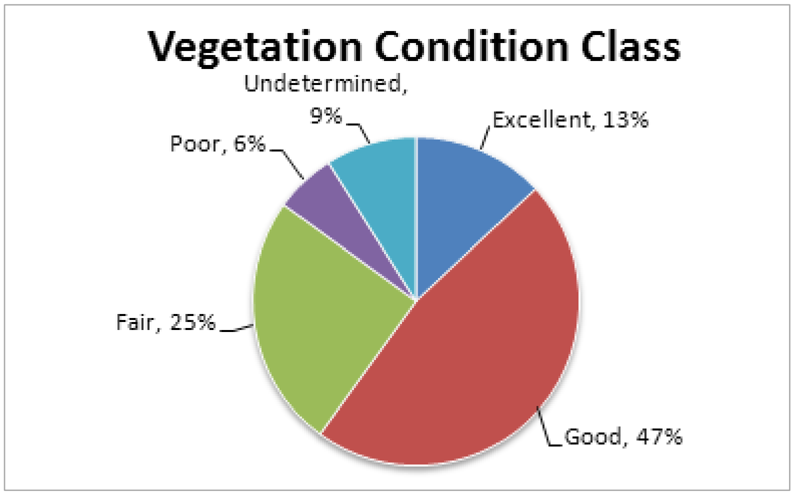


Figure 16. Rangeland vegetation condition class on the Shoshone National Forest

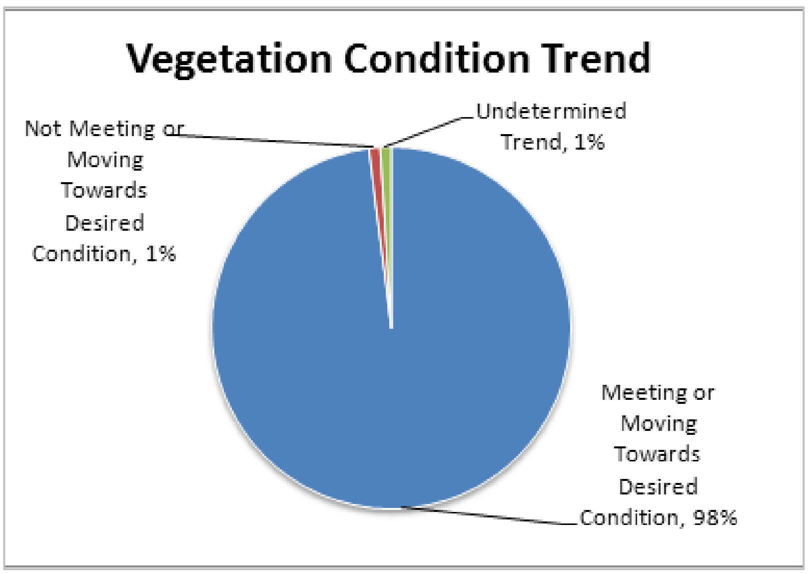


Figure 17. Rangeland vegetation condition trend on the Shoshone National Forest

Cover types

Unless referenced otherwise, much of the overview on cover types is based upon information from *Forest Habitat Types of Eastern Idaho-Western Wyoming* (USDA Forest Service 1983a), *Grassland and Shrubland Habitat Types of the Shoshone National Forest* (USDA Forest Service 1980), and *Riparian and Wetland Plant Community Types of the Shoshone National Forest* (USDA Forest Service 2001).

Forested vegetation varies widely across the Shoshone due to variations in elevation, aspect, climatic factors, and past disturbances (see table 30). The uppermost elevation zone is characterized by alpine tundra and the general absence of trees. The next lower elevation zone is the subalpine zone, dominated in most places by Engelmann spruce, subalpine fir, and whitebark pine. Below the subalpine zone lies the montane zone, characterized by Douglas-fir. Other species that occur in the subalpine and montane zones include lodgepole pine, limber pine, and aspen. Generally, the zones are at higher altitudes in the southern part of the Shoshone than in the northern, and they extend downward on east-facing and north-facing slopes in narrow ravines and valleys subject to cold air drainage.

Grasslands, sometimes mixed with sagebrush, regularly occur in forest openings. In areas where environmental factors do not support tree reproduction, grasslands and shrublands persist. In the foothill zone below the montane zone, grass and shrubs dominate. In the montane and subalpine zones, grass and shrubs persist in areas where site conditions limit moisture, such as well-drained landforms, southern or western exposures, thin or poorly developed soils, and high windswept sites. In the severe environment of the alpine zone, grass and shrubs dominate. Grass and shrubs also dominate sites that are waterlogged throughout the growing season and are consequently poorly aerated for tree growth. Fires or landslides open up the forest in some areas, allowing early successional herbaceous and shrubby stages to flourish for a time. Sometimes grazing pressure on bunchgrasses allows shrubs to become more common (USDA Forest Service 1980).

In portions of the subalpine and montane zones, lodgepole pine and aspen are common early seral[9] species following fire disturbance. Fire also affects the acres that are dominated by grasses and shrubs.

Table 30. Acres of cover types on the Shoshone National Forest

Cover type	2011 percentage*	2011 acreage
Alpine	12.2	297,700
Grasslands	18.8	459,000
Willow	0.6	14,000
Sagebrush	1.6	38,800
Aspen	1.0	23,300
Douglas-fir	14.2	345,300
Spruce/fir	12.7	309,400
Lodgepole pine	15.7	382,900
Whitebark pine	7.8	190,600
Limber pine	1.4	35,300

* Percentages do not add to 100 percent, because 13.9 percent of the Shoshone is non-vegetated, rock, and ice, and water are not included.

Alpine

High-elevation plateaus throughout the Shoshone support large areas of alpine vegetation, except in the Washakie Ranger District area, where minimal soil development occurs on the glacially scoured high-elevation areas. The largest contiguous alpine grassland on the Shoshone is on the Beartooth Plateau. Alpine areas are high biodiversity areas with short growing season and rugged or rocky topography that host shrubs, grass, and forb species. Over 400 of the worldwide 8,000 to 10,000 species of alpine flora occur on the Beartooth Plateau that extends into the northern Shoshone (Rice et al. 2012).

Under current climate change scenarios, alpine areas are expected to undergo the greatest amount of warming and are sensitive to climate change. Potential impacts are declining alpine habitat and in some cases their extirpation (Rice et al. 2012).

[9] Seral refers to the gradual supplanting of one community of plants by another, the sequence of communities being termed a sere and each stage seral (successional).

Grasslands

Grasslands dominated by Idaho fescue occur throughout the Shoshone. In montane forest areas, grasslands are found on smaller, treeless areas on south- and west-facing slopes and ridgetops. Larger Idaho fescue grasslands occur, such as those on Bald Ridge and on Trout Peak and Monument Hill. On the Washakie Ranger District, Idaho fescue grassland types occur as patches on thin sandy soils in forested areas.

Bluebunch wheatgrass dominates the lowest elevations along the eastern margins of the Shoshone. In the South Fork of the Shoshone River drainage, bluebunch wheatgrass dominates arid bunchgrass rangelands found below treeline on soils developed mainly from slump-landslip landforms. This area is the largest arid low-elevation bunchgrass habitat on the Shoshone and is more typical of the Big Horn Basin than the montane vegetation found on the rest of the Shoshone. Another large, dry grassland dominated by wheatgrass is Riddle Flats in Sunlight Basin.

On the Wind River Ranger District, large expanses of nearly continuous grassland develop on the thin, well-drained soils on the limestone flanks of the Wind River Mountains. These grasslands extend from low elevations up to the alpine, interrupted by forests in narrow, discontinuous communities. Whiskey Mountain is an example of such an area. Idaho fescue/tufted hairgrass mix, another major grassland type, is found on the gently rolling glacial tills around the Union Pass summit.

Climate change scenarios indicate that grassland cover type will be favored, resulting in increases in this cover type as it expands upward in elevation (Rice et al. 2012).

Sagebrush

Diverse soils, geology, and climatic conditions cause varying distributions of sagebrush habitat types across the Shoshone.

Mountain big sagebrush dominates the montane shrublands throughout the Absaroka Mountains. These communities are scattered on alluvial deposits [10] or deeper soils on south- and west-facing slopes throughout the Absaroka Mountains. A high-elevation phase of this habitat type occurs on the south- and west-facing slopes just below the high plateau surfaces of Carter Mountain, Phelps Mountain, and the upper Greybull River. On the Clarks Fork Ranger District, mountain sagebrush forms part of an extensive forest/shrubland/grassland habitat type mosaic occurring on granite substrates on the lower portions of the Beartooth Plateau.

Arid low-elevation sagebrush occurs on the eastern margin of the north half of the Shoshone. The most extensive of these shrublands is found in the valleys of the North Fork and South Fork of the Shoshone River. Calcareous soils[11] generally support dwarf sagebrush types dominated by black sagebrush, while non-calcareous alluvial soils support big sagebrush.

On the Wind River Ranger District outside the Absaroka Mountains, younger sediments and non-volcanic substrates support two shrublands with limited ranges. Shallow rocky soils on exposed sites in the East Fork – Button Draw areas support low sagebrush habitat types. These provide important big game winter range because they remain snow-free much of the winter. A contrasting set of conditions supports low sagebrush on shale substrates of the lower Horse Creek and Long Creek areas. Soils under these have a fine-textured layer that interrupts

[10] Alluvial deposits are clay, silt, sand, and gravel left by flowing streams, typically producing fertile soil.
[11] Calcareous soils contain calcium carbonate.

drainage, causing saturation for part of the growing season. These soils are subject to degradation from trampling when they are wet. This habitat type occurs as small patches within a mosaic of shrubland and scattered forest habitat types.

Sagebrush and related types on the Washakie Ranger District are quite different from the remainder of the Shoshone because of the occurrence of shrub species more common to Utah and the Great Basin area. These species form mixed shrub communities occupying basins and lower slopes on sedimentary formations flanking the southern Wind River Mountains. These communities are dominated by mountain big sagebrush and one or more other shrubs including bitterbrush and mountain snowberry. Mid and upper slope portions, and steep south and west exposures, support dwarf sagebrush habitat dominated by threetip sagebrush. The southwestern corner of the Washakie Ranger District contains xeric[12] shrublands dominated by big sagebrush subspecies, which are similar to the less productive shrublands of the Absaroka Mountains.

Climate change scenarios indicate the range for sagebrush may shift, with expansion upward in elevation and contraction at lower elevations (Rice et al. 2012).

Willow

The Shoshone has a great diversity of willow species and communities. Willow communities are associated with a number of wetland and riparian conditions including along stream channels, on floodplains, near seeps, and on lake and pond flats and other depressions with high water tables. Willows occur at elevations ranging from 5,900 to 10,680 feet. Willow communities can range from small isolated stands to large expanses on riparian valley bottoms that are hundreds of feet wide.

Climate change scenarios indicate that the impacts to willows are related to the impacts on wetland communities. Increased potential for wetland desiccation resulting from increasing temperatures and changes in moisture regimes could result in a loss of willow habitat (Rice et al. 2012).

Aspen

Aspen occurs on a variety of sites within the Shoshone, becoming increasingly prevalent on the south end. Aspen is most common on relatively moist sites characterized by fine-textured soils (Reed 1971). Its successional role varies from a purely seral species to persistently seral. These stands frequently occupy concave slopes of low hills and even occur in big sagebrush zones on volcanic talus and boulder fields. When growing within or adjacent to conifer, aspen stands tend to be seral. Here, aspen occupies sites where disturbances have removed the conifers. Conifers will commonly reclaim these sites over time.

Aspen reproduction typically is asexual, with new shoots being produced from root sprouts (suckering) (Barnes 1966, USDA Forest Service 1991). This, combined with the persistence of aspen in the understory of some mature forests, explains why aspen tends to develop where it occurred previously. Sexual reproduction is quite rare, though seedlings do occur when severe disturbances such as fire are followed by extended moist conditions required for seedling establishment (USDA Forest Service 1985). For example, aspen seedlings were abundant in some areas after the 1988 fires in nearby Yellowstone National Park (Romme et al. 1995). Because of reproductive requirements, sexual reproduction of aspen is thought to be episodic (Romme et al. 1997). There is considerable genetic diversity between clones, with some clones

[12] Xeric sites or habitats are characterized by dry conditions.

better adapted for higher elevations and some responding differently to weather conditions than others (Meyer et al. 2006).

Climate change scenarios indicate the range for aspen may shift, with expansion upward in elevation and contraction at lower elevations (Rice et al. 2012).

Douglas-fir

Douglas-fir types are the major low-elevation forested type that occurs on the Shoshone, ranging from 6,500 to 9,500 feet in elevation. With the climate regimes found on the Shoshone, Douglas-fir thrives on soils derived from limestone or basic extrusive volcanics (andesites, basalt) and is less common on soils derived from granitic rocks (USDA Forest Service 1983a). Consequently, in the Wind River and Absaroka Mountains, Douglas-fir is absent in some areas where it might be expected based on climate alone. Since 2000, almost all the Douglas-fir cover type has been affected by Douglas-fir beetle to some degree.

Climate change scenarios indicate the range for Douglas-fir may shift, with expansion upward in elevation and contraction at lower elevations (Rice et al. 2012).

Spruce/fir

Engelmann spruce and subalpine fir habitat types on the Shoshone are complex with a large number of understory and substrate variations. Engelmann spruce occurs as a climax codominant or dominant on the wettest habitat types where it is more successful than subalpine fir. It is also more prevalent on the eastern flanks of the Shoshone’s mountain ranges than it is on the western flanks farther west in the Greater Yellowstone Ecosystem. Types reflect this where Engelmann spruce, rather than subalpine fir, is associated with whitebark pine at cold, dry, high-elevation sites. Engelmann spruce types have a slightly wider elevation range, from 6,200 to 10,300 feet, while subalpine fir types range from 6,500 to 9,800 feet. Soil substrates strongly influence the occurrence of Engelmann spruce and the seral species with which it is associated. Succession to Engelmann spruce and subalpine fir occurs on any soil type at higher elevations or on steep slopes. In some areas with more calcareous soils, the spruce is especially abundant. Spruce beetle activity is widespread on the Shoshone.

Under climate change scenarios, warming temperatures may result in a shift in spruce/fir cover type to higher elevations. This will result in an overall decrease in habitat as there is less acreage at higher elevations (Rice et al. 2012).

Lodgepole pine

Lodgepole pine occurs on a broad range of ecological conditions from the colder Douglas-fir sites to all but the wettest spruce/fir sites. Lodgepole pine is a major seral species that is often the first tree to reforest a severely disturbed site. In these situations, other conifers often replace lodgepole pine within one generation. Lodgepole pine is most persistent on gentle terrain. On lower slopes, benches, and broad valleys with large fluctuations in temperature, lodgepole pine can remain dominant. It can also remain dominant on gentle slopes and benches near treeline. In these situations, the stand may contain small amounts of whitebark or limber pine. Lodgepole pine is more widespread and is common on the acidic, coarse soils derived from granitic rocks and some sandstones.

Lodgepole pine is well adapted to disturbances because it often bears cones that remain closed for many years, thereby storing thousands of seeds. Known as serotinous cones, they open primarily when exposed to higher than normal temperatures, such as during fire or when the cones are near the soil surface. Notably, not all lodgepole pine produce serotinous cones and the proportion of closed and open cone trees is highly variable. Serotinous lodgepole pine are not common on the Shoshone, but observations suggest that serotinous cones are more common in the northern part of the Shoshone than in the southern (about 60 to 70 percent and 10 percent, respectively) (USDA Forest Service 1983a). Since 2000, there has been a continual upward trend in the number of acres affected by mountain pine beetle.

Climate change scenarios indicate the range for lodgepole pine may shift, with expansion upward in elevation and contraction at lower elevations (Rice et al. 2012).

Whitebark pine

Whitebark pine habitat types occur at the upper treeline on exposed ridges—sites too severe for spruce or fir. Whitebark pine is deformed or stunted by wind, cold, and drought on the most exposed sites. Stands range from 7,600 and 10,500 feet in elevation. At lower elevations, it merges with habitat types for subalpine fir, Engelmann spruce, or lodgepole pine. Whitebark pine is most competitive on acidic, igneous-derived soils near or at treeline. The distribution of whitebark pine is strongly affected by the Clark’s nutcracker, a bird that commonly distributes and caches the large seeds of this species into wind-swept openings where snow cover is relatively low. Since 2000, there has been a continual upward trend in the number of acres affected by mountain pine beetle and white pine blister rust. The combination of beetles, blister rust, and wildfire has resulted in an overall decline in this cover type.

Climate change scenarios indicate that the range for whitebark pine (a high-elevation species) will shift upward in elevation and, in some areas, may be extirpated (Rice et al. 2012).

Limber pine

Limber pine habitat types occur on some of the driest sites capable of supporting trees. They extend from lower to upper treeline on calcareous soils, most commonly ranging between 7,000 and 9,200 feet in elevation. Limber pine occurs on all aspects, but is most extensive on southeastern and southwestern exposures. It is frequently found between drier non-forest types and more moist Douglas-fir, spruce, and fir sites. In contrast to whitebark pine, limber pine predominates on calcareous soils. The Clark’s nutcracker also distributes the seeds of limber pine. Since 2000, there has been a continual upward trend in the number of acres affected by mountain pine beetle.

With increases in temperatures and changes in moisture regimes associated with climate change scenarios, the range of limber pine is likely to change with the possibility of an overall expansion as the acres of driest sites expand.

Other hardwood types

Various cottonwood tree species are associated with low-elevation riparian systems on the Shoshone. These habitat types occur on river floodplains, alluvial gravel bars, and stream terraces at elevations between 5,900 and 6,200 feet. Generally, the distribution of cottonwood species on the Shoshone is along the lower-elevation river systems (North Fork of the Shoshone River, South Fork of the Shoshone River, Greybull River, Clarks Fork of the Yellowstone River, Wind River, etc.).

Mountain alder is also associated with riparian systems. Mountain alder occurs up to 6,600 feet in elevation (Fralish and Franklin 2002). Both cottonwood species and mountain alder types occur on stream terraces and gravel bars.

These other cover types amount to only a few thousand acres on the Shoshone.

Climate change impacts to hardwood species will be similar to those for willows where hotter and drier conditions will result in the loss of some habitat.

Comparison of current cover type distribution to historic distribution

The proportion of different vegetation cover types can give additional insights into landscape changes through time. Just as Romme (1982) found for Yellowstone National Park, all major land cover types present in modern times on the Shoshone were also present during the historic range of variability period.

Within the historic range of variability, some evidence suggests the lodgepole pine forest type on the Shoshone has become less abundant in the last century, while the spruce/fir types have increased because of the maturing of the forest after heavy forest fires produced abundant lodgepole pine in the late 1800s. Fire suppression reinforces this trend; increases in wildfire and insect epidemics have reversed this trend in the last 10 years. Overall, variability in cover types due to climatic change is probably greater than variability due to minor changes caused by management (Meyer et al. 2006).

During the historic range of variability period, the low-elevation lands of the Shoshone probably contained grasslands, shrublands, savannas, and relatively open forests as well as small tracts of more closed forest. When forested stands are averaged with the savanna or woodlands, and projected through time during the historic range of variability period, tree and sapling density on low-elevation lands probably ranged from moderately low to moderate. With the frequently open tree canopy, the density of grasses, forbs, and shrubs would have ranged from moderately high to high.

Because of forest encroachment into meadows and shrublands, and natural reforestation following fire and timber harvest, the proportion of the Shoshone in forested vegetation may have been increasing since the late 1800s (Meyer et al. 2006). The percentage of the Shoshone that was forested in the early 1980s was reported to be only 40 percent (USDA Forest Service 1983), and currently it is just above 50 percent. Much of this spatial variability is due to distribution patterns, including topography and geology, but fire suppression can narrow this range. Due to the variability of local climatic conditions over the past 500 years, the present ratio of forest to non-forest land is most likely still within the historic range on high-elevation lands. Spatial distribution may now be different from historic range at low elevations, where trees have invaded grasslands, or have become denser; the amount of land area in grasslands has probably been reduced. Hansen’s bioregional assessment (2006) reported similar conclusions, finding that increases in conifer cover were most rapid in lower-elevation Douglas-fir and limber pine zones. Meyer et al. (2006) noted this effect could be somewhat less than expected on low-elevation forests because tree distribution may be controlled more by soils and topography than the periodicity of fires.

Presently, there is no evidence that limber pine and whitebark pine distribution has changed from the historic range. Although the spreading of white pine blister rust in conjunction with insect impacts and wildfires may be reducing distribution.

It is difficult to say whether the proportion of the Shoshone in aspen has declined below the historic range, as aspen has declined on some national forests (USDA Forest Service 2001a). On the Bighorn National Forest, aspen was not extensive in the 1930s or in the 1990s. Yet on the Targhee National Forest in Idaho, where it is more abundant, aspen stand size and number have declined substantially since 1920, apparently due to fire exclusion (Gallant et al. 2003, Parmenter et al. 2003). On the nearby Bridger-Teton National Forest, a photographic analysis of change between 1878–93 and 1968–72 also shows a decline in aspen (USDA Forest Service 1980). It is possible that aspen has declined beyond the historic range on the Shoshone as well. On the other hand, aspen may not have been as extensive on the drier Shoshone as on the national forests to the west (Meyer et al. 2006). Shoshone personnel believe that based on geology, the Washakie Ranger District and southern Wind River Mountains may be more similar to the forests to the west, while the rest of the Shoshone may be more similar to the situation on the Bighorn National Forest. Though aspen has probably decreased throughout the Shoshone, the greatest potential decreases have been on the southern edge of the Shoshone. Comparison of aerial photos from different periods supports this conclusion. Shoshone personnel believe aspen distribution is either at the lower end or just below the historic range of variation. Meyer et al. (2006) reported the number of land cover types has probably not changed beyond the historic range. Additionally, the proportions of different cover types are naturally dynamic and are probably within the historic range.

The current condition of cottonwood varies by river flow regimes, especially spring or peak runoff across the Shoshone. Generally, these systems are in relatively good shape across the Shoshone, but there are localized areas of regeneration concerns. Domestic grazing and ungulates may impact some areas of cottonwood regeneration.

The grassland cover type may also be declining relative to sagebrush on the Shoshone. On the Bighorn National Forest, grasslands declined by 15 percent and sagebrush increased by 4 percent between 1931 and 1996, which may have been due to fire suppression. However, given the variability in proportion of other cover types over time, sagebrush cover may not be above its historic range on either the Bighorn or Shoshone National Forests. Prescribed burning may be reducing the rate of sagebrush invasion into grassland. During the last 10 years, increasing numbers of wildfires have caused an increase in grassland acres.

Vegetation structure components

Age class distribution

Some species of wildlife have preferences for specific vegetation age classes. The two forested age classes that are most often identified with specific wildlife species are the oldest and youngest age classes. A range of age classes of shrub species such as sagebrush is also important for maintaining the habitats preferred by some wildlife.

The vegetation mosaic of Rocky Mountain landscapes is known to vary greatly through time, primarily because of large-scale fires and other natural disturbances.

In Yellowstone National Park, Romme and Knight (1981) found the amount of land area in forests of early, middle, and late successional stages varied temporally and it was unlikely the subalpine forests of Yellowstone as a whole are in a shifting mosaic. In the mid to late 1700s, young forests dominated more land area; in the mid-1900s, older forests were more common in the same area (Romme and Knight 1981). Old-growth forests (greater than 200 to 300 years old) are important ecologically because they provide considerable large wood on the ground, a relatively large number of snags, and habitat that seems to be required for some species of plants and animals. Much of the diversity within old-growth forest is associated with detrital and heterotrophic food webs (e.g., metabolism based upon respiration rather than upon photosynthesis) (Kaufmann et al. 1992).

A similar shifting mosaic must have occurred during the reference period at high elevations on the Shoshone. Meyer et al. (2006) quantitatively evaluated the proportion of the forested lands at high elevations in different age classes on the Shoshone and compared the age class distribution to Yellowstone. Using FIA data, most successional stages fell within or close to variables in Yellowstone. Overall, the Shoshone appears to have low numbers of stands with trees averaging more than 300 years old. Given the low levels of timber harvest, this cannot be attributed to timber harvesting. When the oldest stage (age class) was defined as greater than 200 years old, all stages were within the historic ranges of variability at the scale of the entire Shoshone.

In low-elevation forests, historic photo documentation indicates many stands of Douglas-fir were very open (Houston 1973). Overall, low-elevation tree density in many Rocky Mountain areas has increased greatly since the beginning of successful fire suppression. A comparison of historic and modern photographs of a pine savanna in north central Wyoming that was grazed in the past (but not currently) shows an increase in tree density (Meyer et al. 2006).

No specific information for age class distribution exists for aspen on the Shoshone. Information from Colorado and southern Wyoming suggests most aspen is even-aged. Some areas in Colorado exhibit two age classes and several age class stands are very rare (less than 4 percent) (Shepperd 2001). Shoshone personnel do not believe the current inventory accurately portrays the age class distribution for aspen. Given the small number of acres on the Shoshone, we do not think the inventory has provided an adequate sample. The inventory indicates that stands are young with few stands over 80 years of age. Field observations and photo typing indicate the opposite condition is the norm, with more stands in older age classes and fewer in the youngest age classes.

The vegetation mosaic of Rocky Mountain landscapes is known to vary greatly through time, primarily because of large-scale fires and other natural disturbances. It is believed the high-elevation forest has increased in age since the early to mid-1700s. The Shoshone appears to have had low numbers of stands with trees averaging more than 300 years old. Overall, for the Shoshone, Meyer et al. (2006) concluded the proportions in different successional stages in high-elevation environments of the Shoshone are within the historic range of variability.

On low-elevation forests, an effect of timber harvesting and fire suppression has been to reduce the natural variability in stand structure and age distribution caused by historic disturbances. The increased tree and sapling density resulting from fire suppression prevents most trees from reaching large sizes and reduces the stand average. The average age structure of unharvested low-elevation stands is probably outside the historic range of variability due to fire suppression. The result is an older age class distribution.

A very small percentage (1 percent) of Douglas-fir has been harvested; timber harvest has probably not yet reduced the percentage of the low-elevation lands in older age class outside the historic range of variability. Old-growth forests certainly could be lost in the future if suitable lands are harvested.

Most of these differences are minor compared to the large shift in age class distribution that is occurring because of the widespread insect epidemics affecting all conifer species on the Shoshone. Over 70 percent of the conifer stands on the Shoshone have been impacted to date. Though impacts are variable, the overall trend is a shift from older forests to younger forests.

Table 31. Current Forest-wide age class diversity by cover type for the Shoshone (Menlove 2008) (percentage of cover type acres*)

Forest cover type	Age class distribution (percentage of age class)		
	Younger	Middle	Older
Aspen	-**	-	-
Douglas-fir	6	78	16
Spruce/fir	6	64	30
Lodgepole pine	15	63	22
Whitebark pine	3	74	23
Limber pine	3	69	28

* Percentages reflect Forest-wide numbers and may vary across the Forest.
** Data on current aspen age classes are inconclusive.

Patch size and edge

Edges are created by different events. For example, edges occur between areas of different burn intensities; human-created edges, such as around clearcuts and roads, are usually more abrupt. The effects of such edges on plants and animals that require interior forest conditions or security cover can be detrimental. Roads and clearcuts can reduce the core area of patches (interior area of patch with edge depth of 50 meters, or 164 feet), increase edge and edge convolution, reduce patch size, and increase patch diversity (Tinker et al. 1998).

Patch size is defined as the amount of continuous forest, uninterrupted by streams, lakes, or other openings. Historically, these forests existed as contiguous tracts of forests in a variety of seral stages broken by differing landscape patterns (rivers, exposed rock, etc.).

There is no standard patch size for whitebark pine due to its pioneering nature from Clark's nutcracker and species establishment in high elevations and harsh elements. Genetic diversity varies in some stands. Some stands consist of all genetic cohorts[13] or siblings and some stands were not genetically related (Tomback et al. 2001).

Fires generally produce many small patches and a few large patches within the high-elevation forest structure. Forests within the historic range of variability would exhibit contiguous, even-aged cohorts that would have developed after fires. Edges are created between areas of different burn intensities. In Yellowstone National Park, Tinker et al. (2003) found the average forested patch size was 320 to 380 hectares (790 to 940 acres).

Low-elevation lands during the reference period probably were composed of distinct and separate clumps of relatively even-aged stands of Douglas-fir (but with some variation in ages within the clumps), in which new cohorts of tree establishment were linked to climatic oscillations (Kerr 1988, Savage 1991). Most Douglas-fir stands in dry soil regimes were open and park-like due to frequent fires. Moist soil regimes produced more contiguous stands of Douglas-fir with a greater variety of age classes.

The patch size of aspen stands on the Shoshone has probably declined due to fire suppression and commercial livestock and wild ungulate grazing. Overall, patch size on the Shoshone is probably smaller than on the adjacent Bridger-Teton National Forest because of differences in

[13] A cohort is a group of individuals having something in common.

soil, topography, and climate. The Bridger-Teton National Forest, situated on the west side of the Rocky Mountains, receives more precipitation and has deeper soils.

Patch and edge variables are outside their respective historic ranges of variability in areas where clearcuts and roads are common, though such areas comprise a small portion of the Shoshone. Generally, edge and patch variables are within the historic ranges of variability at a broad scale. The few watersheds with heavy cutting, mostly on the Wind River Ranger District, have more homogeneous patch sizes than during the reference period.

Generally, aspen has not been harvested on the Shoshone, so most characteristics of edge and patch size alterations are not affected by timber management. Fire suppression has probably aided in succession of conifers into aspen stands, decreasing aspen patch size. Some roads have bisected aspen stands and impacted their edge characteristics. Overall, the effects of fire suppression and roads have probably not altered patch size or edge characteristics outside the historic range of variability at a broad scale.

Snag size and density

The importance of dead trees as a component of wildlife habitat is widely accepted. Dead trees provide key nesting and foraging habitat for cavity nesters and are the primary source of recruitment of down large woody debris.

Snags are created through insect and disease outbreaks, fire, wind events, and natural mortality. Aspen has a natural propensity for insect and disease infestations, leading to natural snag retention in most aspen stands. Snag density in aspen stands is very important to many cavity-nesting birds. In Colorado, nearly 38 percent of all cavity-nesting birds use aspen stands. Early photographs of unburned or untreated areas typically show an abundance of snags.

Data for snag size and density on unharvested stands were gathered by Harris (1999) in southern Montana. Harris's work includes most of the cover types on the Shoshone. Table 32 shows these numbers for cover types that occur on the Shoshone. In the absence of other data, these data for unharvested stands provide a baseline for natural snag levels.

Table 32. Diameter of snags per acre in untreated stands (Harris 1999)

Cover type	Number of sample sites	9 to 14.9 inches	15 to 20.9 inches	21 to 26.9 inches	Greater than 27 inches	Total snags per acre
Spruce/fir	280	16.06	3.79	0.92	0.32	21.09
Douglas-fir	420	6.78	1.62	0.46	0.10	8.96
Lodgepole pine	230	11.13	0.85	0.17	0.03	12.18
Dry subalpine*	30	27.62	2.78	0.98	0.06	31.44
Hardwood**	16	5.33	0.00	0.00	0.05	5.38

* Dry subalpine consists of whitebark pine and limber pine types.

**Hardwood types consist of aspen, cottonwood, and birch.

Table 33 displays snag densities for the Shoshone in 1998. For all species except whitebark and limber pine, total snag numbers on the Shoshone are comparable to those found by Harris. Given the small percentage of the Shoshone impacted by timber harvesting, it is reasonable to assume these snag levels are comparable to natural levels. The densities for whitebark pine and limber pine are lower than those found by Harris. Given the similarity for all other cover types to

Harris's findings and the lack of any activities that would reduce snag levels only for whitebark pine and limber pine, we assume the data represent comparably natural snag numbers for these species on the Shoshone that are lower than those found by Harris in southern Montana. Another difference between the Harris numbers and the Shoshone data is that there are generally fewer snags over 15 inches. Again, given the general lack of activities on the Shoshone that could cause the loss of larger snags only, it is reasonable to assume that, given climate and moisture regimes, tree sizes are generally smaller on the Shoshone than in the Harris study.

Table 33. Diameter of snags per acre on the Shoshone (USDA Forest Service 1998 (FIA data))

Cover type	9 to 14.9 inches	15 to 20.9 inches	Greater than 21 inches	Total snags per acre
Spruce/fir	24.43	4.21	0.43	29.07
Douglas-fir	8.07	1.08	0.23	9.38
Lodgepole pine	15.02	0.50	0.27	15.79
Whitebark pine	9.77	0.68	0.83	11.28
Limber pine	6.83	2.27	0	9.10
Aspen	5.70	1.96	0	7.66

As discussed in Meyer et al. (2006), snag density is often highest in recently burned forests and in old-growth forests (Tinker 1999, Mehl 1992). Fire suppression and timber harvest are the two activities most likely to affect these conditions. Given the general inaccessibility of the Shoshone, fire suppression has had less of an effect than in other areas in the West. In the higher-elevation forests, only 5 to 10 percent has been impacted by fire suppression (Meyer et al. 2006). At lower elevations, most of the Shoshone has been impacted, given the easier accessibility. Fire regime condition class assessments indicate that 24 percent of the Forest has missed at least one fire event.

Studies show that areas subjected to timber harvest (less than 4 percent of the forested land on the Shoshone) have fewer snags than unharvested areas (Harris 1999, Meyer et al. 2006).

In the high-elevation forest, limited harvesting and fire suppression have not shifted snag densities outside the historic range of variability at the broad scale (Meyer et al. 2006).

Considering that most low-elevation forests on the Shoshone have not been harvested, but have been influenced by fire suppression, the larger effect of management on snags and coarse woody debris at lower elevations may be less frequent fire occurrence. Fire tends to create snags, but insect and disease epidemics can do the same. In the absence of fire (or harvesting), pathogens may become more abundant. Meyer et al. (2006) determined that the number of dead trees (snags) due to fire suppression is not yet unusually high or low, so low-elevation snag size and density is within the historic range of variability. At a smaller scale, the effects of timber harvest (including firewood gathering) may have reduced snag densities outside the range of historic variability in the portion of some watersheds. Very little aspen has been harvested—less than 1 percent—on the Shoshone. Snag density and size are thought to be within the historic ranges of variability for aspen forests.

The current insect outbreak has greatly increased snag density across the Shoshone. This increase is not reflected in the FIA data gathered in 1998. Recent reports confirm the level of bark beetle-caused mortality is increasing across the Rocky Mountains, including the Shoshone.

Over the past 10 years, widespread bark beetle epidemics have occurred on the Shoshone. All major bark beetles have been in epidemic status on at least parts of the Shoshone during this time. Under current conditions, snag levels at the broad scale are within or above the range of historic variability.

Coarse woody debris

Adequate snag densities maintained at the broad scale will maintain adequate coarse woody debris. We use snag density as a surrogate for coarse woody debris, i.e., snag densities within the historic range of variability will eventually become coarse woody debris within the historic range of variability.

Coarse woody debris (or logs) plays a key role in soil stability, nutrient cycling, moisture retention, and fish and wildlife habitat. Coarse woody debris that falls across hill slopes acts as a barrier and traps soil to prevent sedimentation from reaching streams and rivers. In turn, plants take root and act to further stabilize this new soil.

The consequences of deviations from the historic range of variability for coarse woody debris are still poorly understood, but both standing and downed tree boles[14] provide important habitat for some species of fungi and a variety of insects, all of which can be important sources of food for vertebrates. Coarse woody debris is also known to be important for diversifying stream channels and structures, and the organic compounds derived from decomposing wood undoubtedly influence the underlying soils.

Natural disturbances do not remove bolewood from the forest floor. Even an intensive fire leaves most of the wood in the form of snags, and most of that becomes coarse woody debris within two decades (Lotan et al. 1985). A reburn can occur, but still considerable coarse woody debris remains on the forest floor (Tinker and Knight 2000). After a century or more, the downed wood becomes incorporated into the surface soils. Some studies of the diversity of snags and coarse woody debris in low-elevation forests of the Black Hills indicate that different disturbances create different sizes of snags and coarse woody debris. For example, the stems of beetle-killed trees tend to break, leaving a relatively short snag, while trees killed by root rot are commonly uprooted.

Harvesting at the stand level is fundamentally different from any kind of natural disturbance and produces a forest that is outside the historic range of variability for coarse woody debris and probably the ecosystem processes associated with structural features dependent on big pieces of wood. Periodic surface fires could consume downed and decaying wood on the forest floor. With less frequent fires, this wood could persist for a longer time, and if coarse woody debris inputs remain constant, then coarse woody debris may increase.

Such changes are probably not large enough to shift coarse woody debris densities outside the historic range of variability for the Shoshone. This conclusion is further supported by the information on snags that indicates they are within the historic range of variability. At smaller scales, there is a possibility that harvesting could reduce coarse woody debris below the historic range of variability in some watersheds.

The current insect outbreak, which has greatly increased the density of standing snags, will also result in an increase of coarse woody debris as those snags fall.

[14] A bole is the main trunk or stem of a tree.

Unique and limited habitats

Fens

Although fens occupy only a minor portion of the Shoshone, they perform important hydrological and water quality functions. Many aquatic biota benefit from the water cleansing action of fens in headwaters of streams. Fens also often possess unique biotic assemblages of plants and animals.

Fens occur frequently throughout the Rocky Mountains from Colorado north into Canada. Fens are confined to specific environments defined by groundwater discharge, soil chemistry, and peat accumulation of at least 40 centimeters (16 inches) (Soil Survey Staff 1999). This system includes extreme rich fens and iron fens, both being quite rare. Fens form at low points or near slopes where groundwater intercepts the soil surface. Groundwater inflows maintain a fairly constant water level year-round, with water at or near the surface most of the time. Constant high water levels lead to accumulations of organic material. In addition to peat accumulation and perennially saturated soils, the extreme rich and iron fens have distinct soil and water chemistry with high levels of one or more minerals such as calcium, magnesium, or iron. These fens usually occur as a mosaic of several plant associations dominated by sedge, bulrush, and a variety of mosses. The surrounding landscape may be ringed with other wetland systems, e.g., riparian shrublands, or a variety of upland systems from grasslands to forests (Heidel 2003, 2008).

No detailed information is available on the historic range of variability of fens sites on the Shoshone.

One of the large complexes of fens is the Swamp Lake Botanical Area, a special interest area that is afforded special protection. Several other fen complexes on the Shoshone are within potential research natural areas or special interest areas. Most fens are not heavily grazed and timber harvesting does not occur on these sites due to following Forest Service Regional and National BMP Directives. There has been encroachment by conifers in some of these areas, but this is probably not outside the historic range of variability.

Although there is no definitive scientific information on the status of fens, we believe the fens are generally within their historic ranges of variability.

Increased potential for wetland desiccation resulting from increasing temperatures and changes in moisture regimes resulting from climate change could result in a loss of fen habitat over the long term.

Riparian communities

Diverse riparian communities occur on the Shoshone from alpine areas to lower montane areas (Walford 2001). Some are dominated by trees and shrubs, while others are dominated by grass/forb communities. All are influenced by natural hydrologic regimes, including flooding and changes in water tables.

The historic range of variability for high-elevation shrubland riparian communities would include a mosaic of multiple communities that are shrub- and herb-dominated and include above-treeline, willow-dominated, snowmelt-fed basins that feed into streams. The historic range of variability for high-elevation forested riparian communities contains the conifer and aspen woodlands that line montane streams. These communities are tolerant of periodic flooding and high water tables. Snowmelt moisture in this system may create shallow water tables or seeps for a portion of the growing season. Generally, these systems would fluctuate periodically with large events such as fire and flooding. Fire return events would occur depending on the adjacent forest types. If we extrapolate some of the information from spruce/fir fire return intervals, the return interval would be approximately 170 to 300 years. Meyer et al. (2006) suggest fire intervals adjacent to riparian, lowland, and wetland areas would be as high as 700 years or more.

At the turn of the 20th century, in some watersheds of the Shoshone, tie hacking probably altered some watershed conditions at higher elevations. Overgrazing during the same period likely decreased the abundance of some willow and aspen communities and favored succession to conifers within riparian areas. This was probably more of an issue at lower elevations where there is greater access by livestock. Interdisciplinary team review of aerial photos (1937 to 1997) indicated current impacts to some riparian areas from livestock grazing.

Fire return intervals are generally within the historic range at high elevations, so we assume fire return intervals associated with riparian corridors at high elevations would also be within historic fire return intervals. Water is diverted in some areas of the Shoshone, which may change the distribution of water downstream, although this is very limited.

In conclusion, some riparian communities within the Shoshone are outside their historic ranges of variability due to tie hacking, grazing, and water diversions. The area affected by these past practices is variable across the Shoshone.

Climate change scenarios indicate that wetland and riparian areas will have increased potential for wetland desiccation resulting from increasing temperatures and changes in moisture regimes (Rice et al. 2012). These changes could result in an overall loss of habitat.

Desired Condition

The desired condition for vegetation is presented in the revised Forest Plan. Tables 1 and 3 from the revised Forest Plan are reproduced here (table 34 and table 35) and display the desired cover type distribution and age class diversity for all alternatives.

Table 34. Desired cover types on the Shoshone

Cover type	Desired percentage	Desired acreage
Alpine	12	297,300
Grasslands	14 to 19	341,300 to 463,200
Willow	0.6 to 0.75	14,600 to 18,300
Sagebrush	1.5 to 3	36,500 to 73,100
Aspen	2 to 3	48,700 to 73,100
Douglas-fir	13 to 16	317,000 to 390,100
Spruce/fir	12 to 17	292,600 to 414,500
Lodgepole pine	11 to 16	268,200 to 390,100
Whitebark pine	9 to 11	219,400 to 268,200
Limber pine	1.5 to 3	36,600 to 73,100

Table 35. Desired age class diversity by cover type for the Shoshone (percentage of cover type acres*

	Desired age class distribution Management area categories 1, 2, 3 (percentage of age class)			Desired age class distribution Management area categories 4, 5, 8 (percentage of age class)		
Forest cover type	**Younger****	**Middle**	**Older*****	**Younger**	**Middle**	**Older**
Aspen	5 to 20	50 to 75	20 to 30	15 to 20	65 to 80	5 to 15
Douglas-fir	5 to 10	65 to 80	15 to 25	10 to 15	70 to 85	5 to 15
Spruce/fir	5 to 10	60 to 75	20 to 30	10 to 15	70 to 85	5 to 15
Lodgepole pine	5 to 15	60 to 80	15 to 25	10 to 20	65 to 85	5 to 15
Whitebark pine	5 to 15	60 to 80	15 to 25	10 to 15	70 to 85	5 to 15
Limber pine	5 to 15	60 to 80	15 to 25	10 to 15	70 to 85	5 to 15

* Percentages reflect Forest-wide numbers and may vary across the Shoshone.

** Less than 20 years old for all forest cover types.

***More than 80 years old for aspen cover type, more than150 years old for lodgepole pine cover type, and more than 200 years old for all other forest cover types.

Environmental Consequences

Climatic and biological processes will continue to be the dominant influence on the composition of the Shoshone. Occurrences of the major cover types are relatively constant over historic timeframes. Current abundance and distribution of major cover types and vegetation composition are generally similar to the common patterns over historic periods (Meyer et al. 2006). Composition changes following disturbances can last for varying amounts of time depending upon the severity of the disturbance. For example, severe wildfire disturbances, insects and disease, or blowdown in spruce/fir ecosystems can change composition for hundreds of years following the disturbance, though eventually a spruce/fir stand will be reestablished. Other types of disturbances create composition changes that last only for a few years.

Timber harvesting and/or prescribed fire can emulate natural disturbances in that they change or remove the dominant vegetation and provide for the growth or establishment of other vegetation. Overall, there are few long-term changes to composition as regeneration occurs and matches pre-existing composition. Timber harvest can directly alter the structure of forested overtypes, either in density, size class, or canopy cover. Several harvest methods are available to achieve silvicultural objectives, producing different effects. Uneven-aged systems maintain a forested canopy. Even-aged systems such as shelterwood retain some of the canopy longer. Clearcut harvests create an immediate change to a seedling age class. Final harvests conducted for timber production objectives on suited timber lands are designed with an assurance of regeneration within 5 years. This successful regeneration maintains cover types and initiates the flow of successional stages over time.

Different management scenarios emphasize or allow retaining forest structural elements within regenerated stands. Timber harvest type affects patch size differently; clearcutting has the most dramatic effect on patch size. Forest direction limits the size of clearcut units to 40 acres or less without regional forester approval, which can perpetuate the trend toward smaller patch sizes. For some cover types (e.g., lodgepole pine), this creates a pattern which is likely different from the patterns associated with natural disturbance events. All conditions are still present, but on the average in comparison to other areas, stands are younger, patch size is less variable with more mid-size patches (10 to 100 acres), and the amount of dead and down material is lower. Areas where vegetation management activities are more frequent have the lowest snag densities, with minimum densities of two to three snags per acre greater than 9 inches in diameter. Occurrence of large woody debris generally mirrors the occurrence of snags, with the greatest densities in those areas where natural processes dominate.

The largest effect to composition would be from natural disturbances including fire, insects, disease, and blowdown. These disturbances would affect all vegetation types by restarting seral progression. In non-forested vegetation types, many plant species are adapted to fire occurrence and would thrive from the effects of fire. Other species would need time to reestablish. There are minor amounts of tree injury due to harvesting practices that allow the spread of some diseases among trees; however, this amount is negligible at the Forest-wide scale due to the few acres harvested each year. Wildfires and insects are both influenced by stand structure and drought. Since many of the existing forest stands are mature, there is potential for large-scale events over large areas of the forest during extreme climatic conditions. Because of subalpine forest's wildfire character (generally wind-driven during dry periods which results in distant spotting), it is projected that large wildfires will continue to occur under all alternatives in this cover type.

Patch sizes created with prescribed fire are likely smaller than those created by natural processes. Patches created by prescribed fire would often be designed to emulate natural patch size shape and connectivity; however, patch size would still be constrained by standards and guidelines for other resources such as riparian areas, recreation, and scenic resources. Blowdown is a random event, though typically mature stands are more affected than young stands of trees. Blowdown has the potential to occur within the next several decades, though would likely be at a scale of hundreds to a few thousand acres. The effects of wind can be greater where trees are already affected by root diseases. After wind events, spruce beetle epidemics can spread out from the blowdown. Wind events can also be followed by large-scale fire events that can create extensive areas of severely burned soil and vegetation from the loading of large fuels. On the average, in unmanaged areas as compared to managed areas, stands are older, patch size is variable with many small patches (less than 10 acres) interspersed among large patches (greater than100 acres) that dominate the area, and the amount of dead and down material is greater. Snags occur within all tree cover types and commonly occur in patches. Densities are highest in areas where natural disturbance processes dominate. In these areas, snag densities range from five snags per acre greater than 9 inches in diameter for aspen cover type to 21 snags per acre greater than 9 inches for spruce/fir cover type.

Grazing effects on composition depend on a number of factors, including the amount of grazing, timing, seral stage of the area, and other environmental parameters. Most changes to composition on the Shoshone, including the expansion of Kentucky bluegrass in riparian areas, noxious weeds, and other effects associated with livestock grazing have occurred from higher stocking rates of livestock in the past. Grazing retards the growth of herbaceous and woody cover if done in excess, and thereby slows progression of seral stages following disturbances. If there are impacts from livestock grazing, they generally are most evident in wetland and riparian areas and, to a lesser extent, in meadows and aspen sites.

Rangelands

Direct and Indirect Effects

For each of the resource areas described below, the environmental consequences for vegetation resources are compared by alternative, based on key indicators of disturbance for each type of activity. In general, alternatives that propose greater levels of disturbance activities for various resource uses increase the potential for impacts to the vegetation resource.

Effects from Timber Harvesting: There is little to no effect to existing rangeland vegetation from timber harvest. However, as timber is harvested, it may open areas in the canopy so that an increase in forage occurs in the understory, or it may create new acreages of transitory (e.g., short-term) rangeland vegetation in small harvest units. This transitory rangeland remains in this state until the forested stands once again close in or the young trees become dense enough that rangeland vegetation no longer occupies the site. In a dynamic forest, with some tree stands closing in while others are opening up, there is no net change in rangeland vegetation acres, except through large-scale natural disturbance events. Alternatives E and F would have the greatest potential for effects due to timber harvesting activities, while alternatives A through D and G are nearly equal in disturbance potential.

Effects from Roads and Trails Management: Effects are similar to those for recreation (described below) except they occur on a greater number of acres (roads versus trails). Past road construction has contributed to a reduction of acres of native meadows and shrublands; roads constructed in and along valley bottoms have reduced and/or altered riparian vegetation and sometimes changed stream channel location and function. Roads have the potential to create a large impact on the health and sustainability of stream/riparian/wetland systems. Effects can include lowered water tables, altered morphology, changed sediment regimes, and removal of canopy cover and other vegetation. Other uses may subsequently contribute to these effects. Currently, unauthorized off-road vehicle travel has had a great effect in moving rangeland vegetation to an earlier seral condition; this use is unplanned and can be widespread, with erosion and riparian degradation resulting. Roads in the uplands tend to fragment rangeland vegetative stands, to alter hydrologic relationships by intercepting overland and sub-surface flow, and are potentially a significant contributor of seed and seed bed for invasion of noxious weeds and other non-native vegetative species. Alternatives E and F present the largest potential area available to summer-motorized travel impacts. Alternatives C and D have the smallest potential area. Alternatives A, B, and G have potential areas between the other alternatives.

Effects from Disturbance Processes (fires/fuels management and insect/disease mortality): On rangelands, fire tends to alter the successional pathway, at least temporarily, and generally sets back succession to an earlier seral stage. It also tends to alter the structure of the vegetative communities. Wildfire, and more specifically, high-intensity wildfire, will often be a greater disturbance (more often moves succession to an early seral stage and reduces or eliminates taller structure in sagebrush or other shrub communities) than will prescribed fire because planned/managed fires are often designed specifically to avoid drastic alterations on the landscape. Fire is a natural factor in maintaining the natural diversity of vegetation across rangelands. It retards or prevents conifer or shrub encroachment in meadows and parks, regenerates aspen stands, and is responsible for maintaining a mosaic of vegetation necessary for wildlife habitat diversity. In general, the greater the use of prescribed fire, the greater the number of acres on which vegetative succession will be moved to an earlier seral stage and on which tall structure will be reduced.

The use of prescribed fire for fuels treatment and vegetative management is greatest in alternative F and the least in alternative C; however, differences among alternatives are not great.

Effects from Livestock Grazing and Big Game: Livestock, big game animals, and other wildlife that graze and browse the herbaceous and shrub cover on rangelands can be considered disturbance agents. These animals also create a disturbance through hoof action, which affects vegetation and soils in riparian and upland sites. Their effect depends on a number of factors including intensity, timing, and frequency of grazing; kind of herbivore; soil moisture and condition; and existing seral condition of the vegetation. Use by ungulates, when properly managed by vegetative type and within habitat capacities, tends to provide for a mix of seral stages across broad landscapes. High intensity of use, repeated use during times of rapid plant growth, frequent use of individual plants or plant communities, or longer periods of use tend to result in more vegetation developing into early to mid-plant succession, while lighter, shorter, or less frequent use tends to result in a higher percentage of mid and late seral vegetation. The analysis of acres suitable for livestock grazing indicates that the average stocking level is moderate as compared to other forests in the Forest Service Rocky Mountain Region (see appendix B for details regarding modeling). Reductions of grazing use over the last several decades coupled with increases in management intensity and improved knowledge regarding habitat requirements and plant ecology have likely resulted in increases in herbaceous production and trends toward desired conditions.

Big game populations are less manageable or predictable than domestic livestock, but their effects on managing for desired conditions are similar to those of domestic livestock. Elk tend to impact meadows and more open grassland types, while deer impact shrublands, grasslands, and riparian areas, and moose impact riparian/wetland habitats. High numbers of big game species will result in maintenance of rangeland vegetation in an early or mid seral condition. Lower numbers allow more acres to move toward a later successional stage. In addition, seasonal use (such as big game moving up the mountain very early following green-up each year) impacts plants when they are most vulnerable, sets back succession, and can damage wet soils. Grazing impacts by permitted livestock and wild ungulates is not expected to differ significantly among alternatives.

Alternatives E and F, which maximize commercial livestock grazing opportunities, have the highest potential to impact rangelands. Alternatives A through D and G have similar and somewhat lower levels of disturbance.

Effects from Recreation: Recreational use generally has little effect upon rangeland vegetation except in the case of repeated or continual uses such as grazing of pack and saddle livestock, camping, fishing, and hiking, or illegal off-road vehicle use. Repeated use by recreational horse or off-road vehicle use in popular areas can alter plant and soil characteristics over time. Such uses tend to return succession to an early seral stage, even to bare soil on trail systems and in very popular dispersed camping sites and along popular fishing areas, generally the number of acres impacted is a very small percentage of the total rangeland acres across the Forest. Off-road vehicle activities that create bare or disturbed soil provide conditions for invasive species establishment and spread, including on roads and roadsides, trails, and trailheads, parking lots, developed and dispersed camping sites, popular fishing locations, and heavy-use areas around summer homes and lodges. Off-road vehicle travel has high potential to introduce and spread noxious weeds, and in turn move rangeland vegetation away from desired conditions. Alternatives that emphasize summer recreational opportunities, especially motorized recreation may have a slightly greater effect on rangeland vegetation.

Effects from Noxious and Invasive Species: Infestations can become established when any type of ground-disturbing activity results in exposure of the soil to a seed source. These infestations result in the degradation of the rangeland plant community with a resulting decrease in native plant composition and productivity. An increase in bare ground, less effective use of precipitation, and increased erosion often occur. Any activity, natural or man-made (i.e., flood, fire, vehicle traffic, livestock or wildlife use, timber activities, etc.) may result in an increased potential for occurrences of invasive species.

Effects from Mineral and Energy Development: Effects are similar to those for roads (see above). The amount of rangeland vegetation that could move to an earlier seral stage is dependent upon the amount of exploration and resultant production. Production sites often create areas of disturbed soil, providing areas for noxious weed infestations. Restoration of these areas following production will involve monitoring and treatment of noxious weeds, along with re-establishment of native species.

Effects from Oil and Gas Development: Same as mineral and energy development.

Effects from Wildlife Habitat Management: Effects are similar to those for prescribed fire (see above).

Effects from Land Use Authorizations: Effects are similar to those for mineral and energy development (see above).

Wilderness and RNA Allocation: There would be no direct impacts from wilderness or research natural area allocation; however, the activities these designations restrict or exclude (i.e., timber harvest, prescribed fire, motorized vehicle use) would no longer have the potential to impact rangelands.

Cover types

Direct and indirect effects

Most cover types are minimally affected by the alternatives. Alpine, grasslands, Douglas-fir, spruce/fir, and lodgepole pine will continue to fluctuate within the desired condition ranges presented in table 34. The acreage directly impacted by the alternatives is such a small percentage of these cover types that any changes resulting from activities will not noticeably impact cover type acreage in comparison to changes resulting from disturbance processes.

For sagebrush, willow, aspen, whitebark pine, and limber pine cover types, the alternatives have some impact on the extent of the cover types. All alternatives have some level of restoration and/or protection objectives for these cover types that will result in changes in cover type acreages.

Sagebrush is protected in all alternatives to maintain habitat conditions for sage grouse. Both prescribed fire and wildfire would be managed to limit the impacts to sagebrush. This protection is more effective in alternatives where greater access provides the opportunity for quicker and more effective fire suppression activities. The action alternatives also provide more direction on protecting sagebrush, though given other Wyoming State direction for sage grouse of which the Shoshone is party to; there is probably little actual difference from what would happen under alternative A. The relative difference among alternatives is small, but would generally be ordered as A, C, D, B, G, E, and F, where C has the least acres of sagebrush and F has the most. Alternatives B and G have the same effect.

Willow restoration is emphasized in all action alternatives and would result in an increase of willow cover type. There would be little difference among any of the alternatives because restoration activities are limited mostly by habitat suitable for restoration. Alternatives which treat more overall acres of vegetation may have a slightly higher increase due to increased activity and opportunity for mutual benefits from related activities. Alternative A has less emphasis on willow restoration, and as a result, will probably have less of a change in willow cover type acres.

Aspen restoration is emphasized in all alternatives and would result in an increase of the aspen cover type. All the action alternatives have an objective for increasing aspen acres using mechanical treatments ranging from 2,000 acres in alternative C to 3,500 acres in alternative G. Though alternative A does not have an objective for aspen, it does include direction emphasizing aspen and it is projected to result in an increase similar to the action alternatives. The alternatives that have higher acres of active management and roaded areas would have increased mechanical treatments for aspen, but they would also result in less wildfire, which would limit aspen expansion resulting from wildfire. In addition, with aspen being a non-commercial species, there are tradeoffs of managing for aspen in suitable timberlands where there is an emphasis on producing commercial timber. This is in contrast to other timberlands where aspen caries a greater emphasis. Because of these factors working against each other, the differences among alternatives are rather small. It is expected that alternative C would generally have fewer acres of aspen because of the much higher reduction in acres available for mechanical treatment.

Whitebark pine restoration is emphasized in all alternatives. All the action alternatives have an objective for restoring whitebark pine acres ranging from 500 acres in alternative C to 1,400 acres in alternative G. The objective in alternatives B, D, and E is 750 acres. In alternative F the objective is 1,250 acres. Some restoration activity may take place in wilderness, but the associated costs would limit the overall acres of whitebark restoration occurring in wilderness. Alternative A does not have an objective for whitebark; however; it does include direction for restoring whitebark and it is projected to result in an increase similar to alternatives B, D, and E. Alternative F has a larger objective because a larger amount of whitebark cover type would be within suitable timber lands. This increase would be partially tempered by the fact that the commercial opportunity provided by whitebark pine is limited and commercial timber would be emphasized on those lands. The objective for alternative G was set higher to indicate an even greater emphasis on whitebark pine restoration. The opportunity for restoration of whitebark pine will be limited in the short term until a suitable supply of whitebark seedlings that are resistant to blister rust is available for planting.

Limber pine restoration is also emphasized in the action alternatives and would have trends similar to whitebark pine, though activity levels would be much smaller because most efforts would be directed toward whitebark pine restoration.

Effects from Timber Harvesting: The effects of timber harvest on the extent of the cover types for lodgepole pine, Douglas-fir, and spruce/fir are small. The acres mechanically treated in these cover types are a small percentage of the overall acres. In addition, the standard silvicultural practice of regenerating stands back to the appropriate cover type would result in little change of total cover type acres over time.

For cover types, aspen, willow, whitebark pine, and limber pine timber harvesting has a greater effect. More timber harvesting is normally connected to the opportunity for more restoration activities. Restoration activities alone can sometimes be expensive, and the ability to conduct them in conjunction with timber harvest activities that produce commercial products can help offset some of the costs. This would result in the alternatives with more treatment likely having more restoration activity and greater increases in acreages of these cover types.

Effects from Fire and Fuels: Fire, both prescribed fire and wildfire, can influence the acres of a number of different cover types. Grassland acres can be maintained and increased by fire activity that kills encroaching conifers, which can, over time, change grassland to timberland. Alternatives with more fire and more wildfire would have a greater effect.

Fire can affect sagebrush both positively and negatively. Positive effects include diversifying sagebrush stand structure, killing conifer encroachment, and renewing growth. Widespread fire, particularly of high intensity, can set sagebrush habitat back to grassland, and in some cases, can lead to the proliferation of invasive species such as cheatgrass that can permanently covert the stand from sagebrush to grassland. All alternatives have direction to minimize, where possible, fire that could lead to cheatgrass expansion. This negative impact would be greatest in those alternatives with the greatest amount of wildfire. Prescribed fire can be conducted in areas to avoid the negative impacts and emphasize the positive impacts.

Fire generally has a positive effect on aspen cover type, by renewing stand conditions, killing encroaching pine, and setting stands back to an earlier seral stage where aspen can colonize a site. Wildfire usually has a greater impact than prescribed fire because the fire intensity required to regenerate aspen is more difficult to achieve in a prescribed fire. Alternatives with more fire, particularly wildfire, will result in a greater increase in aspen cover type.

The mix of Douglas-fir, spruce/fir, and lodgepole cover types on the Forest is influenced by fire, particularly wildfire. Fire can set stands back to an earlier seral stage where lodgepole dominates because it is the first conifer species to recolonize a site. This is particularly true for spruce/fir stands, which commonly change to lodgepole pine after an intense fire. Over time, the lodgepole pine is replaced by spruce/fir. Alternatives with more wildfire would have a higher percentage of lodgepole pine over time than alternatives with less wildfire.

Fire generally has positive effects on whitebark pine. On some sites, fire reduces competition from other shade-tolerant conifer species that can gradually replace whitebark pine over time. Prescribed fire is a common tool for restoration activities and is useful for establishing conditions that are suitable for regenerating whitebark pine.

Fire can limit the extent of the limber pine cover type. Limber pine encroachment into grassland and sagebrush habitats can be reversed where fire kills the limber pine.

Effects from Insects and Disease: The bark beetle epidemics are having substantial effects on conifer species on the Shoshone. In most cases, the insect impacts to conifer cover types are generally not changing cover types. In areas most severely hit, where most of the standing trees are killed, there is some shifting of cover types. Some spruce stands may revert to an earlier seral stage of lodgepole pine. Loss of complete stands of whitebark pine or limber pine could result in an increase of grassland cover types. In some stands, substantial reductions of conifer canopy could allow for earlier seral stages of aspen to expand. These effects are generally the same across all alternatives. Due to the small amount of suitable timberlands, there is not enough active management on the forest to change the overall trend. Alternative F does have a large amount of managed land that could influence the trend, but it is unlikely that budget levels would be adequate to allow enough treatment to reverse any ongoing trends.

White pine blister rust is having an impact on whitebark pine and limber pine. This disease is impacting large areas of whitebark and limber pine and, in conjunction with bark beetle epidemics, is killing large numbers of trees. This combined impact is accelerating the reduction of whitebark pine and limber pine cover types in some areas. Restoration activities are being developed to address this trend in all alternatives, but it will be many years until the scope and effectiveness is to a point that the trend can be reversed.

Effects from Livestock Grazing and Big Game: The alternatives will result in few changes, if any, to cover type composition. Following forest plan standards and guidelines would result in the maintenance of cover types by limiting grazing to sustainable levels. Though Forest-wide grazing levels differ in some alternatives, stocking levels are consistent so that grazing would occur at sustainable levels.

Effects from Invasive Species: Invasive species affect cover types by replacing native plants and cover types. The impacts are mostly to grassland and sagebrush cover types, and the invasive species most often involved is cheatgrass. All the alternatives include direction to limit the impacts management activities would have on the expansion of invasive species. All action alternatives include objectives for treatment of invasive species. The impacts would be similar across all alternatives.

Vegetation structure components

Direct and indirect effects

Age class distribution, patch size, snags, and coarse woody debris are all influenced similarly by the alternatives. Under all alternatives, there will be very little change from current conditions as a result of timber harvest activities at the Forest-wide scale. At this scale, the majority of the forest will be influenced by natural disturbances resulting in older stands, with snags, and coarse woody debris. At the individual stand and watershed level there would be differences in the alternatives. Alternatives that include more active management will have more stands and watersheds that include younger age classes, smaller patch sizes, fewer snags, and less coarse woody material. Table 36 displays the acreage by alternative of lands where management activities are more frequent versus lands where natural processes dominate.

Alternatives A, B, D, E, and G are very similar in the effects. Alternatives C and F show greater differences in the acres available for active management and would show a greater difference from the other alternatives.

Table 36. Management areas with frequent management activity

Management area	Description	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
3.5	Back country recreation and restoration		66,427					65,122
4.2	Travel corridor	164,447	100,883	82,588	100,883	103,422	103,901	99,729
4.3	Back country access corridor		13,982	5,120	13,947	8,775	3,349	14,051
4.5A	Potential Kirwin SIA	481	481	481	481	481		4,603
5.1	Managed forests and rangelands	157,215	173,190	72,298	168,423	253,799	528,146	173,190
5.2	Public water supply		12,868	6,841	7,953	12,868		12,868
5.4	Managed big game crucial winter range	54,972	55,005	145,505	53,983	79,935		54,978
	Total	377,114	422,836	312,833	345,670	459,280	635,397	424,541

Effects from Timber Harvesting: Timber harvesting impacts all the vegetation structure components. Timber harvesting generally results in younger age class distributions, smaller patch sizes, fewer snags, and less coarse woody debris. The alternatives with more treatment would have the greater effects.

Effects from Fire and Fuels: Fire impacts vegetation structure, with the greatest effects resulting from wildfire. Fire generally results in a younger age class distribution, particularly for more intense fires that kill the mature vegetation. Fire kills trees, resulting in increased snag densities. Fires also consume coarse woody debris, though only in the case of the more intense fires. Effects are greatest in the alternatives with more fire.

Active fire suppression favors the opposite of these impacts. All alternatives encourage the natural occurrence of fire and advocate for less fire suppression of all fires. Despite this, in general, those alternatives with more management lands would have less fire, because fire suppression is used to protect the investments made in managed timber stands.

Effects from Insects and Disease: Insects have similar effects to the vegetation structure that the other disturbance agents have. They result in younger age classes, patch stands, and increased snags and coarse woody debris. Like fire, those effects tend to be less in areas that are actively managed and are less susceptible to large insect epidemics.

Unique and limited habitats

Fens are addressed here. See Aquatic, Riparian, and Fisheries Resources for discussion of riparian and wetlands effects.

Direct and Indirect Effects

The Forest Service Regional and National BMP Directives provide a high level of protection for fens as well as other riparian habitats. Those protections are in effect for alternatives A through G. The best management practices are designed to protect fens and the riparian habitats from the potential impacts from management activities. These potential effects include management actions that alter hydrologic regimes; alterations to plant communities through vegetation manipulation; management activities that affect water quality and sedimentation, such as road construction, reconstruction and maintenance; livestock grazing; invasive plants; and recreational use including off-road use.

The highest potential negative effect to fens is from landscape-scale wildfires. Large wildfires have the potential to affect either the hydrologic regime or nutrient inputs into these habitats. This risk would be slightly higher in alternatives A, B, C, D and G, which have higher projected acreages of wildfire than alternatives E and F.

Management area direction for the Swamp Lake and Sawtooth Peatbeds special interest areas includes plan direction to suppress fire that could impact the fen habitats in these areas. Alternatives E and F do not contain this specific direction for the Sawtooth Peatbeds.

Effects from Fire and Fuels: Wild and prescribed fires can pose risks to fen habitats, particularly when the fires are intense. For prescribed fires, design criteria are used to protect unique habitats. Suppression activities associated with wildfire can protect those habitats. Fire and fuel activities that reduce fuel loadings on lands adjacent to fen habitats can reduce fire intensities and the risk associated with burning fen habitats.

Effects from Livestock Grazing and Big Game: Fen habitats are resilient, but can be altered by over grazing if stocking levels are exceeded. Trampling and introduction of invasive species such as Canada thistle are concerns in some fens containing rare plants. The Sawtooth Peatbeds potential special interest area is particularly susceptible to trampling. Management area direction for the Sawtooth Peatbeds special interest area includes plan direction to not authorize commercial livestock grazing within the area. Alternatives E and F do not contain this direction for the Sawtooth Peatbeds.

Effects from Invasive Species: Fens are susceptible to noxious weed invasion. The vectors for potential spread are many and may be linked to increased disturbance from management activities and recreational use. All alternatives contain plan direction to limit and control the establishment and spread of noxious weeds. The risk of spread is highest in the alternatives with the most management and motorized activity. Alternative F would have the highest risk and alternative C would have the lowest risk. The remaining alternatives would be clustered between those two.

Effects from Recreation: Fens can be affected by concentrated areas of recreational activities. Fen habitats are not generally desirable for most recreational activities. Management area direction for the fen associated with the Swamp Lake Special Interest Area provides direction for managing recreational use at that site to protect fen habitat. That direction is in place for all alternatives. The risk to fen habitats from concentrated recreational activity is low and the same for all alternatives.

Snow compaction by heavy snowmobile use may have negative effects on fen habitat. Snowmobile use is prohibited in the Swamp Lake Special Interest Area in all alternatives. No other fen habitats show evidence that snowmobile use is impacting fen habitat.

Summary of Effects to Resource

All alternatives impact vegetation resources to some degree. The greatest impacts from management activities are associated with timber harvest, mechanical fuel treatments, and prescribed fire, which is highest in alternative F and lowest in alternative C. Though these activities do affect vegetation, projections for all alternatives indicate that they will impact less than 2 percent of the Shoshone in the decade following plan implementation. The impact would range from 35,000 acres in alternative C to 41,200 acres in alternative F. This is in comparison to wildfire that could impact over 7 percent of the Shoshone, ranging from 185,200 acres in alternative A to 161,400 acres in alternative F, which is consistent with the 183,000 acres burned by wildfire in the last 10 years. On a Forest-wide scale, the vegetation changes associated with the various alternatives will have little impact.

Most cover types are minimally affected by the alternatives. Alpine, grasslands, Douglas-fir, spruce/fir, and lodgepole pine will continue to fluctuate within the desired condition ranges presented in table 34. For sagebrush, willow, aspen, whitebark pine, and limber pine cover types, all alternatives have some level of restoration and or protection objectives that would result in changes in cover type acreages.

Age class distribution, patch size, snags, and coarse woody debris are all influenced similarly by the alternatives. Under all alternatives, there will be very little change from current conditions at the Forest-wide scale. At the stand and watershed level, alternatives that include more active management will have greater area that includes younger age classes, smaller patch sizes, fewer snags, and less coarse woody material. Alternatives A, B, D, E, and G are very similar in the effects. Alternatives C and F show greater differences in the acres available for active management and will show a greater difference from the other alternatives.

The Forest Service Regional and National BMP Directives provide a high level of protection for fens as well as other wetland and riparian habitat. Those protections are in effect for alternatives A through G. The highest potential negative effect to fens is from landscape-scale wildfires. This risk is slightly higher in alternatives A, B, C, D, and G that have higher projected acreages of wildfire than alternatives E and F.

Cumulative Effects

The analysis area for cumulative effects to biodiversity composition would include the Shoshone and the land immediately adjacent to it within approximately 3 miles. Cumulative effects include past, present, and reasonably foreseeable (planning period) projects, as mentioned in the summary of activities table (table 20). The time period into the future considered would be the planning period (10 to 15 years). From this table, refer to the past and present activities of vegetation management for the most significant effects to ecosystem composition.

The effects that past activities have had on all of the components of forest vegetation (e.g., cover type, age class, patch size, snags, and coarse woody debris) were discussed in the Affected Environment section and are reflected in the current condition of the forest vegetation. Therefore, other than activities within the last 10 years, past activities are not carried forward into the following cumulative effects analysis. Present and foreseeable future activities that could affect forest vegetation are summarized below:

- **National Fire Plan, Healthy Forest Initiative, and Healthy Forest Restoration Act**: Since they were developed, these national and regional level plans, initiatives, and acts (these are called “other plans” for the rest of this discussion) have influenced the vegetation and fuel management programs on the Shoshone. Therefore, they have had some effects on forest vegetation and it is anticipated that they will continue to do so for the foreseeable future. In general, these other plans have resulted in more hazardous fuel vegetation treatments in the vicinity of wildland-urban interface areas and fewer vegetation treatments in areas located away from communities. In addition, the types of fuel treatments that are being done in response to these other plans are often more expensive and are likely to lead to fewer acres being treated within a given budget level. These effects fall within the range of effects displayed in the alternatives.
- **Conservation Efforts for Whitebark Pine**: As discussed in the Affected Environment section, the U.S. Fish and Wildlife Service (USFWS) recently determined that this tree species warranted listing as a threatened or endangered species, but that it was precluded due to higher priority species. The species is now designated as a Federal Candidate species and it is now on the Sensitive Species list. The forests in the Greater Yellowstone Area (including the Shoshone), are implementing various restoration efforts for this species and these activities will likely continue or intensify (contingent upon funding). If the tree species is eventually listed as a Federal threatened or endangered species, there could be effects to the vegetation and fire management programs on the Shoshone. All action alternatives contain forest plan components that stress the desire to increase the abundance and resiliency of this species to disturbances and stressors. If listed, there could be additional emphasis placed on restoration actions.
- **Climate Change**: Of all of the ongoing and foreseeable future actions that have the potential to affect forest vegetation on the Shoshone, climate change is likely the most important

factor. The effects of climate change will likely combine with some of the effects that result from implementing the alternatives, to produce cumulative effects.

The potential effects (and uncertainties) that climate change may have on forest vegetation on the Shoshone are summarized in *Climate Change on the Shoshone National Forest, Wyoming* (USDA Forest Service 2012). In general, given the existing condition of the forest vegetation on the Shoshone, the potential effects of climate change can be summarized as:

- Potential decline or extirpation of alpine habitat
- Potential for higher-elevation refugia for dynamic and novel combinations of plant species
- Potential reduction in or loss of the whitebark pine habitat type
- Potential loss of low-elevation habitat associated with aspen
- Potential reduction or loss of low-elevation habitat associated with Douglas-fir and lodgepole pine, but increase in higher-elevation associated habitat
- Potential increased grassland expansion upward in elevation
- Potential reduction or loss of wetlands (riparian)

At the Forest-wide scale, the alternatives analyzed in this draft EIS would generally combine with the potential effects from climate change noted above. For all alternatives, some effects from climate change may be delayed by active management (restoration, planting) while some effects may accelerate change (prescribed fire). There is no alternative where management activity would reverse the overall trend that climate change will have on the vegetation cover types and structure on the Shoshone.

Climate change predictions for the Shoshone generally forecast warmer temperatures, slightly wetter winters, slightly drier summers. If those predictions are correct, the effect of dense forests on the soil water balance could be compounded. In general, the soil water balance (especially in the summer droughty period) determines which tree species can ultimately survive on a specific site. Early seral tree species have the unique ability to establish on bare soil surfaces where high surface temperatures exclude other species. One adaptation of these seral species is the deep rooting characteristic that allows the tree to find an adequate water supply and avoid extensive competition with shallow and fibrous rooted grasses and forbs. As the shade from these species limits shade-intolerant grasses and forbs, shade-tolerant tree species can become established in the understory. These species usually have shallower rooting characteristics that allow them to gather water from near the soil surface. The overall rooting structure on the site becomes much more competitive for water resources as succession progresses. As the density of the stand and the amount of leaf area increase, water transpiration increases, which, in turn, can deplete the water stored in the soil throughout the summer. The additional forest canopy interception of rain and snow, which directly evaporates back into the atmosphere (snow sublimation), further compounds this effect and reduces soil water recharge. The end result is a water-stressed forest, that not only becomes more susceptible to insects and disease, but also more prone to supporting severe wildfires, because live fuel moisture is relatively low.

Whether it is invasive species (e.g., white pine blister rust), drought, uncharacteristic wildfires, elevated native insects and disease levels, unusually high forest densities, or some other agent or combination of agents that serves to stress trees and forest ecosystems, recent research suggests that climate change will likely exacerbate those stressors and "stress complexes" will continue to manifest themselves (Littell et al. 2010, McKenzie et al. 2009).

- **Carbon sequestration:** From available science, the amount and timing of future temperatures increases, expected changes in precipitation regimes, and future fire and insect disturbance regimes suggest the regional C balance could shift to a carbon source. Mitigation options can help reduce climate change impacts on carbon by maximizing forest capacity to store C, decreasing C loss potential from disturbance, or utilizing biomass for energy, but these options need to weigh tradeoffs and risks and must ultimately be coupled with adaptation strategies (Rice et al. 2012).
- Activities that could increase carbon sequestration include: (1) maintaining or increasing forested area; (2) decreasing wildfire and insect disturbance by increasing forest resilience; and (3) in some situations, increasing the use of forest biomass. All alternatives include elements of all these activities and would help increase and/or maintain C stocks. Alternative F, which manages more ground, has the greatest potential to increase carbon sequestration, while alternative C, which manages the least, has the lowest potential. These differences are small in comparison to the C stocks on the Forest. Though the alternatives do have an effect on C stocks, which is not discernible at the regional level and is masked by the changes that are occurring at a regional scale.
- **Human Population Increases and/or Shifts toward Wildland-urban Interface**: For the last several decades, there has been more human development around the edges of lands administered by the Shoshone. This trend is expected to continue in the future and is likely to have effects on the forest vegetation that are similar to those discussed above under the item titled National Fire Plan, Healthy Forest Initiative and Healthy Forest Restoration Act. In addition, with a greater number of people living and recreating in these wildland-urban interface areas, there is a greater probability of more human-caused wildfire ignitions that could affect the forest vegetation.
- **Increased Regulation and Concern over Smoke Emissions**: The ability to implement the vegetation treatments that would occur as a result of the alternatives is highly dependent upon prescribed burning (both associated with timber harvesting and without it) as well as using wildfires for resource benefits. Therefore, to the extent that air quality regulations may become more stringent in regard to the quantity and timing of smoke emissions, there could be substantial effects in limiting vegetation treatments using prescribed burning.
- **Timber Product Manufacturing Infrastructure and Economics**: The ability of the Shoshone to positively affect the forest vegetation is partially dependent upon the ability to sell forest products to manufacturing companies and to use the harvesting processes, including residual slash disposal activities. If the forest products industry continues to decline in areas surrounding the Shoshone to the degree that it is more difficult to sell forest products, or if "stumpage prices" decrease significantly, it would affect how many acres could be treated. While some treatments could be accomplished by using prescribed burn only treatments, it is generally too risky in the wildland-urban interface and too expensive elsewhere.

Species Diversity

Terrestrial Wildlife

Introduction

This section discloses the potential influences of the revised Plan and alternatives to terrestrial wildlife threatened, endangered, proposed and candidate species; sensitive species; management indicator species (MIS); and species of local concern. These species serve several roles in forest planning, one of which is serving as surrogates for other species and their habitat in general.

Riparian areas provide the most important habitat attribute for many wildlife species. There are a variety of aquatic and riparian ecosystems on the Forest, including streams, rivers, ponds, reservoirs, wetlands, and riparian areas. These ecosystems support complex communities of vertebrate and invertebrate aquatic animals and an assortment of riparian and aquatic plants.

Threatened and endangered species are also addressed in the biological assessment; Forest Service sensitive species are also addressed in the biological evaluation; effects on these species are summarized in this chapter. Effects to management indicator species and species of local concern are disclosed in this chapter, with additional information contained in the species viability assessments (on file in the administrative record).

Legal and Administrative Framework

The Forest Service has a legal requirement to maintain or improve habitat conditions for threatened, endangered, proposed or candidate species under the Endangered Species Act. Species covered under the Endangered Species Act are those listed by the USFWS. Sensitive species are developed and protected under the Regional Forester’s Sensitive Species Program. Forest Service Rocky Mountain Region Policy is to add candidate species to the Regional Forester’s sensitive species list. Therefore, candidate species are analyzed under sensitive species. The Forest Service is required to identify and mitigate potential effects to these species from Federal land-disturbing actions.

Laws

These acts, along with other land use laws, executive orders, and policies guide management of wildlife, aquatics, riparian, fisheries, and botanical resources on NFS lands. Other laws pertinent to wildlife, aquatics, riparian, fisheries, and botanical management of NFS lands can be found in Forest Service Manual (2600).

These acts, along with other land use laws, executive orders, and policies guide management of wildlife, aquatics, riparian, fisheries, and botanical resources on NFS lands.

Organic Administration Act of 1897 recognized watersheds as systems to be managed with care to sustain their hydrologic function and secure favorable conditions of water flow.

Migratory Bird Treaty Act of 1918 established a comprehensive Federal regulatory system governing the conservation, management and taking of migratory birds.

Animal Damage Control Act of 1931 as amended provided broad authority for investigations, demonstrations, and control of mammalian predators, rodents, and birds.

Bald and Golden Eagle Protection Act of 1940 as amended provides Federal protection for the bald eagle as a symbol of our national heritage. This act was amended (1962) to extend like protection to the golden eagle.

Sikes Act of 1960 establishes that Forest Service policies recognize that state agencies and Indian tribes are responsible for the management of animals and assign national forests a role in cooperatively managing wildlife habitat.

Multiple Use-Sustained Yield Act of 1960 16 U.S.C. §528 established that national forests are to be managed for fish and wildlife among other purposes.

Wilderness Act of 1964 provides direction for fish management including fish stocking in wilderness.

National Environmental Policy Act (NEPA) of 1969 as amended requires the Forest Service to address fish and wildlife concerns during the environmental analysis.

Endangered Species Act (ESA) of 1973 as amended creates an affirmative obligation "that all Federal departments and agencies shall seek to conserve endangered and threatened species of fish, wildlife, and plants." The act also requires Federal agencies to ensure that any authorized action funded or carried out by them does not jeopardize the continued existence of listed species or modify critical habitat.

Forest and Rangelands Renewable Resources Planning Act of 1974: Provides for maintenance of land productivity and the need to protect and improve the soil and water resources. Requires an assessment of present and potential productivity of the land. This act contains many references to suitability and capability of specific land areas, to maintenance of land productivity, and the need to protect and, where appropriate, improve the quality of soil and water resources. The act specifies that substantial and permanent impairment of productivity must be avoided and has far-reaching implications for watershed management on national forests.

Federal Land Policy and Management Act (FLPMA) of 1976 directs that monies received as fees for grazing livestock be put in a special fund to be spent solely for "range betterment," including fish and wildlife habitat enhancement. Second, it permits the Secretary to exchange public lands for private lands and it requires the Secretary to consider the fish and wildlife aspects of the proposed exchange. Finally, it authorizes the Secretary on lands under their jurisdiction "where, and establish periods when, no hunting or fishing will be permitted for reasons of public safety, administration or compliance with provisions of applicable law."

National Forest Management Act (NFMA) of 1976: "It is the policy of the Congress that all forested lands in the NFS shall be maintained in appropriate forest cover with species of trees, degree of stocking, rate of growth and conditions of stand designed to secure the maximum benefits of multiple use sustained yield. Plans developed shall provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet the overall multiple-use objectives, and within the multiple-use objective." Land productivity must be preserved. NFMA prevents watershed condition from being irreversibly damaged and protects streams and wetlands from detrimental impacts. Fish habitat must support a minimum number of reproductive individuals and be well distributed to allow interaction between populations.

Executive Orders

Executive Order 12443 directs the appropriate Federal agencies to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat.

Executive Order 13186 directs Federal agencies to promote the conservation of migratory bird populations and that any actions that have, or likely to have, a measurable negative effect on migratory bird populations, will be analyzed

Regulation, Policies and Regional Direction

Regulations, policies, and regional direction have been passed in support of these laws and require the following:

- FLPMA 43 U.S.C. §1701 requires that public lands are to be "managed in a manner…that will provide food and habitat for fish and wildlife and domestic animals."
- The 1982 NFMA planning regulations provide direction for managing fish and wildlife habitat to maintain viable populations of existing native and desired non-native vertebrate species within the planning area. Viable populations are defined as those with the estimated numbers and distribution of reproductive individuals to ensure their continued existence and that they are well-distributed. To ensure maintenance of viable populations, habitat must be provided to support at least a minimum number of reproductive individuals, and it must be distributed so that individual sub-populations can interact (36 CFR §219.19).
- 36 CFR 219.19 additionally directs the Forest Service to estimate the effects of changes to wildlife habitat; consult with biologists from other agencies; consider access and dispersal problems of hunting, fishing, and other uses; evaluate the effects of pest and fire management; and select management indicator species to be monitored (36 CFR 219(a)(1)).
- Forest Service Manual (FSM) 2600 and Forest Service Handbook (FSH) 2609 state policy and direction regarding wildlife, fish and sensitive plant program management.
- Protection of surface resources and productivity from all natural resource management activities (36 CFR 219).
- The Forest Service Manual directs the Forest Service to develop and implement management practices to ensure that sensitive species do not become threatened or endangered because of Forest Service actions (FSM 2670.22). Sensitive species are those plant and animal species identified by a regional forester for which population viability is a concern as evidenced by (a) significant current or predicted downward trends in population numbers or density or (b) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (FSM 2670.5).
- The Forest Service Manual directs the Forest Service to prepare biological evaluations for projects, as part of the NEPA, to determine the potential effects from those projects on sensitive species and to ensure that Forest Service actions do not contribute to loss of viability of threatened, endangered, proposed, or sensitive plant and animal species, or contribute to a trend toward Federal listing of any species under the Endangered Species Act (FSM 2672.41 and 2670.32). A biological evaluation is defined as a documented review of Forest Service programs or activities in sufficient detail to determine how an action or proposed action may affect any sensitive species (FSM 2670.5). A separate biological assessment was prepared to address effects on threatened, endangered and proposed species (FSM 2670.5).
- FSM 2631.3. This manual outlines regional policy on the management of fens. Fen habitat accounts for 13 of the current 26 Region 2 sensitive plants on the Shoshone.

- Region 2 Species Conservation Assessments for Yellowstone cutthroat trout, mountain suckers, and lake chubs. Describes current status and management direction for these sensitive fish species.

Other Agreements and Management Direction

National Interagency Memorandum of Agreement (dated August 30, 2000) clarified Federal departments' obligations to the Endangered Species Act, which states our shared mission to "enhance conservation of imperiled species while delivering appropriate goods and services provided by the lands and resources."

Memorandum of Understanding Detailing Agency Agreement to Implement the Final Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Area (2003) provides the guidance for coordinated management and monitoring within and outside the primary conservation area for the grizzly bear.

Policies and guidelines for fish and wildlife management in National Forest and Bureau of Land Management Wilderness, 2006. Provides guidance to State fish and wildlife agencies, Forest Service, and Bureau of Land Management (BLM) personnel for the management of fish and wildlife populations in wilderness in accordance with the Wilderness Act of 1964 (16 USC 1131-1136).

Memorandum of Understanding (Supplement No. 1500-2007-1, August 1, 2007) between the Rocky Mountain Region and Intermountain Region of the Forest Service and the Wyoming Game and Fish Commission, through the Wyoming Game and Fish Department (WGFD). This memorandum of understanding outlines the agencies' respective responsibilities in the management of fish and wildlife populations and their habitat. The Shoshone and the WGFD work in partnership to address habitat and population management issues for wildlife.

Memorandum of Understanding between the Wyoming Game and Fish Commission and the USDA Forest Service on fish and wildlife habitat management within National Forest Wilderness in Wyoming, 2010. This memorandum of understanding serves as a framework for enhanced cooperation between Wyoming Game and Fish and the Forest Service Regions 2 and 4 in the management of fish, wildlife, and habitat on Forest Service-administered wilderness areas in Wyoming.

Following the listing of the lynx as a threatened species in March 2000 (USDI Fish and Wildlife Service 2000), the Forest Service signed a Lynx Conservation Agreement with the USFWS in 2001, to consider the Lynx Conservation Assessment and Strategy (LCAS) (Ruggerio et al. 2000) during project analysis and the Forest Service agreed to not proceed with projects that would be "likely to adversely affect" lynx until forest plans were amended. The conservation agreement was amended in 2006 to define occupied habitat and list the national forests that were occupied. The conservation agreement was extended until all relevant forest plans were revised to include guidance necessary to conserve lynx. In response, the Northern Rockies Lynx Management Direction (NRLMD) EIS Record of Decision (ROD) was signed in March 2007. The management direction in the NRLMD was based upon science and recommendations in the "Ecology and Conservation of Lynx in the United States (Ruggerio et al. 2000), the LCAS, and other publications. The purpose of the NRLMD was to incorporate management direction into land and management plans that conserves and promotes the recovery of lynx in the Northern Rockies Ecosystem. The direction applies to NFS lands presently occupied by lynx, (Shoshone included). Plans and projects that incorporate the standards and guidelines in the NRLMD are generally not expected to have adverse effects on lynx, and implementation of these measures across the range of the lynx is expected to lead to conservation of the species.

Resource Protection Measures

Region 2 of the Forest Service has developed a White-nose Syndrome Response Plan Cave and Mine Closure 2011–2012 in an attempt to slow the westward spread of white-nose syndrome and reduce the effects on regional bat populations. Forests use this plan during project planning efforts.

Terrestrial wildlife species on the Shoshone are very diverse in their habitat use and needs. Numerous standards and guidelines, primarily Forest-wide, are included in all of the proposed alternatives to ensure that quality habitat for wildlife is maintained or enhanced.

Prescriptions that provide specific direction to protect or manage habitat are provided in the Forest-wide direction section in the revised Plan, while further direction is provided for special emphasis habitats in management areas (MA). MA 5.4 for example, provides management direction to benefit big game species habitat.

Forest-wide direction for other resource management activities would accommodate many of the habitat requirements for most species. Timber management direction directs adequate regeneration in harvested areas, and adequate snag and coarse woody debris amounts. Vegetation guidelines direct retention of older forest habitat. Direction for other resource disciplines would benefit some wildlife species, including direction for livestock grazing, caves, riparian resources, fire, and invasive species management. The most significant changes for wildlife in this revision include increased protection for aspen, sagebrush whitebark pine, sensitive species, and elk secure habitat.

Direction for all alternatives identify many activities designed to improve the overall conditions on the Shoshone. These activities include restoring terrestrial habitat through such activities as prescribed burning or harvesting to regenerate aspen and enhance sagebrush, and the treatment of invasive species. Resource inventory and monitoring would also be included.

Threatened, endangered, proposed, or candidate species have special management requirements for all Forest Service management activities. The Endangered Species Act section 7 guidelines and recovery objectives have been followed where potential habitat of suspected threatened species may occur on the Shoshone.

Methodology

A review of best available science is the most practical method along with utilizing appropriate existing monitoring that has occurred for species habitat similar to that on the Shoshone. In addition, the use of species conservation assessments developed in the region and species viability assessments prepared for the Forest were considered in this analysis.

For this integrated analysis, we incorporated historical habitat and population information, current survey and monitoring data, and relevant research, reports, and publications. We used this information to determine current stream and riparian habitat conditions, potential effects from future land management activities and their effects on the terrestrial wildlife and aquatic biota that use these habitats.

A review of information regarding the distribution of habitats on the Shoshone, observations of species on the Forest, known areas of occupancy, and fieldwork over the past several years has been incorporated. Sources of information include Forest Service records and files, the Wyoming Natural Diversity Database, WGFD and other Federal wildlife agency information, and published research. A list of threatened, endangered, proposed, or candidate species was obtained from the USFWS (2012) and sensitive species are from the Rocky Mountain Region 2 Regional Forester sensitive species, updated May 25, 2011. Management indicator species selected for the revised Plan were analyzed along with species of local concern.

Spatial and Temporal Context for Effects Analysis

The spatial context will vary by species. For most, it would be the Shoshone boundary. For some, it would be as large as the Greater Yellowstone Ecosystem. The timeframe for the effects analysis would be for the life of the plan (15 years).

Incomplete and Unavailable Information

There is very limited information available for the Yellowstone checker spot due to its limited distribution.

Emphasis Species

We identified emphasis species to facilitate analysis and monitoring of effects to wildlife. They include threatened, endangered, Forest Service sensitive, management indicator species, and species of local concern. Threatened, endangered and Forest Service sensitive species are categories that represent species whose populations either are in peril or could be in peril, and therefore, demand increased management attention. Management indicator species, on the other hand, serve several functions in forest planning as documented in the Management Indicator Species Selection Process document in the administrative record. Species of local concern for the most part, were selected due to their social values, primarily hunting or other commercial values. The Emphasis Species appendix 3 of the revised Plan describes the selection process for these species. A single species assessment was prepared for threatened and endangered species and is fully documented in the biological assessment and the biological evaluation assesses impacts to sensitive species. The effects analyses describe the condition and effects to habitat, in general, on the Forest for purposes of assessing viability for wildlife. The main approach for species viability is to ensure that ecosystem components and processes remain functioning, and then verifying needed habitat components persist for rare species and species representative of others due to similar habitats. Individual species viability assessments were prepared and are part of the project record.

This section is organized as follows:

- Endangered, threatened, proposed, and candidate species
- Sensitive species
- Management indicator species
- Species of local concern

Threatened, endangered, proposed, and candidate species

Threatened, endangered, proposed, and candidate species that occur, or could occur, in the planning area are displayed in table 35. The grizzly bear and Canada lynx are currently listed as threatened species. The North American wolverine is a proposed for Federal listing species and the Greater sage-grouse, is a candidate species. Forest Service Rocky Mountain Region policy is to add candidate species to the Regional Forester’s sensitive species list. The candidate species are analyzed in the appropriate biological evaluation and discussed under sensitive species. Currently, there are no endangered or proposed species on the Shoshone.

Table 35. Threatened, endangered, proposed and candidate species and their habitats on the Shoshone

Species	Status	Global/state ranking	Habitat
Mammal species			
Canada lynx (*Lynx canadensis*)	Threatened	G5/S1	Mature forest and dense young conifers
Canada lynx Critical Habitat	Designated		Boreal forest landscapes in Fremont, Park, Sublette and Teton Counties
Grizzly bear (*Ursus arctos horribilis)*	Threatened	G4/S1	Montane forests
North American wolverine (*Gulo gulo luscus*)	Proposed	G4/S2	Subalpine to alpine
Bird species			
Greater sage-grouse (*centrocercus urophasianus*)	Candidate	G4/S4	Sagebrush communities

1 Conservation status ranks estimate a species risk of elimination. Status ranks are based on a 1 to 5 scale, 1 denoting a species is critically impaired and 5 denoting a species is secure. Species status is assessed at three geographic scales: global (G), national (N), and state/province (S). The overall status of a species is denoted by its G-rank, while its condition in a particular country is denotes by its N-rank, and its condition in a particular state/province is denoted by its S-rank. State rank is assigned by Wyoming Natural Diversity Database biologists and denotes a species probability of elimination in Wyoming. Subspecies, varieties, or any other designation below the level of a global ranked species, receive a T-rank that denotes their conservation status. A species may receive a B- or N-rank that refers to the conservation status of the breeding (B) or non-breeding (N) population in a particular nation or state/province. (NatureServe, February 2012, Wyoming Natural Diversity Database February 2012)

The environmental baseline for this analysis includes the existing grizzly bear habitat conditions and conflict situation within the planning area, relationship to the threats to the species and grizzly bear management direction in the existing land and resource management plan for the Shoshone and best available science. With the relisting of the grizzly bear, updates to the 1993 Recovery Plan and the Conservation Strategy are determined the ‘best available science’ in regard to grizzly bear management.

The environmental baseline also includes the existing wolverine, Canada lynx and Canada lynx Critical Habitat within the planning area, relationship to existing threats to these species and the management direction in the revised Plan and the Northern Rockies Lynx Management Direction (USDA Forest Service 2007).

Canada lynx

Affected Environment

Canada lynx have a circumboreal distribution. In North America, lynx range across most of Canada and Alaska following the boreal forest south to Colorado, Minnesota, and Maine. In Wyoming, lynx occur in the western mountains on the Bridger-Teton and Shoshone National Forests, and Grand Teton and Yellowstone National Parks (WGFD 2010a).

No trend data are available that is specific to the Shoshone or Wyoming. Lynx occur at very low densities within the region. During recent surveys in the winter of 2008 to 2009, one potential track was found on the Shoshone near the Beartooth Plateau (Holmes and Berg 2009). Tracks were found on multiple occasions adjacent to the Shoshone in the Togwottee Pass area on the Bridger-Teton National Forest. During the winter of 2004 to 2005, one confirmed track was detected on the Shoshone in the Warm Springs Creek watershed (Berg et al. 2005). The WGFD (2010) suggest that released lynx from Colorado are the only lynx left in Wyoming and that native Wyoming populations are nearly extirpated.

On the Shoshone, spruce/fir habitat is relatively abundant. There are about 316,000 acres of spruce/fir on the Forest with about 30 percent of it being mature (over 200 years old) and 6 percent in the seedling/sapling stage (under 20 years old) (USDA Forest Service 2012b). About 20 percent (58,800 acres) of the lodgepole pine on the Forest is in the seedling/sapling stage (under 20 years old). This dense young lodgepole pine may provide habitat for snowshoe hares, the primary prey for lynx. Additional habitat likely exists in Douglas-fir and lodgepole pine stands that are succeeding to spruce/fir.

Fire suppression has likely increased the amount of spruce/fir on the Shoshone, but also has increased the risk for large catastrophic wildfires.

Recently, habitat and extensive winter snow survey work for this species was conducted on the Shoshone in partnership with the WGFD. The areas with the most potential habitat occur in the Dubois/Togwotee Pass area (Wind River Ranger District) with more limited potential on parts of the Washakie Ranger District and in the Beartooth Mountains (Wapiti Ranger District). Tracks of two different lynx were confirmed in the Dubois/Togwotee Pass area in the winter of 2006 to 2007 and tracks of a single lynx in the Washakie Ranger District area were located. In the winter of 2008 to 2009, a possible lynx track was located in the Beartooth Mountains, just across the Wyoming/Montana state line, but immediately adjacent to the Shoshone.

Colorado Parks and Wildlife in their monitoring of telemetry-collared lynx from Colorado, provided data to the Shoshone, showing that in 2007, six different lynx left Colorado and made their way north as far as southern Montana; including passing through and even staying on the Shoshone. Areas of focused use on the Shoshone were the Togwotee Pass, Brooks Lake and Long Creek areas, all on the southern part of the Forest (Jake Ivan 2013, personal communications).

Canada Lynx Critical Habitat

Critical habitat is designated for the conservation of the primary constituent element essential to the conservation of the lynx and necessary to support lynx life history functions. The primary constituent element comprises the essential features of the boreal forest types that provide, for example, prey, reproduction, and denning habitat, and snow conditions that give lynx their competitive advantage. Critical habitat provides habitat connectivity for travel within home ranges, and exploratory movements and dispersal within critical habitat units.

The Greater Yellowstone Area[15] includes approximately 9,500 square miles of Canada lynx critical habitat designated by the USFWS. Canada lynx critical habitat is designated in portions of Gallatin, Park, Sweetgrass, Stillwater, and Carbon Counties in Montana; and Park, Teton, Fremont, Sublette, and Lincoln Counties in Wyoming (74 FR 8616). Approximately 648,840 acres of Canada lynx critical habitat is designated on the Shoshone.

[15] Yellowstone National Park and surrounding lands in southwestern Montana and northwestern Wyoming.

The USFWS outlined the physical and biological features that are essential to the conservation of the Canada lynx and that may require special management considerations and protection. They considered the physical and biological features to be the primary constituent elements laid out in the appropriate quantity and spatial arrangement for the conservation of the species. The primary constituent element for lynx critical habitat is:

> Boreal forest landscapes supporting a mosaic of differing successional forest stages and containing : (a) a presence of snowshoe hares and their preferred habitat conditions, which include dense understories of young trees, shrubs or overhanging boughs that protrude above the snow, and mature multistoried stands with conifer boughs touching the snow surface; (b) winter snows that are generally deep and fluffy for extended periods of time; (c) sites for denning that have abundant coarse woody debris, such as downed trees and root wads; and (d) matrix habitat (e.g., hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares) that occurs between patches of boreal forest in close juxtaposition (at the scale of a lynx home range) such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range (Federal Register, Vol. 74, No. 36, pp 8638).

Adverse modification of critical habitat is defined as “a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species.” The key factor related to the adverse modification determination is whether, with implementation of the proposed Federal action, the affected critical habitat would remain functional (or retain the current ability for the primary constituent elements to be functionally established) to serve the intended conservation role for the species. Activities that may destroy or adversely modify critical habitat are those that alter the physical and biological features to an extent that appreciably reduces the conservation value of critical habitat for lynx. Generally the conservation role of lynx critical habitat is to support viable core area populations. Therefore, an analysis for adverse modification must be applied at a survival and recovery scale.

Canada Lynx Habitat on the Shoshone

The Shoshone has mapped lynx habitat following criteria in the Lynx Conservation Assessment and Strategy (LCAS) (Ruediger et al. 2000), into lynx analysis units (LAUs) on a majority of the Forest (see map 7). The entire Forest is considered occupied habitat. The best opportunities for snowshoe hares and lynx are on north slopes with mixed conifers, including a strong subalpine fir component. Subalpine fir retains live and dead branches close to the ground for an extended period of time.

Lynx inhabit mountainous regions at elevations ranging from 2,356 to 2,869 meters (7,730 to 9,410 feet) and on slopes of 8 to 12 percent (WGFD 2010a). They usually occur within extensive stands of dense boreal forest. Older forests and dense young conifer stands provide good quality foraging habitat. About 597,000 acres have been mapped as lynx habitat within lynx analysis units on the Shoshone (table 36). Mapped lynx habitat occurs on the northern two-thirds of the Shoshone from Union Pass to Montana. The southern third of the Shoshone contains marginal habitat because of its patchiness and dry forest types.

Table 36. Canada Lynx habitat and critical habitat acres by lynx analysis unit

Lynx Analysis Unit (LAU)	LAU acres	Lynx Habitat acres	Critical Habitat?	Critical Habitat Acres
13	89,557.94	41,452.07	Yes	66,327.16
12	140,364.15	74,824.85	Yes	115,607.97
11	77,505.05	29,261.36	Yes	48,629.51
10	113,604.75	24,823.18	No	
9	135,188.91	44,561.01	Yes	115,054.24
20	168,453.93	66,182.04	No	
8	125,172.79	32,239.64	No	
19	199,722.46	31,992.11	No	
7	170,207.85	43,795.53	No	
6	113,610.7	37,831.17	Yes	92,939.85
5	65,113.18	21,278.69	No	
4	120,860.06	41,074.36	No	
3	109,876.68	57,145.58	Yes	109,910.12
2	104,998.91	49,914.12	Yes	100,372.4
1	9,249.29	723.66	No	
Total	1,743,486.7	597,099.37		648,841.25

The primary risk factors from forest management are timber harvest, winter recreation, and fire suppression. Natural risk factors include epidemic insect outbreaks. Habitat for lynx and their primary prey (snowshoe hare) is relatively abundant on the Forest, but has a patchy distribution. Continuing to manage for diverse habitats including mature spruce/fir and young densely regenerated coniferous forest is important. Continue to manage winter recreation (groomed over-the-snow trails) in lynx habitat at or below current levels would be important. Groomed trails may allow access by lynx competitors (i.e., bobcat and coyote) into lynx habitat.

Lynx are adapted to deep powder snow conditions. Climate change has the potential to reduce Canada lynx populations and habitat on the Shoshone. Lynx have low adaptability potential and narrow environmental tolerance, which make them susceptible to climate change (Rice et al. 2012).

Canada Lynx Critical Habitat on the Shoshone National Forest

The USFWS designated critical habitat for lynx on February 25, 2009. Five lynx critical habitat units were selected in the United States that provide adequate habitat elements for lynx. The Yellowstone area is Unit #5 and is slightly over 6 million acres. For the Shoshone National Forest, the majority of the Forest (and all mapped lynx habitat) is included in critical habitat with the exception of the Washakie Ranger District (Lander). About 648,840 acres of critical habitat are designated as lynx critical habitat on the Shoshone.

Note, not all critical habitat is mapped as lynx habitat, thus the difference in table 36. The acre differences are due to matrix habitat, which makes up a portion of the primary constituent element for lynx (boreal forest landscapes) (Federal Register, Vol. 74, No. 36, p 8638). Unit 5 also includes Yellowstone National Park and surrounding lands in southwestern Montana and northwestern Wyoming.

Activities that may affect critical habitat include but are not limited to: (1) Actions that would reduce or remove understory vegetation within boreal forest stands on a scale proportionate to the large landscape used by lynx. Such activities could include, but are not limited to, forest stand thinning, timber harvest, and fuels treatment of forest stands. These activities could significantly reduce the quality of snowshoe hare habitat such that the landscape's ability to produce adequate densities of snowshoe hares to support persistent lynx populations is at least temporarily diminished. (2) Actions that would cause permanent loss or conversion of the boreal forest on a scale proportionate to the large landscape used by lynx. Such activities could include, but are not limited to, recreational area developments; certain types of mining activities and associated developments; and road building. Such activities could eliminate and fragment lynx and snowshoe hare habitat. (3) Actions that would increase traffic volume and speed on roads that divide lynx critical habitat. Such activities could include, but are not limited to, transportation projects to upgrade roads or development of new tourist destination. These activities could reduce connectivity within the boreal forest landscape for lynx, and could result in increased mortality of lynx within the critical habitat units, because lynx are highly mobile and frequently cross roads during dispersal, exploratory movements, or travel within their home ranges (Federal Register, Vol. 74, No. 36, pp. 8644-8645).

In matrix habitat, activities that change vegetation structure or condition would not be considered an adverse effect to lynx critical habitat unless those activities would create a barrier or impede lynx movement between patches of foraging habitat and between foraging and denning habitat within a potential home range, or if they would adversely affect adjacent foraging habitat or denning habitat. For example, a precommercial thinning or fuels reduction project in matrix habitat would not adversely affect lynx critical habitat. However, a new highway passing through matrix habitat that would impede lynx movement may be an adverse effect to lynx critical habitat (Federal Register, Vol. 74, No. 36, p. 8645).

Direct and Indirect Effects

Effects from Forest-wide direction: The direction in the NRLMD applies to NFS lands presently occupied by lynx (Shoshone National Forest included). Plans and projects that incorporate the standards and guidelines in the NRLMD are generally not expected to adversely affect the lynx, and implementation of these measures across the range of the lynx is expected to lead to conservation of the species.

Effects analyses at the national forest planning scale were completed in the Final Environmental Impact Statement (FEIS) NRLMD (March 2007). A review of the potential effects of alternatives A through F was completed for this analysis to look for consistency between this proposal and the NRLMD. Two resource areas are not consistent with the NRLMD and their effects are discussed below.

Alternative A. This alternative incorporates the NRLMD as it amended forest plans in March 2007, and has no additional effects than those disclosed in the FEIS, NRLMD. This alternative is not expected to adversely affect Canada lynx or Canada lynx critical habitat. The amount of existing snowmobile trails remains at 276 miles.

Alternatives B through E and G. These alternatives incorporate the NRLMD as it amended forest plans in March 2007 with the addition of including 2,130 acres of precommercial thinning in lynx habitat for the next 10 to 15 years. The amount of snowmobile trails remains the same as in alternative A, at 276 miles except for alternative C, which decreases the amount of trails to 163 miles.

The effects of these precommercial thinning acres were analyzed in the FEIS, NRLMD under alternative D, but were not brought forward under the selected alternative (Alternative F, Scenario 2). We were unable to find documentation of why these acres were dropped from the selected alternative in the FEIS, NRLMD, nor why the Shoshone did not receive any acres of precommerical thinning in lynx habitat. The effects of these acres have not changed since the analysis in the FEIS, NRLMD, and are summarized below:

- Precommercial thinning reduces stem densities to increase the growth of the remaining trees. Precommercial thinning generally occurs when forests are 10 to 30 years old, about the time young regenerating forests are beginning to provide winter snowshoe hare habitat.
- Precommerical thinning may reduce stem densities and cover to the point that the young trees have little to no value for snowshoes (Ruggiero et al. 2000a). Researchers found precommercial thinning decreased snowshoe hare abundance, compared to unthinned stands (control plots) and areas where 80 percent of the stand was thinned, but 20 percent was unthinned (Griffin and Mills 2007).
- Declines in the number of snowshoe hares in the second winter after treatment occurred. In addition, estimated survival rates decreased as individuals spent proportionately more time in open young and open mature forests (Griffin and Mills 2007).

Alternative F. This alternative incorporates a majority of the NRLMD as it amended forest plans in March 2007, with the addition of including 2,130 acres of precommercial thinning in lynx habitat for the next 10 to 15 years. In addition, this alternative eliminates any direction for winter motorized activity restrictions in lynx habitat by eliminating Objective HU 01, Guideline HU G11, and Guideline HU G12 from the NRLMD Record of Decision (2007) and increases the amount of snowmobile trails by 91 miles more than alternative A, to 367 miles.

The effects of adding 2,130 precommerical thinning acres is the same as alternatives B through E discussed above.

Objective HU 01, Guideline HU G11, and Guideline HU G12 all deal with snow compacting activities and designated over-the-snow routes. In the FEIS, NRLMD (page 175) the main issue addressed with regard to snow compaction was whether this activity would allow competing carnivores—primarily coyotes, but also mountain lions and bobcats—winter access along compacted routes into lynx habitat, where they hunt. Based on the effects analysis in the FEIS, NRLMD, it was determined that there was still no conclusive evidence that, if competition exists between lynx and other predators, it exerts a population-level threat on lynx.

Winter recreation such as snowmobiling, cross-country skiing, dog-sledding, and snowshoeing compacts snow throughout the winter in some places, potentially increasing the access other predators have into lynx habitat (Halfpenny et al. 1999). These activities are increasing in lynx habitat.

About 276 miles of designated snowmobile and cross-country trails exist in the planning area. All are in lynx habitat. These activities compact the snow and may provide access for competing predators to areas with deep snow. This alternative proposes to increase the amount of snowmobile trails to 367 miles. However, grooming winter trails is likely to remain at current levels for the next 3 to 5 years because the amount of money available for grooming is not likely to increase substantially.

Mining or energy development may change or eliminate lynx habitat, and can promote winter access. Access roads may be plowed during winter, improving access for competing predators into lynx habitat. These activities are likely to be localized because there is no information indicating that mining or energy development poses a threat to lynx populations as a whole (USDA Forest Service 2007). There are no proposed mining or energy developments in any of the alternatives.

Cumulative Effects

All the alternatives incorporate management direction—to varying degrees—that would reduce or eliminate adverse effects from management actions in the planning area. The alternatives incorporate management direction to address programmatic direction for certain activities. For example, national policy and Congressional intent has established that reducing fuels within the wildland-urban interface, as well as other areas, is an important focus on NFS lands. Because of this focus, the effects from these programs (e.g., National Fire Plan) on lynx have been evaluated, including their potential cumulative effects. Activities on corporate and small private lands could still adversely affect lynx; however, the management direction requires consideration of activities on private land when evaluating the effects of projects on the forest.

Determination of Effects and Rationale for the Determination

Under alternatives A through E and alternative G, management activities such as winter recreation and vegetation management in habitat occupied by lynx have been identified as a risk factor that will likely affect individual lynx. Management activities are guided by the habitat standards that limit changes to lynx habitat. Canada lynx exist on the Shoshone in very low densities. As a result of the effects analysis, it is the conclusion and determination that these alternatives, “**may affect, likely to adversely affect**” individual Canada lynx. As a result of this determination formal consultation would be required. Under alternative F, snow compaction activities on trails would increase by 33 percent as a result of increased miles of snowmobile trails. Vegetation management activities in habitat occupied by lynx are guided by the habitat standards that limit changes to lynx habitat. Canada lynx exist on the Shoshone in very low densities. As a result of the effects analysis, it is the conclusion and determination that this action (alternative F), “**may affect, likely to adversely affect**” individual Canada lynx. As a result of this determination formal consultation would be required

Adverse modification of critical habitat is defined as “a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species.” Based on the information above, alternatives A through E and G will not impact a measurable amount of critical habitat in Unit #5 (Greater Yellowstone Area). There would be insignificant affects to the function of the critical habitat unit and the primary constituent elements for lynx for example prey, reproduction and denning habitat, and snow conditions that give lynx competitive advantage. This is because there is little to no change to the function of the Greater Yellowstone Area critical habitat unit and the primary constituent elements. Therefore, alternatives A through E and alternative G “**may affect, but is not likely to adversely affect**” Canada lynx critical habitat.

Based on the information above, alternative F has the potential to impact a measurable amount of critical habitat on the Shoshone and in Unit #5 (Greater Yellowstone Area). There would be insignificant affects to the function of the critical habitat unit and the primary constituent elements for lynx except for a decrease in snow conditions that give lynx competitive advantage.

This is because alternative F proposes to increase the miles of snowmobile trails by 33 percent. Therefore, alternative F "**may affect, likely to adversely affect**" Canada lynx critical habitat.

Grizzly bear

Affected Environment

The grizzly bear population in the Yellowstone geographic area is hereafter referred to synonymously as the Greater Yellowstone Ecosystem, Greater Yellowstone Area, or Yellowstone Grizzly Bear Ecosystem. The Yellowstone grizzly population is identified as a threatened population under the Endangered Species Act (USDI Fish and Wildlife Service 2010a).

Home range sizes of grizzly bears vary in relation to food availability, weather conditions, and interactions with other bears. In addition, individual bears may extend their range seasonally or from one year to the next (USDI Fish and Wildlife Service 1993) and the home ranges of adult grizzly bears frequently overlap. The home ranges of adult male grizzlies are generally two to four times larger than that of females, averaging in approximately 884 square kilometers (341 square miles) for females and 3,757 square kilometers (1,450 square miles) for males (Blanchard and Knight 1991). The home ranges of grizzly females appear to be smaller while they are with cubs, but ranges expand when the young are yearlings to meet increased foraging demands.

Grizzly bears disperse as subadults and their pattern of dispersal is not well documented. Dispersing young males apparently leave their mother's home ranges and their dispersal may be mediated by avoiding home ranges of established adults. Young females may establish a home range soon after family breakup, often within the vicinity of their mothers' home ranges. Grizzly bear mothers may tolerate female offspring and may shift their home ranges to accommodate them (USDI Fish and Wildlife Service 1993).

Food Habits: Bears feed on animal matter or vegetable matter that is highly digestible and high in starch, sugars, protein, and stored fat. Grizzly bears must consume foods rich in protein or carbohydrates in excess of maintenance requirements to survive denning and post-denning periods. Other plant materials are eaten as the plants emerge, when crude protein levels are highest. Grizzly bears are opportunistic feeders and will prey or scavenge on almost any available food including ground squirrels, ungulates, carrion, and garbage. In areas where animal matter is less available, roots, bulbs, tubers, fungi, and tree cambium may be important in meeting nutrient requirements. High-quality foods such as berries, nuts, and fish are important in some areas.

The search for food has a primary influence on grizzly bear movements. Upon emergence from the den, they seek lower elevations, drainage bottoms, avalanche chutes, and ungulate winter ranges where their food requirements can be met. Throughout late spring and early summer, they follow plant maturity back to higher elevations. In late summer and fall, there is a transition to fruit and nut sources, as well as other plant materials. This is a generalized pattern, however, and it should be kept in mind that bears are individuals trying to survive and will go where they can best meet their food requirements.

Specific to the Greater Yellowstone Area, four seasonal foods have been identified as being important to the grizzly bear population. Ungulates (primarily elk and bison, but also deer and moose) are especially important during spring after emergence from dens and through the calving/fawning seasons (Cole 1972, Gunther and Renkin 1990, Mattson et al. 1991, Mattson and Knight 1992, Green et al. 1997, Mattson 1997). Recent research has demonstrated that grizzly bears seek hunter-killed carcasses and gut-piles (Haroldson et al. 2004). Grizzly bears in the Greater Yellowstone Area have the highest percentage of meat consumption in their diet of any inland grizzly bear population (Hilderbrand et al. 1999). Meat is considered to be any form of animal including ungulates (i.e., deer, elk, moose, bison), fish, army cutworm moths, other insects, and small mammals (i.e., ground squirrels, mice, voles). Approximately 30 to 70 percent of the Yellowstone grizzly bear diet is some form of meat.

Whitebark pine seeds are the most important fall food of Yellowstone grizzly bears, and the availability of nuts influences annual feeding strategies and movement patterns (Kendall 1983, Blanchard 1990, Mattson et al. 1992a and 1992b, Mattson and Reinhart 1997, Mattson 1997). Army cutworm moths are a preferred source of nutrition for many grizzly bears in the Yellowstone ecosystem and represent a high-quality food that is available during the summer (Mattson et al. 1991, French et al. 1994). Grizzly bears feed on spawning cutthroat trout along the tributaries of Yellowstone Lake during the spawning season from May 1 to July 15 (Mattson and Reinhart 1995).

Army cutworm moth sites were first recognized as an important food source for grizzly bears in the Greater Yellowstone Ecosystem during the mid-1980s. Early observations indicated that moths, and subsequently bears, showed specific site fidelity. These sites are generally high alpine areas dominated by talus and scree adjacent to areas with abundant alpine flowers. Such areas are referred to as “insect aggregation sites.” Since 1986, insect aggregation sites have been monitored during aerial observations in the Greater Yellowstone Ecosystem. Knowledge of these sites has increased as in 1986 there were 4 confirmed moth sites in the Greater Yellowstone Ecosystem, and in 2010, there were 38 (Bjornlie 2011). Only a few insect aggregation sites have been investigated by ground reconnaissance and the boundaries of sites are not clearly known. In addition, it is likely that the size and location of insect aggregation sites fluctuate from year to year with moth abundance and variance in environmental factors such as snow cover (Bjornlie 2011).

Denning Chronology and Habitat: Grizzly bears in the Greater Yellowstone Area can den from the end of September to the last week in April or early May, with entrance and emergence dates being affected by the gender and reproductive status of the bears (Judd et al. 1986, Haroldson et al. 2002). Denning periods differed among classes and averaged 171 days for females that emerged from dens with cubs, 151 days for other females, and 131 days for males. Known pregnant females tended to den at higher elevations and, following emergence, remained at higher elevations until late May. Females with cubs remained relatively close (less than 3 kilometers) to den sites until the last two weeks in May.

Denning habitat has been described as follows (Judd et al. 1986, Haroldson et al. 2002):

- Den sites are associated with moderate tree cover (26 to 75 percent canopy cover).
- Den sites are usually on 30- to 60-degree slopes.
- Den sites occurred on all aspects, although northerly exposures were most common.
- Grizzly bears usually dig new dens, but occasionally used natural cavities or a den from a previous year.
- Mean elevation at den sites for females with cubs that emerged from dens was 8,845 feet. Mean elevation for other females was 8,467 feet, and for males was 8,444 feet.

Grizzly Bear/Human Interactions and Conflicts: A primary factor in providing for the conservation of grizzly bears is managing grizzly bear/human interactions. A majority of grizzly bear mortality is attributable to grizzly bear/human conflicts with a common outcome of bear removal by interagency bear managers or killing by humans for other reasons. In addition to mortality concerns, providing secure habitat (areas free of motorized access) is important to enable bears to fully use their food sources, denning sites, and other living needs. Human presence can limit bear use of habitat, create tolerance among some bears that allows for interaction at great risk to the bears, or attract bears to unnatural or unsecured food sources increasing the risk of habituation to unnatural foods and human conflict.

Grizzly bear/human conflicts are defined as incidents, in which grizzly bears injure people, damage property, kill or injure livestock, damage beehives, obtain anthropogenic (unnatural) foods, or damage or obtain garden and orchard fruits and vegetables. All conflicts reported to State and Federal agencies are entered into State databases and complied annually by Yellowstone National Park and then reported in the Interagency Grizzly Bear Study Team Annual Report. Grizzly bear/human encounters that did not result in human injury or property damage are also recorded, but categorized as confrontations rather than conflicts.

There were 229 grizzly bear/human conflicts in the Greater Yellowstone Ecosystem in 2011. This was down from 2010, which recorded the most conflicts (295) reported since recordkeeping began in 1992. These incidents included bears obtaining anthropogenic foods (37 percent), killing livestock (38 percent), damaging property (10 percent), obtaining vegetables and fruits from gardens and orchards (9 percent), and injuring people (6 percent). Of the 229 reported conflicts, 74 percent occurred outside of the recovery zone or PCA. Over half of the conflicts (54 percent) occurred on private land. The remaining (46 percent) conflicts occurred on public land with 41 percent on National Forest System lands and 3 percent on National Park Service lands. Grizzly bear habitat under different ownership exhibited different types of bear-human conflicts in 2011. On private property, bears damaging property and obtaining anthropogenic foods (garbage, grain, bird seed, dog food, garden vegetables, apples) were most common (76 percent); on National Forest System lands, livestock depredations were most common (62 percent) and on National Park Service lands, 8 total conflicts occurred involving property damage and anthropogenic foods (Gunther et al. 2012).

The Interagency Grizzly Bear Study Team (IGBST) constructed a conflict distribution map in 2011. This map identified 4 geographic areas where most grizzly bear-human conflicts occurred in the Greater Yellowstone Ecosystem over the last 3 years. These four areas contained more than half (57 percent) of the conflicts that occurred between 2009 and 2011.

The areas are:

- Green River area (154 conflicts);
- North and South Forks of the Shoshone River (125 conflicts);
- Clarks Fork area (56 conflicts); and
- Gardiner Basin (50 conflicts).

The North and South Forks of the Shoshone River, the Clarks Fork area, and portions of the Green River area are areas within the Shoshone National Forest (the planning area). The Interagency Grizzly Bear Study Team recommends that these areas receive consideration when allocating funding for grizzly bear conservation (Gunther et al. 2012).

Historically, numbers of grizzly bear-human conflicts and management actions tend to decrease during years with good white bark pine cone production. Interagency Grizzly Bear Study Team research clearly shows that bears tend to eat more meat when whitebark pine seeds are not available and that there is an increase in hunter-grizzly bear conflicts and mortalities in poor seed years. However, extensive areas of beetle-killed whitebark pine may reduce cone abundance and availability locally and may dampen or modify this trend (IGBST 2010). According to the 2011 Whitebark Pine Cone Production Report (IGBST 2012), whitebark pine surveys showed good cone production. The mean cones per tree was 19.8, which is above the average mean cones per tree of 17.4.

The long-term pattern of a good cone crop in alternating or every third year has been evident since the mid-1990s (Haroldson and Podruzny 2012).

Grizzly Bear Mortalities within the Greater Yellowstone Area: From 1973 to 2012 there have been approximately 696 grizzly bear deaths in the GYA (IGBST Final Reports 2000-2012, USGS 2012 Known and Probable Grizzly Bear Mortalities Greater Yellowstone Ecosystem). It’s important to note the 2012 data are preliminary and limited information is available for mortalities still under investigation. Of these 696 deaths, there were 555 human-caused grizzly bear deaths (80percent of the total) and 141 natural and unknown-cause grizzly bear deaths (20 percent of the total). From 1973 through 1996, grizzly bear deaths occurred outside of the Primary Conservation Area (Recovery Zone) in only five years. Starting in 1997, grizzly bear deaths have occurred each year outside the Primary Conservation Area.

Table 37 lists the known and probable grizzly bear mortalities on NFS lands within the Greater Yellowstone Area have been human-caused. The majority of these mortalities are in the category of hunting related self-defense, with the remaining a combination of food habituated bears or bears responsible for property damage, livestock related, hunting related mistaken identity, and others.

Table 37. Grizzly bear human-caused mortalities on all national forest system lands within the Greater Yellowstone Area 2003–2010 (IGBST 2003–2011)

Type of Mortality	Percentage	Number
Self Defense Hunting Related	42%	60
Livestock	10%	14
Handling/Accident	2%	3
Mistaken Identity Hunter Related	7%	10
Food Habituated or Property Damage	17%	24
Malicious Killing	3%	4
Human-Caused unknown	14%	20
Roadkill	4%	5
Defense of Life	1%	2
	Total:	142

Of these grizzly bear human-caused mortalities on the National Forests in the Greater Yellowstone Area (142), approximately 45 percent (64) have occurred on the Shoshone. The majority of the human-caused mortalities on the Shoshone have occurred from hunting related incidents (self-defense and mistaken identity) or management removal for food habituated or property damage conflicts (table 38).

To reduce grizzly bear deaths on NFS lands, the Forest Service has established food storage regulations, provided bear resistant containers for garbage and food storage, provided information and education materials and programs, established special grizzly bear requirements in contracts and permits, and issued access restrictions and regulations.

Table 38. Grizzly bear human-caused mortalities on the Shoshone National Forest 2003–2011 (IGBST 2003–2011)

Type of Mortality	Percent	Number
Self Defense Hunting Related	45%	29
Livestock	6%	4
Handling/Accident	2%	1
Mistaken Identity Hunter Related	9%	6
Food Habituated or Property Damage	13%	8
Malicious Killing	3%	2
Human-Caused unknown	14%	9
Roadkill	3%	2
Defense of Life	5%	3
	Total:	59

Grizzly Bear/Motorized Access and Secure Habitat Interactions: The management of human use levels through access route management is one of the most powerful tools available to balance the needs of grizzly bears with the needs and activities of humans. It has been documented in several research projects, completed and ongoing, that unregulated human access and development within grizzly bear habitat can contribute to increased bear mortality and affect bear use of existing habitat (Interagency Grizzly Bear Committee (IGBC) 1998, Interagency Conservation Strategy Team 2007).

Historically, management of motorized use has been primarily accomplished through restriction of certain types of motorized use on established access routes, i.e. management of open motorized route densities. Recent research has shown that secure habitat (areas that are free of motorized traffic, also referred to as core areas) is an important component of grizzly bear habitat (IGBC 1998).

By managing motorized access, the following grizzly bear management objectives can be met (IGBC 1998):

- Minimize human interaction and potential grizzly bear mortality
- Minimize displacement from important habitats
- Minimize habituation to humans
- Provide relatively secure habitat where energy requirements can be met

Historically grizzly bear populations survived where frequencies of contact with humans were very low. Populations of grizzly bears persisted in those areas where large expanses of relatively secure habitat were retained and where human-induced mortality was low. In the Yellowstone area, this is primarily associated with national parks, wilderness areas, and large blocks of public lands (IGBST 1998). Habitat security requires minimizing mortality risk and displacement from human activities in a sufficient amount of habitat to allow the population to benefit from this secure habitat and respond with increasing numbers and distribution. Habitat security allows a population to increase in numbers and distribution as lowered mortality results in more reproduction and cub recruitment into the adult population. This results in an increasing population. As the population increases, it begins to expand in range and distribution. Both of these responses to habitat security are currently ongoing in the Yellowstone population as the population is increasing at 3 to 4 percent per year (Boyce et al. 2001) and increasing in distribution (Schwartz et al. 2002).

Secure habitat must also provide the basic seasonal habitat requirements for grizzly bears and should be representative of seasonal habitats available to bears in the entire analysis area (IGBC 1998). The Cumulative Effects Model was used to evaluate the relative habitat value of the existing secure habitat inside the primary conservation area (Interagency Conservation Strategy Team (ICST) 2007).

Grizzly Bear/Developed Site Interactions: The effects of human activity associated with developments on grizzly bear habitat use have been reported by Mattson et al. (1987), and include the following:

- Grizzly bear use was lower in areas near human developments
- Foraging behavior was disrupted
- Dominant bears tended to displace subordinate bears into areas with more human development
- Adult females and subadult males residing closer to developments were more likely to be involved in management actions (such as being trapped and relocated)

The Shoshone instituted a food storage order in 2004 on all NFS lands except for the Washakie Ranger District. This food storage order was implemented to reduce grizzly bear/human conflicts associated with developed sites as well as dispersed sites. Mattson and Knight (1991) analyzed grizzly bear mortality data by three 8-year periods (1962 to 1969, 1975 to 1982, and 1983 to 1990) and by association with different levels of human access, including major developments, primary roads, secondary roads, and back country areas. They reported that unit area mortality rates associated with all levels of access decreased over the three time periods. Renkin and Gunther (1996) evaluated bear mortalities in relation to developed sites over a 10-year period (1987 to 1996) and found that bear mortalities in relation to developed areas declined during that period. Even though grizzly bear/human conflicts still occur throughout the Greater Yellowstone Ecosystem (and the Shoshone), these studies show that efforts to reduce those conflicts have been successful.

Grizzly Bear/Livestock Interactions: Knight and Judd (1983) reported the following information about bears that kill livestock:

- All radio-collared grizzly bears that came in close contact with sheep, killed sheep.
- Most grizzly bears that encountered cattle did not make kills.
- All known cattle killers were adult bears, while sheep killers included both adults and subadults.

They concluded that sheep grazing in occupied grizzly range is a serious problem, since bears kill sheep more readily and because the sheep are closely tended by herders that are protective of their flocks.

Anderson et al. (1997) reported the following information from a study on grizzly bear/cattle interactions on two cattle allotments in northwest Wyoming:

- From a minimum of 24 grizzly bears that were known to use two cattle allotments during a 3-year period, seven bears (possibly eight) preyed on cattle.
- Thirty percent of 194 cattle mortalities documented during the three years were the result of bear predation, 65 percent were not bear-related, and 5 percent were classified as unknown.
- Predatory grizzly bears selected calves (51 of 58, or 88 percent) over adult and yearling cattle.
- All sex/age groups of grizzly bears, except subadult male, were associated with cattle depredations. However, three adult males were responsible for 84 percent of the documented losses where individual depredators could be identified.
- Cattle depredations were limited to a relatively short period (three to eight weeks) during two of the three grazing seasons, and five of the eight bears suspected of killing cattle did not appear to kill more than one calf each.
- Translocating grizzly bears is a viable option for reducing losses, since roaming bears may not return before that depredation period ends. Translocation could prevent the occasional depredator, which appears to be common among grizzlies, from being unnecessarily removed from the population.
- Removing cattle carcasses from allotments also appeared to reduce bear densities, but it could not be determined whether this would reduce depredations.
- Since adult males are responsible for the majority of cattle depredations, selective removal may also be a possible management option, particularly when habitual adult males are involved and translocation, aversion tactics, or carcass removal efforts are ineffective.

In summary, most, if not all, grizzly bears that come in contact with domestic sheep prey on sheep and conflicts are inevitable. Within the planning area from 2003 to 2012, none of the three remaining sheep allotments have had documented grizzly bear conflicts; however, the allotments are not considered occupied by grizzly bears. Not all grizzly bears that come in contact with cattle make kills. However, within the planning area, 22 of the 58 cattle allotments (38 percent) have had documented grizzly bear conflicts (2003 through 2012) (table 39).

Table 39. Documented grizzly bear/livestock conflicts Shoshone National Forest (2003 to 2012) (WGFD 2003-2012)

Allotment Name	Allotment Within PCA	No. of Grizzly Bear Depredation Conflicts since 2003	No. of Grizzly Bear Management Actions and Result of Action (lethal, non-lethal)
Bald Ridge	X	3	1 non-lethal
Basin	X	5	1 non-lethal
Bench	X	14	
Ghost Creek	X	4	
Crandall and Reef Creek	X	4	
Beartooth/Face of the Mountain		12	1 non-lethal
Little Rock		3	1 non-lethal
Table Mountain	X	14	
Dick Creek		1	
Sage Creek		2	1 non-lethal
Piney		4	
Belknap		3	1 non-lethal
Rock Creek/Hardpan	X	9	
Dunior	X	9	1 non-lethal
Fish Lake		3	
Ramshorn/Parque Ck/Horse Ck	X	15	1 non-lethal
Union Pass		10	1 non-lethal
Warm Springs		10	**1 lethal**, 2 non-lethal
Wiggins Fork		17	2 non-lethal
Wind River	X	22	**3 lethal**, 2 non-lethal
Bear Creek		2	
Salt Creek		6	

Status of the Grizzly Bear on the Shoshone National Forest: At minimum, grizzly bears need food, seasonal foraging habitat, denning habitat and security in an area of sufficient size for survival. The precise mixture of these diverse elements, however, is impossible to specify. The difficulty lies in the fact that grizzly bears are long-lived opportunistic omnivores whose needs for foods and space vary depending on a multitude of environmental and behavioral factors and on variation in the experience and knowledge of each individual bear. According to the Interagency Conservation Strategy Team (ICST 2007), the key to establishing habitat criteria that will maintain a healthy population is to look at the habitat factors in the past that produced a grizzly bear population in the Yellowstone area that is increasing in numbers and expanding in range. These habitat factors were used to establish the habitat criteria for the future that must be maintained if a healthy population continues to be preserved and are detailed in the Conservation Strategy. Since there is no quantitative way to estimate precisely the number of animals required for a viable population of any species, the best way to ensure a healthy population of grizzly bears is to monitor both population and habitat parameters closely and respond when necessary with adaptive management addressing the problems of the population in a dynamic way (ICST 2007). The Conservation Strategy is designed to accomplish this and all the forests in the Greater Yellowstone Area are signed partners.

The Yellowstone grizzly bear population was removed from the threatened species list in April 2007, after the population exceeded recovery goals for several years. Grizzlies became relisted as a federally threatened species in September of 2009, after a successful legal challenge to the delisting process. Grizzlies are still expanding in number and distribution throughout the ecosystem including on the Shoshone. The Final Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Area was released in 2003 in preparation for delisting, and finalized in 2007. Although it is not Forest Service policy at this time, it does represent best available science for grizzly bear conservation, and therefore, is considered to be the standard used for grizzly bear management. The State and Federal implementation plans within the strategy provide a framework for managing the primary conservation area (synonymously, the recovery zone) and adjacent areas of suitable grizzly bear habitat The primary conservation area is the area considered the adequate seasonal habitat needed to support the recovered Yellowstone grizzly bear population for the foreseeable future and allow bears to continue to expand outside the primary conservation area (see map 8). A recovered grizzly bear population is one having high probability of existence into the foreseeable future (greater than 100 years) and for which the five factors in Section 4(a)(1) of the Endangered Species Act have been successfully addressed. The primary conservation area was designed specifically with these five factors in mind.

A major change to the 1993 Demographic Recovery Criterion 3 in the Grizzly Bear Recovery Plan was updated with the 2007 Demographic Recovery Criteria because the 1993 version was no longer considered the best technique to assess recovery of the Yellowstone grizzly bear populations. The end result was revised methods for calculating population size, estimating the known to unknown mortality ratio, and estimating sustainable mortality levels for the Yellowstone grizzly population based on best available science (ICST 2007). The allowable mortality limits for each bear class are calculated annually based on total population estimates of each bear class for the current year. The Interagency Grizzly Bear Study Team calculates both the total population size and the mortality limits within an area designated by the Conservation Strategy that overlaps and extends beyond suitable habitat (the project area is within the Conservation Strategy area).

For independent females, a 9 percent limit was considered sustainable because simulations have shown that this level of adult female mortality rate allows a stable to increasing population 95 percent of the time (Harris et al. 2006). For independent males, a 15 percent limit was considered sustainable, because it approximates the level of male mortality in the Greater Yellowstone Area from 1983 to 2001, a period when the mean growth rate of the population was estimated at 4 to 7 percent per year. The Interagency Grizzly Bear Study Team will reevaluate mortality limits every 8 to 10 years or as new scientific information becomes available or at the request of the Coordinating Committee.

Forest Plan Direction for Grizzly Bear Habitat Management

The 1986 Forest Plan included a goal to “maintain or improve habitat for threatened and endangered species including participation in recovery efforts for listed species.” In 1991, an amendment to the plan established the primacy of the Grizzly Bear Guidelines over all other plan direction. This amendment incorporated the guidelines, in total, by reference. In addition, the plan provides specific direction for minimizing impacts to grizzly bears from timber harvest, wilderness, oil and gas leasing, and motorized access activities.

The grizzly bear is a management indicator species and served as the basis for formulating the habitat diversity standards in the revised Plan. Monitoring is required for known human-caused grizzly bear mortalities, compliance with the 1986 Guidelines, and grizzly bear habitat effectiveness.

Grizzly Bear Habitat/Distribution on the Shoshone National Forest

Approximately 59 percent (5,383 square miles) of the primary conservation area is NFS lands, consisting of six national forests. The Shoshone has approximately 1,233,000 acres or 36 percent of the primary conservation area that occurs on NFS lands (table 36).

The grizzly bear is a management indicator species (recovery species) identified in the 1986 Forest Plan. Grizzly bear/human conflict minimization is a high priority management consideration throughout the Forest within all areas occupied by grizzlies. As stated above, based on population monitoring, sightings of females with young have increased within the Greater Yellowstone Ecosystem as well as on the Shoshone in recent years. Grizzly bears have also increased from relatively uncommon to common in most northern areas of the Forest in the past two decades, in conjunction with a steady trend of increasing bear density east and south of Yellowstone National Park. Grizzly bears now frequent most parts of the Clarks Fork, Greybull, and Wapiti Ranger Districts, and areas of the Wind River Ranger District north of Dubois. Sightings south of Dubois are increasing.

The grizzly bear is known to occur on all five ranger districts on the Shoshone. In 2011 a single male grizzly bear was trapped west of Lander, Wyoming, and relocated to the Bridger-Teton National Forest. This bear most likely used habitat on the southern end of the Shoshone (Washakie Ranger District). Sightings and radio locations of grizzlies have increased outside the primary conservation area and numbers of bears have been increasing. Grizzly use is occurring at various levels on roughly 2 million acres on the Forest. Documented use has occurred in many areas east and south of the primary conservation area both on and off-Forest. Grizzlies have been documented south of Union Pass on the Bridger-Teton/ Shoshone National Forest boundary. The most extensive use by grizzlies outside the primary conservation area occurs in habitats to the south near Dubois, and the southeast near Meeteetse.

Very little is known about the insect aggregation sites on the Shoshone. Some sites are known more to the public than others because of word of mouth and because of their sightability and access from nearby roads. Other sites are miles into the back country, where the occasional hiker or horseman might stumble on the site during its use.

However, one study in the Absaroka Mountains on the north half of the Shoshone, summarized site information for 18 suspected and confirmed moth sites from data collected during aerial observations from 1981 to 1989. Six of the sites were then visited from 1987 to 1989. All 18 sites were located in glacial cirques on scree slopes immediately below steeper headwalls or cliffs. Elevations at the 18 sites ranged from 3,024 to 3,680 meters (9,072 to 11,040 feet) and slopes were 13 to 60 degrees. Sites were located on all aspects, with a majority of the sites being on north, west, and south aspects. Scree slopes used for feeding by bears were essentially devoid of vegetation; even lichen cover on rocks was sparse (Mattson et al. 1991b).

The study goes on to suggest that insect aggregation sites on the Shoshone are important to grizzly bears. Army cutworm moths are predictably a high-quality food; during July and August coinciding with the onset of spring hyperphagia (probably during late July) when grizzly bears accumulate the body fat necessary for surviving winter hibernation (Mattson et al. 1991b).

In 2001, a preliminary survey was undertaken in the Wind River Range on the Shoshone to identify any moth sites in the southern part of the forest. Of the 19 sites surveyed, 14 contained moths (Ratner 2001). This survey was expanded in 2003, and included 20 sites surveyed. Of these sites, 17 had moths with 15of the 17 having “very high” to “high” densities (Ratner 2003). While none of these sites had documented grizzly bear use, the potential exists as the bear population expands to the south. The number of confirmed moth sites on the Shoshone is unknown at this time. The 1986 Forest Plan and its amendments do not contain any direction for managing insect aggregation sites on the Forest.

Effects from Livestock Grazing and Big Game: Grizzly bear occurrence is variable across the commercial livestock grazing allotments on the Shoshone. Grizzly bear densities are generally high in the area from the Montana border to areas north of Dubois, with densities being lower east of the Greybull River drainage. Bear use continues to expand immediately south of Dubois. The following categories summarize grizzly bear occurrence and grizzly bear/livestock conflict potential within livestock grazing allotments on the Shoshone:

Grazing Allotments within or having a portion in the primary conservation area. Eighteen allotments are within (in whole or part of) the primary conservation area boundary (map 9). Grizzly bear occurrence and use in and adjacent to these allotments is common. Depredation, other conflicts, and control actions have occurred in these areas. These allotments have the highest potential for grizzly bear/livestock conflicts.

Grazing allotments occupied by grizzly bears outside of the primary conservation area. Twenty-nine allotments are occupied by grizzly bears outside of the primary conservation area boundary. Grizzly use in these allotments is variable, but is anticipated to increase as most are in historical habitat. Depredation, other conflicts, and control actions have occurred in these areas. These allotments have a high to moderate potential for grizzly bear/livestock conflicts.

Grazing allotments outside of the PCA and not occupied by grizzly bears. Thirteen allotments are unoccupied by grizzly bears. Grizzly bear occurrence on these 13 allotments in the Wind River Mountains near Lander is limited to an occasional sighting. Suitable grizzly bear habitat likely exists throughout these allotments, as evidenced by the common presence of black bears and historical records. These areas are likely to be occupied by grizzly in the future due to natural expansion; the potential for future cattle depredation exists.

Grizzly Bear Habitat Conservation on the Shoshone National Forest

The Final Conservation Strategy for Grizzly Bear in the Greater Yellowstone Area is the best available science and applies to NFS lands in the six greater Yellowstone Area national forests that include the Shoshone. The Conservation Strategy was developed to be the document guiding management and monitoring of the Yellowstone grizzly bear population and its habitat upon recovery and delisting. Even though delisting has not occurred, this document is still used to advance the grizzly bear’s recovery. The Conservation Strategy identified five key areas for land managers to focus on (Conservation Strategy, pp 5-11). These include:

- Population Standards and Monitoring
- Habitat Standards and Monitoring
- Management and Monitoring of Grizzly Bear/Human Conflicts
- Information and Education, and
- Implementation and Evaluation

The proposed action and alternatives have the potential to directly impact three of the five keys areas. These three focus areas (Habitat Standards and Monitoring, Management and Monitoring of Grizzly Bear/Human Conflicts and Information and Education) and appropriate planning area related standards will be the only ones brought forward for further discussion.

Habitat Standards and Monitoring Focus Area

Habitat standards include:

- Maintenance of secure habitat at 1998 levels in each bear management unit subunit (see map 10) through management of motorized access route building and density, with short-term deviations allowed under specific conditions. Secure habitat is defined as more than 500 meters from an open or gated motorized access route or reoccurring helicopter flight line and must be greater than or equal to 10 acres in size. The proposed action and alternatives could impact this standard, and thus, it will be discussed further.
- The number of commercial livestock allotments and number of permitted sheep will not exceed 1998 levels inside the primary conservation area. Existing sheep allotments will be phased out as the opportunity arises with willing permittees. The proposed action and alternatives could impact this standard, thus, it will be discussed further.
- Management of developed sites at 1998 levels within each bear management unit subunit with some exceptions for administrative and maintenance needs. The proposed action and alternatives could impact this standard, thus, it will be discussed further.

Habitat criteria that will be monitored and reported include:

- Monitoring open and total road motorized access route density in each bear management unit subunit inside the primary conservation area.
- Monitoring four major food items throughout the Yellowstone area: winter ungulate carcasses, cutthroat trout spawning numbers, bear use of army cutworm moth sites, and whitebark pine cone production. The incidence of white pine blister rust in sampled areas will also be monitored.
- Monitoring of habitat effectiveness in the primary conservation area using the databases from the Yellowstone Grizzly Bear Cumulative Effects Model.
- Monitoring the number of elk hunters inside the primary conservation area.
- Monitoring the number of grizzly bear mortalities throughout the Yellowstone area on private lands and development of a protocol to monitor private land status and condition.
- Land managers will ensure that habitat connectivity is addressed throughout the Yellowstone area as part of any new road construction or reconstruction.

Management and Monitoring of Grizzly Bear/Human Conflicts Focus Area

The management of grizzly bear/human conflicts inside and outside of the primary conservation area is based upon the existing laws and authorities of the State wildlife agencies, the Federal regulatory agency and Federal land management agencies. Management of nuisance bears usually falls into one or more of the following categories:

- Removing or securing the attractant,
- Deterring the bear from the site through the use of aversive conditioning techniques,
- Capturing and relocating the nuisance bear,
- Removing the bear from the wild, including lethal control, or

- The focus and intent of nuisance grizzly bear management inside and outside the primary conservation area will be predicated on strategies and actions to prevent grizzly bear/human conflicts.

Information and Education Focus Area

The purposes of the information and education aspects of this cooperative effort are to support the development, implementation, and dissemination of a coordinated information and education program. This program should be understandable and useful for the people who visit, live, work, and recreate in bear habitat to minimize grizzly bear/human conflicts and to provide for the safety of people while building support for viable bear populations.

Implementation of Habitat Standards and Monitoring Focus Area

The number of commercial livestock allotments in the primary conservation area on the Shoshone in 1998 was 24 (Appendix F, Conservation Strategy). The current number of commercial livestock allotments in the primary conservation area is 18, due only to combinations of allotments into a single managed allotment. In 1998 the permitted number of sheep (animal months) in the primary conservation area was 5,390. The current number of permitted sheep animal months is 0. This is as a result of the remaining two sheep allotments being vacated in 2003. The action alternatives propose changes to this standard; therefore, this will be analyzed further.

The Shoshone staff is responsible for certain elements of four of the six monitoring requirements. These include:

- Monitoring open and total road motorized access route density in each bear management unit subunit inside the primary conservation area. The Shoshone submitted this information to the Interagency Grizzly Bear Study Team (IGBST) for 2010 on February 22, 2011 (IGBST 2011).
- Monitoring four major food items throughout the Yellowstone area: winter ungulate carcasses, cutthroat trout spawning numbers, bear use of army cutworm moth sites, and whitebark pine cone production. The incidence of white pine blister rust in sampled areas will also be monitored. The Shoshone annually monitors established whitebark pine cone production transects and these data are used to prepare the Interagency Grizzly Bear Study Team annual report.
- Monitoring of habitat effectiveness in the primary conservation area using the databases from the Yellowstone Grizzly Bear Cumulative Effects Model. The Shoshone submitted this information to the Interagency Grizzly Bear Study Team for 2010 on February 22, 2011 (IGBST 2011).
- Land managers will ensure that habitat connectivity is addressed throughout the Yellowstone area as part of any new road construction or reconstruction. No new road construction or reconstruction needed this issue addressed in 2010.

The Shoshone is in compliance with these monitoring elements. Monitoring open and total road motorized access route density in each bear management unit monitoring element could be affected by the proposed action or alternatives.

Implementation of the Management and Monitoring of Grizzly Bear/Human Conflicts Focus Area

The following is a brief summary of the actions that the Shoshone National Forest has required within the planning area to maintain or improve grizzly bear habitat and reduce grizzly bear/human conflicts.

Food storage orders/regulations Food storage Order 04-00-104 (USDA 2004):

> All food and refuse must be acceptably stored or acceptably possessed during daytime hours.
>
> All food and refuse must be acceptably stored during nighttime hours, unless it is being prepared for eating, being eaten, being transported, or being prepared for acceptable storage.
>
> Any harvested animal carcass must be acceptably stored, unless the carcass is being field dressed, transported, being prepared for eating, or being prepared for acceptable storage.
>
> Camping or sleeping areas must be established at least 0.5 mile from a known animal carcass or at least 100 yards from an acceptably stored animal carcass.

Bear-resistant facilities/sanitation

The Shoshone and WGFD have provided bear-resistant facilities (i.e., bear-resistant food boxes, food tubes, garbage containers, meat hanging poles, panniers, etc.) at campgrounds, trailheads, dispersed campsites, and to permittees in the project area.

Information, Education, and Patrolling

The Shoshone annually hires a bear education specialist to coordinate and lead the bear awareness programs. Substantial information and education materials (pamphlets, brochures, signs, videos, etc.) and programs have been provided to the public at all Forest Service offices. Signs and brochures are available at campgrounds, trailheads, dispersed recreation sites, picnic areas, etc. Forests contributed financing for producing the information and education film "Living in Grizzly Country." The forests have cooperated with State wildlife management agencies and other cooperating institutions and individuals in giving "Living in Bear Country Workshops," which include bear identification, safe camping, hiking, hunting, and working procedures to use in bear country, and the proper use of bear-deterrent pepper spray. Back country rangers and other back country patrols have been used to inform and educate the public on food storage orders, and to check on compliance with these orders. Field patrols have been used during hunting seasons to reduce hunter-caused conflicts and grizzly bear mortalities, specifically within the project area.

Special grizzly bear requirements in permits

All special use permits and livestock grazing permits issued on the Shoshone contain clauses requiring protection of the grizzly bear and its habitat, and proper food storage and sanitation both inside and outside of the primary conservation area boundary.

Grizzly Bear Population

Following the direction in the Conservation Strategy; the Interagency Grizzly Bear Study Team annually monitors unduplicated females with cubs of the year within the Greater Yellowstone Area; calculates a total population estimate for the entire Greater Yellowstone Area based on an estimate of females with cubs of the year, monitors the distribution of females with all young in each bear management unit within the primary conservation area, and monitors all sources of mortality. The new analysis protocol for estimating total population and sustainable mortality limits were developed by the Interagency Grizzly Bear Study Team and was appended to the Conservation Strategy.

Current information indicates the Greater Yellowstone Area population of grizzly bears is growing at approximately 3 to 4 percent annually. While there is some debate related to the actual level of population increase since the bear was listed in 1975, all of the current information (i.e., number of unduplicated females, distribution of reproducing females, distribution of bears, informal sightings by agency personnel, and areas where nuisance bears are being managed) indicates this population has increased in both numbers of bears and the geographic area they occupy (ICST 2003). The distribution of the grizzly bear population on the Shoshone in 2011 has not really changed in the last 8 years. All 13 of the grazing allotments unoccupied in the 2003 are still considered unoccupied in 2011.

Secure Habitat on the Shoshone National Forest

Maintaining or improving secure habitat at or above the 1998 levels in each bear management subunit inside and outside the primary conservation area is required under the Conservation Strategy as an objective. Secure habitat as defined in the Conservation Strategy is any contiguous area greater than 10 acres in size occurring more than 500 meters away from an open or gated motorized access route or recurring helicopter flight line. Lakes larger than 1 square mile in spatial extent are excluded from the secure analysis. No motorized access objectives are identified for areas outside the primary conservation area in the conservation strategy. Annual reporting of changes in secure habitat is required for areas inside the primary conservation area and in alternating years for areas outside of the primary conservation area.

On the Shoshone, 2012 changes in secure habitat were last reported in February 2013, for areas both inside and outside the primary conservation area. Since the 2012 monitoring report has not been finalized at this time, we utilized the 2011 monitoring report. In 2011, there had been no net decline in secure habitat in any of the bear management subunits in the primary conservation area, including the Shoshone (IGBST 2012). Existing secure habitat on the Shoshone is displayed in table 40 (see also map 11).

Secure habitat had increased by 0.1 percent or more in 15 subunits from that identified in the 1998 baseline. The Shoshone increased secure habitat in 5 of its 10 bear management subunits (Crandall/Sunlight 1 and 3, Shoshone 1 and 3, and South Absaroka 3) (IGBST 2012). The Shoshone is in compliance with the secure habitat objective.

Table 40. 1998 baseline and 2011 for secure habitat for bear management unit (BMU) subunit on the Shoshone

BMU Subunit Name	% Secure Habitat	Square Miles Secure Habitat		
	1998	2010	% Change	1998/2010
Crandall/Sunlight 1	81.1	81.4	0.3	105.2/105.6
Crandall/Sunlight 2	82.3	82.3	0.0	260.3/260.3
Crandall/Sunlight 3	80.4	80.7	0.3	178.3/178.9
Shoshone 1	98.5	98.5	0.1	120.3/120.4
Shoshone 2	98.8	98.8	0.0	130.9/130.9
Shoshone 3	97.0	97.7	0.8	136.5/137.6
Shoshone 4	94.9	94.9	0.0	179.1/179.1
South Absaroka 1	99.2	99.2	0.0	161.9/161.9
South Absaroka 2	99.9	99.9	0.0	190.3/190.3
South Absaroka 3	96.8	96.8	0.0	337.1/337.2

Changes in secure habitat in areas identified by State grizzly bear management plans as biologically suitable and socially acceptable for grizzly bear occupancy are reported every 2 years on national forests outside the primary conservation area. Since 2008, when secure habitat outside the primary conservation area was last reported, small gains in grizzly bear secure habitat were achieved in 7 out of 43 bear analysis units, with one bear analysis unit (Warm Springs-Shoshone National Forest) reporting a slight decrease. Two of the seven bear analysis units on the Shoshone (Carter and Wood River) saw a slight increase (IGBST 2011).

Alternatives (except alternative G) to the revised Forest Plan may impact road densities within the planning area, thus, they could have an effect on secure habitat. The preferred alternative will not impact road densities within the planning area.

Grizzly Bear Conflicts on the Shoshone National Forest

There were 64 grizzly bear/livestock conflicts from 1986 to 2002, and no documented bear mortalities had occurred (USDA Forest Service 2003). Conflicts with livestock have increased in recent years, primarily outside of the primary conservation area.

From 2003 to 2012 there have been 336 reported grizzly bear conflicts on the Shoshone (table 40). A majority of these conflicts were from livestock injuries/depredations, followed by food habituated, property damage, and human injury conflict. As a result of the 336 grizzly bear conflicts, 64 bears were killed or removed from the Shoshone (table 38).

Table 41. Grizzly bear conflicts on the Shoshone National Forest 2003 to 2012 (IGBST 2003–2012, Wyoming Game and Fish Department (WGFD) 2012)

Type of Conflict	Percent	Number
Livestock	59%	196
Food Habituated	21%	69
Property Damage	15%	46
Human Injury	5%	25
	Total:	336

Grizzly bear conflicts with livestock have generally been managed according to the Grizzly Bear Guidelines and/or Conservation Strategy, which include protocols for nuisance bear management. Table 41 displays documented livestock conflicts for presently active allotments on the Shoshone since 2003. All of these allotments are grazed by cattle, as domestic sheep are no longer permitted in occupied habitat. A management action, as shown in table 42 is an action that results in a bear being killed (lethal action), trapped and relocated, or aversive-conditioned (non-lethal action). A management action also includes any action that attempts to take a bear, such as attempting to trap a bear.

Table 42. Documented grizzly bear/livestock conflicts Shoshone National Forest (2003 to 2012) (WGFD 2003–2012)

Allotment Name	Allotment Within Primary Conservation Area	No. of Grizzly Bear Depredation Conflicts since 2003	No. of Grizzly Bear Management Actions and Result of Action (lethal, non-lethal)
Bald Ridge	X	3	1 non-lethal
Basin	X	5	1 non-lethal
Bench	X	14	
Ghost Creek	X	4	
Crandall and Reef Creek	X	4	
Beartooth/Face of the Mountain		12	1 non-lethal
Little Rock		3	1 non-lethal
Table Mountain	X	14	
Dick Creek		1	
Sage Creek		2	1 non-lethal
Piney		4	
Belknap		3	1 non-lethal
Rock Creek/Hardpan	X	9	
Dunior	X	9	1 non-lethal
Fish Lake		3	
Ramshorn/Parque Ck/Horse Ck	X	15	1 non-lethal
Union Pass		10	1 non-lethal
Warm Springs		10	**1 lethal**, 2 non-lethal
Wiggins Fork		17	2 non-lethal
Wind River	X	22	**3 lethal**, 2 non-lethal
Bear Creek		2	
Salt Creek		6	

As can be seen from table 42, there have been four documented grizzly bear mortalities due to cattle grazing on the Shoshone from 2003 to 2012. Incidental take was exceeded when the second bear mortality occurred in 2010. Consultation was reinitiated in 2011, and a new take statement was received in 2012. There are several allotments where conflicts are concentrated—Bench, Beartooth/Face of the Mountain, Table Mountain, Rock Creek/Hardpan, Dunior, Ramshorn/Parque Ck/Horse Ck, Wiggins Fork and Wind River. This is an increase in conflict allotments since 2003, when only three of these allotments (Rock Creek/Hardpan, Dunior and Ramshorn/Parque Ck/Horse Ck) were identified in the 2003 biological assessment.

Direct and Indirect Effects

Effects from Motorized Access: Research has shown that secure habitat (areas that are free of motorized access) is an important component of grizzly bear habitat (Interagency Grizzly Bear Committee 1998). Secure habitat is defined as areas more than 10 acres in size and more than 500 meters from an open or gated motorized access route or recurring helicopter flight lines. Alternatives A through E and G provide secure habitat for the grizzly bear both inside and outside the primary conservation area and they all provide the most secure habitat with no allowance for management activities that would decrease the secure habitat. These alternatives would be consistent with the Final Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Area 2007. Alternative F proposes eliminating the security requirement for grizzly bears. Alternative F would have the greatest effect on this species, would be inconsistent with how secure habitat is managed in the Greater Yellowstone Ecosystem, and would be inconsistent with the Final Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Area 2007. Existing secure habitat in alternatives A through E and G is at 93 percent (table 43), while secure habitat in alternative F would be reduced to 0 percent. Alternatives A through E and G would allow varying amounts of management activities within portions of the existing secure habitat that could temporarily or permanently decrease the amount of secure habitat. Under alternative F, management activities would not be restricted for grizzly bears with regard to secure habitat management.

Within the Primary Conservation Area on the Shoshone National Forest

There are 1,800 square miles of secure habitat on Shoshone NFS lands within the primary conservation area (table 43). The maximum allowable temporary change to secure habitat for a project cannot exceed 1percent of the area of the largest subunit within the bear management unit (Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Area 2007)

All alternatives, except alternative F, maintain or increase the amount of long-term secure habitat, but allow changes in the secure habitat according to the 1 percent rule. Under alternatives A through E and alternative G, any secure habitat affected by the 1 percent rule would be restored after project completion. Under alternative F, secure habitat direction would be eliminated.

Alternative A (the 1986 Plan, as amended) has a standard for no net increase in roads. The activity levels associated with Plan objectives are relatively low. In practice, secure habitat is being maintained or increased under this alternative. The amount of secure habitat has increased in Shoshone bear management units subunits 3 and 4 due to road closures in the North Fork Shoshone River corridor. The amount of secure habitat has stayed the same in all other bear management unit subunits. Currently, 93 percent of the NFS land within the primary conservation area is secure habitat (table 43).

In alternative A, the standard for no net increase in roads would result in stable amounts of secure habitat. The location of secure habitat could change over time when roads are constructed in some areas and closed in other areas to meet the standard of no net increase.

For alternatives B through E and alternative G, the existing secure habitat (1,137,000 acres, 93 percent of the NFS land within the primary conservation area) would be maintained, with the allowance of the 1 percent rule to accomplish various management objectives.

For alternative F, there would be no standard for secure habitat within the primary conservation area. This alternative would not be in compliance with the Conservation Strategy and would have negative influences on the grizzly bear due to the potential loss of secure habitat for the species.

Effects from Winter Motorized Use: Within the Shoshone, there are over 567,000 acres of grizzly bear denning habitat within the primary conservation area (Podruzny et al. 2002) (table 43).

Table 43. Grizzly bear denning habitat in thousands of acres, closed to snow machine use within the primary conservation area

Acres of denning habitat	Acres (%) closed to snow machine use						
	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
731	80%	80%	96%	90%	80%	70%	80%

Within the primary conservation area, approximately 80 percent of the grizzly bear denning habitat would be closed to snow machine use in alternatives A, B, E and G (table 43). Alternatives C and D would increase the amount of denning habitat closed to snow machine use to 96 percent and 90 percent, respectively. Alternative F would decrease the amount of closed habitat to 70 percent. It also projects an additional 90 miles of snowmobile trails. Alternative F has the potential to have the greatest impact on denning habitat for grizzly bear.

Therefore, in alternatives A through E and alternative G, potential impacts to grizzly bears from snow machine use would be expected to be low, while effects from alternative F could be moderate.

Effects from developed sites: Developed sites in grizzly bear habitat increase the potential for conflict with humans primarily due to the potential availability of human foods. Developments also reduce the effectiveness of the natural habitat near these sites. Dominant bears sometimes displace subordinate bears into less desirable habitat, resulting in increased conflicts compared to bears using habitats farther away from developed sites. The larger the developed site and the more people using the site, the greater the potential for conflicts and reduction in the effectiveness of the adjacent habitat for bears (Mattson et al.1987 in grizzly bear amendment).

Inside the Primary Conservation Area on the Shoshone

Developed sites on the Shoshone National Forest inside the primary conservation area are displayed in table 44 as depicted in the Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Area 2007. Forest Service food storage regulations minimize the potential for grizzly bear/ human conflicts independent of the alternatives. Minerals development under the 1872 General Mining Law would be permitted and mitigated as possible.

Table 44. The 1998 baseline for numbers of developed sites on the Shoshone within each bear management unit

Subunit	Permitted Summer home complex	Developed campgrounds	Trailheads	Major Developed Sites and lodges	Administrative or maintenance sites	Other developed sites	Plans of operations for mineral activities
Crandall/Sunlight #1	0	2	5	1	1	5	0
Crandall/Sunlight #2	0	5	4	1	2	5	1
Crandall/Sunlight #3	0	2	3	0	1	2	0
Shoshone #1	1	2	0	0	0	6	0
Shoshone #2	0	0	1	1	0	0	0
Shoshone #3	2	0	1	1	0	0	0
Shoshone #4	3	3	3	6	0	8	0
South Absaroka #1	0	0	0	0	0	0	0
South Absaroka #2	0	0	0	0	2	0	0
South Absaroka #3	1	3	4	1	1	4	0
Total	7	17	21	11	7	30	1

Alternatives A through G. Recreational use and associated demand for developed sites is expected to increase. Increases in capacity and the number of developed sites would not be allowed unless it were determined that there were no impacts to grizzly bears or the impacts could be mitigated effectively within the same bear management unit subunit. Conflicts at developed sites would likely remain at current levels or decrease, and the acreage of impacted habitat would decrease or remain at 1998 levels.

Consultation with the USFWS would be required under all alternatives for projects that may affect the grizzly bear. Should the grizzly bear be delisted, a biological evaluation would be required under all alternatives for projects that may affect the grizzly bear as a regional sensitive species. The number and capacity of developed sites would likely increase outside the primary conservation area under all alternatives. Grizzly bear/human conflicts would increase outside the primary conservation area as bears expand their range even with the existing level of developed sites. An increase in number and capacity of developed sites would further increase the potential for conflicts and displacement.

Effects from Commercial Livestock Grazing: The number of commercial livestock allotments in the primary conservation area on the Shoshone in 1998 was 24 (ICST 2007). The current number of commercial livestock allotments in the primary conservation area is 18, due only to combinations of allotments into a single managed allotment. In 1998, the permitted number of sheep (animal months) in the primary conservation area was 5,390. The current number of permitted sheep animal months is 0. This is as a result of the remaining two sheep allotments being vacated in 2003. Grizzly bear/livestock conflict data are displayed in table 39.

Alternatives A, B, D, and G. The number of commercial livestock allotments would remain unchanged under these alternatives and would be consistent with this standard in the

Conservation Strategy. Sheep AUMs would remain below 1998 levels inside the primary conservation area. Conflicts with grizzly bears and domestic sheep have been eliminated. No new allotments would be created in the primary conservation area and numbers of cattle would likely remain close to, or below, 1998 levels in existing allotments. Conflicts with cattle would likely continue at current levels, and any potential for increase in conflicts would not be a result of new allotments. Cattle numbers could increase in existing allotments, although any increases would likely be minor. Under these alternatives, cattle allotments with recurring conflicts that could not be resolved through modification of grazing practices would be retired as opportunities arise with willing permittees. As allotments with recurring conflicts are retired, grizzly bear conflicts would decrease.

The past level of conflicts and grizzly bear mortalities has not precluded achieving recovery of the grizzly bear and, in addition, sheep conflicts have been eliminated.

Alternative C. No new allotments would be created in the primary conservation area. Under alternative C, permitted AUMs decrease by 45 percent and would be below 1998 levels in existing allotments. Under this alternative, cattle allotments with recurring conflicts, that could not be resolved through modification of grazing practices, would be retired as opportunities arise with willing permittees. As allotments with recurring conflicts are retired, grizzly bear conflicts would decrease. Similar to alternative A, the past level of conflicts and grizzly bear mortalities has not precluded achieving recovery of the grizzly bear and, in addition, sheep conflicts have been eliminated.

Alternative E. The number of cattle AUMs would increase under this alternative by 20 percent above alternative A. This would be accomplished within the existing number of allotments. Portions of these allotments lie with the primary conservation area. This alternative would be consistent with the 1998 baseline standard as the number of allotments is not increased and no increase in sheep AUMs. Due to the increase of livestock use, this alternative would result in increased conflicts with grizzly bears.

Recovery of the grizzly bear would be set back by alternative E, as the number of conflicts and results of the conflicts would have increased negative impact on the species.

Alternative F. The number of commercial livestock allotments and cattle AUMs would increase under this alternative. Seven allotments that are currently vacant would be made available for livestock grazing and increase AUMs by approximately 25 percent over alternative A. Portions of these allotments lie within the primary conservation area. This alternative would not be consistent with the 1998 baseline standard in the Conservation Strategy and would result in increased conflicts with grizzly bears.

Recovery of the grizzly bear would be set back by alternative F, as the species would no longer be managed consistently in the Greater Yellowstone Ecosystem.

Outside the Primary Conservation Area on the Shoshone National Forest

Outside the primary conservation area, there are currently 39 active cattle allotments and two active sheep allotments (USDA Forest Service 2011, this is the Grazing BA Table 2 and 3). During the years 2003 through 2011, there were 12 cattle allotments and no sheep allotments (30 percent of the active allotments) with documented grizzly bear conflicts.

Alternatives A, B, C, D, E, and G. The existing active sheep allotments would be maintained. There have been no grizzly bear conflicts on the existing active sheep allotments. Grizzly bear conflicts are expected on the 12 cattle allotments outside the primary conservation area with previous conflicts, and are anticipated on some but not all of the other cattle allotments if the grizzly bear population expands into these areas. Both cattle and sheep conflicts would be handled under State nuisance grizzly bear guidelines. These nuisance grizzly bear guidelines allow a variety of management actions, depending on site-specific conditions and situations. Conflicts would likely increase under all five alternatives outside the primary conservation area as bears continue to expand their range. Consultation with the USFWS would be required under all alternatives, until the grizzly bear is delisted.

Alternative F. The number of active commercial allotments would be increased and the numbers of cattle would be increased under this alternative. Grizzly bear conflicts would occur on the new allotments and conflicts are also expected on the 12 cattle allotments outside the primary conservation area with previous conflicts, and are anticipated on some but not all of the other cattle allotments if the grizzly bear population expands into these areas. Livestock conflicts would be handled under State nuisance grizzly bear guidelines. These nuisance grizzly bear guidelines allow a variety of management actions, depending on site-specific conditions and situations. Conflicts would likely increase under all five alternatives outside the primary conservation area as bears continue to expand their range. Consultation with the USFWS would be required under all alternatives until the grizzly bear is delisted.

Effects from Forest-wide Direction: Effects are common to all alternatives. All alternatives provide some level of protection to grizzly bear habitat; the quantity and quality of available habitat are only two of the factors that influence total population numbers. Controlling human-caused mortality has been key to increases in bear numbers over the last 25 years. Human-caused mortality, coupled with the amount of effective habitat, would be the ultimate limiting factors for the grizzly bear population in the Greater Yellowstone Area.

Coordinated management of nuisance bears, food storage orders, information and education efforts, and the availability of Forest Service facilities to store food unavailable to bears would minimize conflicts and grizzly bear mortalities under all alternatives.

Grizzly bear/human conflicts and human-caused mortalities would likely increase with increased contact between bears and humans on the six national forests. Many of the grizzly bear/human conflicts occur on private lands in the Greater Yellowstone Area, where the Forest Service has no authority to require food storage.

Recreational use of NFS lands is expected to increase over the next decade as the human population in the counties in the Greater Yellowstone Area continues to grow.

Weather conditions play a key role in the yearly availability of foods for bears, which in turn affects female fecundity (fertility) and cub survival (Schwartz et al. 2005). In poor food years, bears often seek non-traditional foods and end up in conflicts with humans, increasing the risk of mortality. Regardless of the amount of habitat protection, weather conditions would still influence the basic productivity of the land and the foods available to bears, and ultimately, the carrying capacity of the landscape for grizzly bears.

Future minerals development could impact grizzly bears, but would be minimized by mitigation efforts.

Cumulative Effects

Livestock grazing is an identified potential threat to grizzly bear conservation that contributes to cumulative adverse effects, due primarily to control actions when grizzly bear/livestock conflicts occur. Most grizzly bears that persistently kill livestock are eventually euthanized or otherwise removed from the population (Reinhart et al. 2001). Although many conflicts in the Greater Yellowstone Area were associated with livestock depredations, most were resolved without bear mortalities (IGBST 2000). This is very similar on the Shoshone where from 2003 to 2012, there were 168grizzly bear/livestock conflicts that resulted in 4 bear mortalities. As grizzly bear populations expand outside the primary conservation area, the proportion of livestock depredations occurring outside the primary conservation area have increased, especially since there are more livestock grazing operations outside the PCA than inside. With the existence of the nuisance bear policy in effect outside the primary conservation area in Wyoming, it is likely that more grizzly bears would be killed when livestock depredations occur.

In addition to the grazing activities that may influence grizzly bears and their habitat on the Shoshone, other private or State-permitted activities are reasonably certain to occur within the immediate influence zone that would result in cumulative effects to the grizzly bear. The activities that are likely to occur on private and State land within close proximity to the Shoshone are presented below. The primary State-permitted activity that will occur on public and private land is regulated wildlife hunting/trapping and fishing seasons. This activity will likely remain the same or increase slightly, and thus, the potential for grizzly bear\human conflicts will likely increase, particularly as the grizzly bear increases in numbers and distribution. Of the 64 human-caused grizzly bear mortalities on the Shoshone from 2003 to 2012, 54 percent were hunting related. This percentage is a 17 percent increase since 2003. One of the greatest causes of grizzly bear mortalities in recent years is self-defense in fall by big game hunters. Black bear hunting using bear baiting techniques will continue and possibly increase on State and private lands near the Shoshone. This is another potential source for grizzly bear/human conflict and human-caused grizzly bear mortality. All alternatives are not expected to have any influence on or be affected by this non-Forest Service permitted or regulated activities.

Additional activities likely to occur in the immediate influence zone include actions on private inholdings and private lands adjacent to the Shoshone. Livestock grazing on public lands is a long tradition of western culture and the use of public lands has been a key component of viable ranching operations. Working ranches are an important part of the landscape as they provide large expanses of habitat essential to the conservation of grizzly bears. The importance of working landscapes should not be minimized as they are not only vital to the grizzly bear, but many wide-ranging species. Should there be a loss of our working landscapes; the fragmentation of wildlife habitat would have long-term adverse impacts to grizzly bears. Examples include construction of homes and development of residential subdivisions. This can reduce or fragment available bear habitat and reduce its effectiveness because of human disturbance. In these human activity areas, bears can become human-habituated and food-conditioned, which will lead to increases in grizzly bear/human conflicts, particularly as bears increase in numbers and distribution.

Private and State lands that currently have livestock grazing occurring will likely continue to have livestock grazing, and these actions can have similar effects that have and can occur relative to livestock grazing on the Shoshone. Loss of, displacement from, or decrease in value of available habitat can occur from increased development on private lands related to oil and gas exploration, and development and recreational developments. With these increases in developments on the periphery of the Shoshone, there will be increases in recreational activities on both private and public lands, which can lead to increases in grizzly bear/human conflicts and cumulative effects.

Determination of Effects and Rationale for the Determination

Under alternatives A through E and alternative G, management activities such as livestock grazing, recreation, and vegetation management inside the primary conservation area and in areas occupied by grizzly bears have been identified as a risk factor that will likely affect individual bears and may affect grizzly bear populations. Management activities are guided by the habitat standards that limit changes to grazing allotments, developed sites and secure habitat. It is likely that only a small number of grizzly bears will be affected by grazing activities and the potential adverse effects can be minimized through adherence to the terms and conditions. Grizzly bear populations have expanded and are expected to continue to expand throughout the Shoshone. Given the high potential for grizzly bear/human and grizzly bear/livestock interactions to continue and the resulting control actions, it is the conclusion and determination that this action (alternatives A through E and G), "**may affect, likely to adversely affect**" individual grizzly bears. As a result of this determination formal consultation would be required.

Alternative F would remove any secure habitat requirements for grizzly bears and increase the number of commercial grazing allotments. There is an expected increase in bear/livestock conflicts. Developed sites are guided by the habitat standards that limit changes to the number of sites. Expansion of the grizzly bear population in the primary conservation area would not occur. Given the high potential for grizzly bear/human and grizzly bear/livestock interactions to continue and the resulting control actions, it is the conclusion and determination that this action (alternative F), "**may affect, likely to adversely affect**" individual grizzly bears. As a result of this determination, formal consultation would be required.

North American wolverine

Affected Environment

Wolverines (*Gulo gulo*) have a circumboreal distribution. In North America, they occupy much of Alaska and northern Canada, and follow the Rocky Mountains south to northwestern Wyoming (Beauvais and Johnson 2004). Northwestern Wyoming, including the Shoshone, is thought to support the southernmost population of wolverines in North America. Historical populations, distribution, or abundance are unknown on the Forest.

Due to low population densities, no trend data are available for the Shoshone or the Greater Yellowstone Ecosystem. Over an 18-year period (1992 to 2009) only three observations of breeding wolverines were made in Wyoming (Inman et al. 2009). As of the winter of 2008 to 2009, the Wildlife Conservation Society had five radio-collared wolverines that had home ranges within northwestern Wyoming (Inman et al. 2009), one of which dispersed to Colorado. Wolverines were also recently documented in the Thorofare region of the Washakie Wilderness (Shoshone National Forest) and Teton Wilderness (Bridger-Teton National Forest), but no wolverines were detected in the North Absaroka Wilderness (Shoshone National Forest), which contains prime habitat for wolverines (Murphy et al. 2011).

Habitat Distribution and Condition on the Shoshone

Wolverine habitat typically consists of remote, undisturbed, and mountainous regions. Habitat consists of mature boreal forest, alpine tundra, and rock. Home ranges are large from 40 to

200 square kilometers (24.9 to 124.3 square miles) (Buskirk and Ruggiero 1994). These areas typically contain herds of large ungulates.

Due to the wide use of habitats, there is no limiting habitat association (topography or vegetation type) for wolverines. It is assumed that pockets of mature forest with an abundance of coarse woody debris is beneficial, along with open areas supporting big game foraging, coupled with boulder fields for denning. The Shoshone contains abundant potential habitat for wolverines, especially in wilderness (Wildlife Conservation Society 2010, Beauvais and Johnson 2004).

Snow cover that persists through the spring denning period appears vital to reproduction, and Copeland et al. (2010) showed that nearly 100 percent of documented dens (n=562) documented through worldwide research studies (primarily Fennoscandia and North America) occurred at sites with persistent snow cover. Overall, the denning period for wolverines, regardless of worldwide location is estimated to be between approximately mid-February to mid-May.

If wilderness areas represent optimal wolverine habitat, then the Shoshone contains about 1,365,154 acres of potential habitat. One large area of potential wolverine habitat that is not in wilderness is the Beartooth Plateau. Winter motorized recreational use of this area is high.

On the Shoshone, spruce/fir habitat is relatively abundant. There are about 309,442 acres of spruce/fir on the Forest with about 30 percent of it being mature (over 200 years old) (USDA Forest Service 2012b). Also, due to fire suppression, the spruce/fir forest type has likely increased on the Forest.

Risk Factors

The primary risk factors from forest management are winter recreational activities, infrastructure development and transportation corridors. Predicted effects of climate change on the distribution of late spring snowpack is expected to reduce the overall acreage of wolverine habitat.

Habitat and Population Management Considerations

Fur trapping has historically been a large source of mortality. Wolverines in Wyoming are currently classified as a nongame mammal with full protection from take, including fur harvest. Trapping wolverines is still allowed in Montana. Given wolverine’s large home ranges, it’s possible that some wolverines in Northwestern Wyoming are at risk of being trapped in Montana at some point.

Winter recreation, especially snowmobiling, is a primary source of disturbance for denning wolverines (Beauvais and Johnson 2004, Inman et al. 2009, Olliff and Kaeding 1999). Regulating snowmobile use in important denning areas and deterring wilderness trespassing by snowmobiles are important.

Land-use conversion due to development and roads is an important risk factor. This is most evident on lands adjacent to the Shoshone. Some of these areas may serve as linkage areas between suitable habitats.

Climate change could also impact wolverines (Rice et al. 2012, Inman et al. 2009). Wolverines are adapted to cold temperatures and snow. Changes in climate may result in increased competition for food and less successful den site selection (Inman et al. 2009).

Conservation Measures

Although abundant habitat exists in wilderness areas, high value wolverine habitat outside of wilderness may be at risk, therefore, there is some viability concern on the Shoshone. To address these concerns and to provide management for this species to maintain or improve its potential distribution on the Forest, conservation measures need to be considered for incorporation into forest plan goals, objectives, standards and guidelines.

Conservation measures summarized include:

1. In general, implementation of the NRLMD (USDA Forest Service 2007) would benefit wolverines as well. Especially, Standards and Guidelines related to vegetation management and winter recreation.
2. If important denning habitat is identified outside of wilderness (i.e., Beartooth Plateau) snowmobiling in these areas may need to be restricted.
3. Actively patrol for snowmobiles that are trespassing in wilderness.

Monitoring Considerations

Monitoring the intensity and snowmobile use in the Beartooth Plateau area could be important, especially if the wolverine is listed in the future. If listed, it could greatly restrict snowmobile use in this area.

The Shoshone will continue to collaborate with other agencies and organizations to monitor wolverines in the Greater Yellowstone Ecosystem.

Direct and Indirect Effects

Effects from Roads, Motorized and Non-motorized Recreation, and Ski Area Development: Plan direction that could potentially influence the wolverine involves road construction/reconstruction, motorized and non-motorized recreation, and ski area development. Differences in projected outputs by alternative for these activities are displayed in table 45.

Table 45. Activities and outputs that could Influence the North American wolverine by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Motorized Recreation-Winter(Acres available)	887,600	479,800	103,000	323,700	525,200	825,200	510,500
Motorized Recreation-Winter(Acres not available)	1,550,000	1,958,000	2,331,000	2,114,000	1,913,000	1,613,000	1,845,600
Motorized Recreation-Summer (Acres available)	570,600	570,800	322,400	350,600	656,500	823,900	529,000
Motorized Recreation-Summer (Acres not available)	1,867,000	1,867,020	2,116,000	2,087,000	1,782,000	1,614,000	1,909,000
Ski Area Development Or Expansion	1,150	1,150	1,150	1,150	1,150	1,150	1,150
Wilderness Acres	1,365,000	1,365,000	1,968,000	1,559,000	1,365,000	1,365,000	1,365,000

Alternative A: No action

As displayed in table 45, the no-action alternative offers the most acres, approximately 887,600 acres, for over-the-snow motorized travel. Although this alternative did not recognize Sleeping Giant Ski Area, nonetheless the effects of the ski area under alternative A are the same as the action alternatives (B through G). No expansion of the ski area boundary is proposed in any of the alternatives, which is important to the conservation and future habitat options for the wolverine.

Action Alternatives: Alternatives B through G

As displayed in table 45, the action alternatives differ in the amount of solitude and undeveloped terrain potentially available for the wolverine. Of the action alternatives, alternative F offers the largest amount of acres available to winter motorized recreation. Alternatives C and D offer the least amount of acres available for motorized travel. Alternatives C and D, therefore, offer the highest probability of maintaining habitat options for species such as the wolverine that depend on solitude, little human disturbance, and undeveloped terrain. Alternatives B and E and alternative G offer a balance between the three other action alternatives, but also they provide more undisturbed habitat and less potential disturbances than no action.

In regard to undeveloped habitat, alternatives B through G are the same as alternative A where no expansion of the ski area boundary is proposed.

Cumulative Effects

A considerable amount of wilderness and unfragmented habitat remains in the Shoshone. Recreational use on the Forest has increased to a point that previously undisturbed areas are now supporting various types of extreme sports and other recreational pursuits. These activities have the potential to reduce the amount of solitude habitat available for species such as the wolverine.

In Wyoming, wolverines are a species of greatest conservation need and trapping of wolverines is illegal. Fur trapping has historically been a large source of mortality. Trapping wolverines is still allowed in Montana. Given the wolverine’s large home ranges, it’s possible that some wolverines in northwestern Wyoming are at risk to trapping in Montana at some point.

Increasing global temperatures may degrade habitat quality and quantity in the conterminous United States during the 21st century, triggering reductions in the size of wolverine habitat patches and their connectivity (Schwartz et al. 2009, Copeland et al. 2010). Because of its high average elevation and location, in the continent’s interior, the Yellowstone ecosystem (includes the Shoshone) has some of the largest and most contiguous patches of wolverine habitat in the conterminous United States (Brock et al. 2007, Copeland 2010). Thus, the ecosystem is likely to play an increasingly important role in the population dynamics and persistence of wolverine populations as the regional-scale coverage of spring snow declines.

Determination of Effects and Rationale for Determination – North American Wolverine

Alternatives A through G are “not likely to jeopardize continued existence” of the species. Because of this determination, no conferencing with the USFWS is needed.” The rationale for this determination follows:

- The Shoshone and its connectivity with the Greater Yellowstone Ecosystem provide an abundance of suitable habitat for the wolverine.
- In general, implementation of the Northern Rockies Lynx Management Direction (USFS 2007) would benefit wolverines, especially standards and guidelines related to vegetation management and winter recreation.

- Alternatives A, B, E, F, and G provide for motorized recreational activities that may further impact the species.
- Alternatives C, D, and G decrease the amount of potential disturbance beyond baseline conditions, and do not allow for further ski area expansion or development.

Sensitive Species Considered

Sensitive species that occur, or could occur, in the planning area are displayed in table 46.

Table 46. Rocky Mountain Region sensitive species on the Shoshone National Forest (as of March 2012)

Common name(s)	Global/state ranking[16]	Habitat
Mammal species		
American marten *Martes Americana*	G5/S3	Late successional conifer (Subalpine spruce/fir forests, alpine tundra, montane) forests
Gray wolf *Canis lupus*	G4/S1	Variable, Forest, Meadows, Riparian areas with ungulates, Ungulate winter range
Fringed myotis *Myotis thysanodes pahasapensis*	G4/G5/S2	Caves, mines, forested areas (Dry habitats where open grasslands and shrublands are interspersed with mature xeric forests creating ample edges)
Hoary bat *Lasiurus cinereus cinereus*	G4/S4	Aspen and pine forests (snags)
North American wolverine *Gulo gulo*	G4/S2	Rare; Boreal spruce/fir forests and tundra. Subalpine coniferous forest
River otter *Lontra Canadensis*	G5/S3	Streams, Lakes, Aquatic habitats bearing fish
Rocky Mountain bighorn sheep *Ovis canadensis canadensis*	G4/S3	Alpine, Cliffs, Meadows
Spotted bat *Euderma maculatum*	G4/S3	Caves, mines, rock outcrops (Coniferous forest, Cliffs over perennial water)
Townsend's big-eared bat *Corynorhinus townsendii*	G4/S2	Caves and mines in deciduous forests
Water vole *Microtus richardsoni*	G5/S2	Subalpine and alpine meadow water courses
Bird species		
American peregrine falcon *Falco peregrinus anatum*	G4/T4/S2	Breeds on cliffs, often in association with riparian areas.
Bald eagle *Haliaeetus leucocephalus*	G4/S3B/S5N	Large riverine, Forested stands around aquatic fish bearing settings
Black-backed woodpecker *Picoides arcticus*	G5/S1	Mature spruce/fir forest (mid and high elevation)
Boreal owl *Aegolius funereus*	G5/S2	Mature subalpine spruce/fir forests (high elevation)

[16] Conservation status ranks estimate a species risk of elimination. Status ranks are based on a 1 to 5 scale, 1 denoting a species is critically impaired and 5 denoting a species is secure. Species status is assessed at three geographic scales: global (G), national (N), and state/province (S). The overall status of a species is denoted by its G-rank, while its condition in a particular country is denotes by its N-rank, and its condition in a particular state/province is denoted by its S-rank. State rank is assigned by Wyoming Natural Diversity Database biologists and denotes a species probability of elimination in Wyoming. Subspecies, varieties, or any other designation below the level of a global ranked species, receives a T-rank that denotes their conservation status. A species may receive a B- or N-rank that refers to the conservation status of the breeding (B) or non-breeding (N) population in a particular nation or state/province. (NatureServe, February 2012, Wyoming Natural Diversity Database February 2012)

Table 46. Rocky Mountain Region sensitive species on the Shoshone National Forest (as of March 2012)

Common name(s)	Global/state ranking[16]	Habitat
Brewer's sparrow *Spizella breweri*	G5/S5	Mountain foothills and basin-prairie sagebrush (shrub-steppe)
Grasshopper sparrow *Ammodramus savannarum*	G5/S4	Basin-prairie (shortgrass prairie) shrublands
Greater sage-grouse *Centrocercus urophasianus*	G4/S4	Grasslands with sagebrush (sagebrush steppe)
Ferruginous hawk *Buteo regalis*	G4/S4B/S5N	Shrub-steppe, Shortgrass prairie
Harlequin duck *Histrionicus histrionicus*	G4/S1B	Swift forest rivers and streams (Montane riparian)
Loggerhead shrike *Lanius ludovicianus*	G4/S3	Open sagebrush (shrub-steppe), grasslands
Northern goshawk *Accipter gentilis atricapillus*	G5/S3	Mature montane coniferous and mixed forests including aspen
Northern harrier *Circus cyaneus*	G4/S4B/S5N	Marshes, meadows, grasslands
Olive-sided flycatcher *Contopus cooperi*	G4/S4B	Coniferous forest (mid and high elevation)
Sage sparrow *Amphispiza belli*	G5/S3	Basin-prairie sagebrush (sagebrush-steppe)
Short-eared owl *Asio flammeus*	G5/S2	Basin-prairie shrublands, grasslands, marshes
Trumpeter swan *Cygnus buccinator*	G4/S2	Shallow lakes. large ponds, wetlands
Amphibian species		
Boreal toad *Anaxyrus boreas boreas*	G4T4/S1	Marshes, wet meadows, streams, ponds, lakes
Columbia spotted frog *Rana luteiventris*	G4/S3	Grass and sedge edges of streams, lakes, ponds, springs, and marshes
Northern leopard frog *Lithobates pipiens*	G5/S3	Grass and sedge edges of streams, lakes, ponds, springs, and marshes

Forest mammals

American marten

Affected Environment

Marten (*Martes Americana*) are a circumboreal species. In North America, they range from Alaska, through Canada, east to Maine, and south into New York, California, and New Mexico, following the boreal forest zone (Patterson et al. 2003). They are associated primarily with mature boreal forests.

Marten are known to occur throughout the mountainous regions of Wyoming, including the Shoshone National Forest. Historical populations, distribution, or abundance are unknown on the Forest. The current population trend is unknown. Marten tracks are commonly seen in the winter based on past surveys. During the winter of 1995 to 1996, marten tracks were seen along routes at a rate of 0.7 tracks per mile on the Shoshone. Several of the same routes were run in the winters 2002 to 2003 and 2003 to 2004. In the winter of 2002 to 2003, 50 marten tracks were recorded (USDA Forest Service 2009a). The winter of 2003 to 2004 was a poor snow year, which resulted in less snow tracking. Based on past surveys, marten are likely common on the Forest where suitable habitat exists.

Marten habitat in the Rocky Mountains is typically dominated by Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*). They tend to avoid dry stands of lodgepole pine (*Pinus contorta*) (Buskirk 2002). Ruggiero et al. (1998) in their study concluded that large logs, large snags, and large live spruce and fir trees were important characteristics for marten dens sites in the Wyoming.

On the Shoshone, spruce/fir habitat is relatively abundant. There are about 309,442 acres of spruce/fir on the Forest with about 30 percent of it being mature (over 200 years old) (USDA Forest Service 2012b). About 178,678 acres of spruce/fir habitat is within wilderness. Due to fire suppression, the spruce/fir forest type has likely increased on the Forest. This suggests that there is relatively abundant potential habitat for marten on the Shoshone. Additional habitat may be available in mature lodgepole pine or Douglas-fir that is succeeding to spruce/fir.

Spruce/fir habitat on the Shoshone has recently been impacted by spruce budworm and spruce beetle. From 2000 to 2009, about 11,003 acres have been affected by spruce budworm and 256,310 acres by spruce beetle. In 2010, about 3,743 acres were impacted by spruce budworm and 57,362 acres by spruce beetle (USDA Forest Service 2012a). In addition, the Western balsam bark beetle has impacted subalpine fir. From 2000 to 2009, about 117,299 acres were impacted. In 2010, about 39,811 acres were impacted by Western balsam bark beetle. These outbreaks may reduce the potential habitat to some degree.

It is uncertain if these recent insect outbreaks are outside of the historic range of variability. The spruce beetle attack on Carter Mountain was atypical in that beetles killed small-diameter trees as well as large-diameter trees (USDA Forest Service 2012a).

Risk Factors

The primary risk factors from forest management include timber harvest and associated road construction/reconstruction, fuelwood collection, and fire suppression. Other risk factors include epidemic-level insect outbreaks within suitable habitat and wildfire. At the local population level, trapping is an additional risk factor.

Habitat and Population Management Considerations

Trapping has historically been a major source of mortality for marten. In Wyoming, marten can legally be trapped. Ease of trapping is known to be of more concern with increased road densities that allow access to prime habitat (Buskirk and Ruggiero 1994).

There are currently no known disease, usually plague or distemper, or predation problems known for marten that are outside of the range of what likely has occurred over time.

Timber harvest can have a variable effect on marten depending on the harvest type (Buskirk 2002). Marten are sensitive to reductions in patch size. Regeneration harvest types would have the greatest impact on marten habitat. Timber harvest occurs at a very small scale compared to the available habitat on the Shoshone, so overall risks would be low.

Given the natural patchiness of the Forest, maintaining connectivity between habitats would be important.

Fire suppression has both positive and negative impacts to marten habitat. In the short term, spruce/fir habitat has likely increased with increased amounts of course woody debris. In the long term, fire suppression increases the likelihood of catastrophic fires that would cause major losses of marten habitat (Buskirk 2002). Insect outbreaks are likely increasing the risk of catastrophic wildfires.

Fuelwood collection could remove course woody debris from potential marten habitat. Fuelwood collection is limited to areas near roads, so the overall risk to marten habitat is low.

Conservation Measures

To provide management for the species to maintain or improve its potential distribution on the Shoshone, conservation measures need consideration for incorporation into forest plan goals, objectives, standards and guidelines. Given the amount of potential habitat in wilderness, and potential impacts from forest management are limited to roaded areas (timber harvest/fuelwood collection), viability risk from forest management is low.

Conservation measures summarized include:

1. To maintain habitat connectivity, retain snags and course woody debris of adequate size and density within regeneration harvest units.
2. In general, implementation of the NRLMD (USDA Forest Service 2007) would benefit marten as well. Especially, standards and guidelines related to vegetation management.

Monitoring Considerations

Of most importance for this species would be the inventory and management of mature conifer stands and distribution on the Shoshone. This would include the location and extent of insect outbreaks and recent wildfires. Both of which are currently inventoried on an annual basis.

Direct and Indirect Effects

Effects from Timber Management and Road Construction and Use: The primary activity that could potentially influence primary habitat for this species is timber harvest and associated activities such as road construction/use. To a lesser degree, winter motorized (i.e., snowmobile use) and summer recreation may also impact the marten due to increased disturbances within suitable habitat. Although not a planned activity, wildland fire use could also potentially influence the marten if large-scale burns reduce suitable habitat components. Differences in projected outputs by alternative for these activities are displayed in table 47. Hoary bats use forested habitat that is similar to the marten thus their habitat is included in table 48 and also in order to reduce redundancy, some species share same tables.

Table 47. Activities and outputs that could Influence the American marten and hoary bat by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Suitable Timber base acres	86,300	127,000	122,100	124,500	179,700	251,200	127,000
Vegetation Treatment Acres Mechanical and Mechanical w/Prescribed Fire (Total)	15,500	15,600	14,500	15,100	17,900	21,700	15,600
Douglas-fir	2,920	2,940	2,340	2,630	3,180	4,250	2,940
Spruce/fir	1,410	1,420	1,060	1,260	1,550	1,770	1,420
Lodgepole pine	5,290	5,320	5,640	5,360	7,060	9,210	5,320
Limber pine	610	620	550	580	640	670	620
Whitebark pine	540	540	270	510	540	550	540
Aspen	620	630	530	620	640	660	630
Vegetation Treatment Acres Prescribed Fire(Total)	23,600	23,300	23,300	23,300	22,800	21,900	23,300
Douglas-fir	4,950	4,870	4,840	4,870	4,750	4,590	4,870
Spruce/fir	550	540	500	530	550	570	540
Lodgepole pine	1,970	1,970	2,020	1,980	2,190	2,450	1,970
Limber pine	1,740	1,720	1,720	1,720	1,660	1,540	1,720
Whitebark pine	340	340	300	340	330	310	340
Aspen	920	910	900	910	880	820	910
Wildfire Acres	185,200	182,900	184,100	183,700	175,000	161,400	182,900
Road Construction Miles-Timber	2	2	2	2	3	4	2
Miles of open motorized roads and trails-Summer(total)	940	940	820	940	940	940	940
Miles of open motorized roads and trails (Winter total)	670	690	230	680	690	970	690
Miles of snowmobile trails	280	280	160	280	280	280	280
Motorized Recreation-Winter(Acres available)	887,600	479,800	103,000	323,700	525,200	825,200	479,800
Motorized Recreation-Winter(Acres not available)	1,550,000	1,956,800	2,335,000	2,114, 300	1,911,600	1,612,800	1,845,600
Winter Range Motorized Closure (total)	173,800	155,260	224,400	155, 800	115,400	0	150,023
Motorized Recreation-Summer (Acres available)	570,000	570,200	321,800	350,000	655,900	823,300	529,000
Motorized Recreation-Summer (Acres not available)	1,868,000	1,868,000	2,116,000	2,088,0007	1,782,000	1,615,000	1,909,000
Ski Area Development Or Expansion	1,150	1,150	1,150	1,150	1,150	1,150	1,150

In regard to activities that could potentially influence the American marten, alternative A designates the least amount of suitable timber base (86,300 acres) as compared to alternatives B through F while offering approximately the same amount of suitable habitat (1,960 acres) to active management as alternatives B, D, and G more acres then alternative C but less acres (approximately 140 and 370 acres) then alternatives E and F, respectively, that could potentially alter the habitat components preferred by the species.

As displayed in table 47, the predicted timber harvest output in primary habitat (spruce/fir) varies from 1,550 to 2,330 acres and is very minimal in all alternatives. These amounts represent about 2 to 3 percent of the total suitable habitat on the Shoshone. The amount of timber harvest in alternative A is, therefore, expected to have little, if any, influence on American marten habitat or populations on the Shoshone. Construction of new roads as result of timber harvest that would remain open to public use is very minimal for all alternatives; estimated between 2 to 3 miles. Additional fragmentation effects may be associated with these activities, but are expected to be minor because of the large amount of unroaded area that remains undeveloped.

Alternative A offers the third highest amount of motorized recreation compared to the other alternatives. This difference could potentially allow greater disturbances to the solitude that marten prefer depending upon the type, timing, and scope of the activity. Greater winter travel via snowmobiles could theoretically alter snow conditions and allow low-elevation predators to access more winter habitat due to snow compaction.

Wildland fire use is not a planned output. However, it will be utilized as a tool to allow natural disturbances to occur within suitable marten habitat as opportunities arise. It is estimated that all alternatives may allow from 161,400 to 185,200 acres of wildland fire use. Depending upon fire severity and scale, these outputs could have negative or positive influences on American marten.

Action Alternatives: Alternatives B through G

As displayed in table 47, there is little difference between no action and alternatives B through G in regard to vegetation treatment acres in suitable marten habitat (92,832 acres). Construction of new roads as result of timber harvest that would remain open to public use is very minimal for all alternatives; estimated between 2 to 3 miles. Alternative F offers the greatest amount of vegetation treatment area where this activity may occur. However, less than 3 percent of suitable marten habitat is influenced by all alternatives and is expected to have no detectable effect on American marten.

As displayed in table 47, alternative C offers fewer potential disturbances than the other alternatives from both summer and winter motorized recreation because of decreases in the amount of motorized use area. Alternative D offers the next fewest motorized, while alternative F offers the highest amount of acreage. Alternatives B, E and G offer a balance between the other action alternatives, but provide less solitude habitat than no action. Although the marten is not highly sensitive to motorized disturbance, reductions in open motorized areas should decrease the potential for displacement or disturbances.

As with no action, it is estimated that wildland fire use may be used as a management tool on 161,400 to 185,200 acres in all action alternatives. Depending upon fire severity and scale, these outputs could have negative or positive influences on the American marten.

Cumulative Effects

The single-most influential habitat management action undertaken in potential marten habitat on the Shoshone is timber harvesting. As previously discussed, timber harvest occurs at a very small scale compared to the available habitat on the Forest. For the past 10 years (2002 to 2011) approximately 18,751 acres of vegetative treatment has occurred.

A review of management activities and land use designations on the Shoshone suggests that a considerable amount of suitable habitat for the marten is available, and should remain available, throughout and beyond the current planning period (10 to 15 years). Timber management activities may still influence individual martens where it occurs. However, approximately 57 percent of the spruce/fir habitat on the Shoshone occurs as wilderness that maintains high-quality marten habitat. In addition, all alternatives maintain this protection. Given the natural patchiness of the Forest, maintaining connectivity between habitats would be important.

Due to fire suppression, the spruce/fir forest type has likely increased on the Forest. This suggests that there is relatively abundant potential habitat for marten on the Shoshone. Additional habitat may be available in mature lodgepole pine or Douglas-fir that is succeeding to spruce/fir.

Determination of Effects and Rationale for Determination – American marten

All alternatives, including alternative A, **"may adversely impact individuals, but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide."** The rationale for this determination follows:

- All alternatives involve projected timber harvest activities in primary habitat types (spruce/fir) that may adversely influence individual marten. However, the projected scope of these activities is very minimal.
- All alternatives involve over-the-snow and summer motorized recreation that may disturb individual marten.
- Extensive late-successional primary habitat occurs on the Shoshone National Forest in wilderness where natural processes will dominate.

Gray Wolf

Affected Environment

The Northern Rocky Mountain gray wolf (*Canis lupus irremotus*) was initially listed by the U.S. Fish and Wildlife Service as endangered in 1974. On November 22, 1994, the USFWS designated portions of Idaho, Montana, and Wyoming as two nonessential experimental population areas for the gray wolf under section 10(j) of the Act, including the Yellowstone Experimental Population Area (59 FR 60252). In 2005 and 2008, the USFWS revised these regulations to provide increased management flexibility for this recovered wolf population in States with USFWS-approved post-delisting wolf management plans [70 FR 1286; 73 FR 4720; 50 CFR 17.84(n)].

The Northern Rocky Mountain gray wolf population achieved its numerical and distributional recovery goals at the end of 2000. The temporal portion of the recovery goal was achieved in 2002 when the numerical and distributional recovery goals were exceeded for the third successive year. The states of Idaho, Montana, and Wyoming developed post-delisting wolf management plans to meet the Endangered Species Act requirements to ensure adequate regulatory mechanisms would exist should the Endangered Species Act protections be removed. In 2004 and in 2009, the U. S. Fish and Wildlife Service determined that the Wyoming's wolf management plan was inadequate to conserve Wyoming's share of a recovered Northern Rocky Mountain gray wolf population. In August of 2011, the Wyoming Governor and Interior Secretary reached an agreement to move forward with delisting. In September 2011, the Wyoming Game and Fish Commission approved changes to its Gray Wolf Management Plan and in October, the USFWS published a notice to delist wolves in Wyoming. The Wyoming Legislature in 2012 made changes to State statutes, which allow Wyoming to move forward with its management plan. The provisions of the 1994 experimental population rules will remain in place until the U. S. Fish and Wildlife Service approves Wyoming's plan in all of Wyoming, except the Wind River Tribal Lands, because the tribe had a USFWS-approved plan.

Habitat Requirements, Home Range, Food Habits

The following information is from: *Endangered and Threatened Wildlife and Plants; Final Rule to Identify the Northern Rocky Mountain Population of Gray Wolf as a Distinct Population Segment and to Revise the List of Endangered and Threatened Wildlife* (USDI Fish and Wildlife Service, 2009a).

> Gray wolves (*C. lupus*) are the largest wild members of the dog family. In the Northern Rocky Mountain [NRM], adult male gray wolves average over 45 kilograms (100 pounds), but may weigh up to 60 kilograms (130 pounds). Females weigh slightly less than males. Wolves primarily prey on medium and large mammals and normally live in packs of 2 to 12 animals. In the NRM, pack sizes average about 10 wolves in protected areas, but a few complex packs have been substantially bigger in some areas of Yellowstone National Park (Smith et al. 2006, p. 243; Service et al. 2008, Tables 1–3). Packs typically occupy large distinct territories from 518 to 1,295 square kilometers (km^2) (200 to 500 square miles (mi^2)) and defend these areas from other wolves or packs. Once a given area is occupied by resident wolf packs, it becomes saturated and wolf numbers become regulated by the amount of available prey, intra-species conflict, other forms of mortality, and dispersal. Dispersing wolves may cover large areas as they try to join other packs or attempt to form their own pack in unoccupied habitat (Mech and Boitani 2003, pp. 11–17).

Population Information

The Wyoming Game and Fish Department monitored and managed wolves following delisting in Wyoming outside of YNP, Grand Teton National Park (GTNP), WRR, and the National Elk Refuge (NER) from September 30, 2012 to December 31, 2012. Monitoring and management of wolves was conducted by the National Park Service (NPS) in YNP and GTNP, the Eastern Shoshone and Northern Arapaho Tribal Fish and Game Department (TFGD) on tribal lands in WRR, and the USFWS on NER.

The following information (and references therein) are from the 2012 Wyoming Gray Wolf Population Monitoring and Management Annual Report (Wyoming Game and Fish Department et al. 2013).

Radio-collars are the primary tool used for monitoring wolf populations in Wyoming and throughout the Northern Rocky Mountain gray wolf population. A pack is defined as more than two wolves traveling together using a defined home range. A breeding pair is defined as 1or more adult males and 1 or more adult females in a pack producing 2 or more pups that survived through 31 December of that year.

At the end of 2012, 277 or more wolves in 43 or more packs (27 or more breeding pairs) inhabited Wyoming, including Yellowstone National Park. Even though the wolf population decreased statewide by approximately 16 percent, 2012 became the eleventh consecutive year that the wolf population in Wyoming has exceeded the numerical, distributional, and temporal recovery goals established by the USFWS.

Wolf/Livestock Interactions

In 2012, confirmed livestock depredations by wolves included 44 cattle and 112 sheep; other animals killed included 3 dogs and 1 horse (table 48). Agency control efforts removed 43 depredating wolves in Wyoming (35 percent of all mortality causes) to reduce livestock losses due to wolves. The number of cattle depredations in Wyoming decreased in 2007, 2008, and 2009, and increased in 2010, 2011 and 2012; however, the number of sheep killed by wolves increased in 2008, 2009 and 2012 and decreased in 2010 and 2011(Jimenez et al. 2012, Wyoming Game and Fish Department et al. 2013).

Table 48. Wolf depredations in Wyoming: 2000–2012 (Jimenez et. al 2012, Wyoming Game and Fish Department et al. 2013)

Depredations	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Cattle	18	23	34	75	54	123	55	41	20	26	35	44
Sheep	34	0	7	18	27	38	16	26	195	33	30	112
Dogs	2	0	0	2	1	1	2	0	7	0	1	3
Goats	0	0	0	10	0	0	0	0	0	0	0	
Horses	0	0	2	0	1	0	1	0	0	1	1	1
Wolves Controlled	2	4	6	18	29	41	44	63	31	40	36	43

Status of the Gray Wolf

Gray wolf populations naturally fluctuate with food availability, strife within packs, and disease. Within the planning area, the main factor controlling the population is management by the Wyoming Game and Fish for livestock/wolf conflicts and the public hunting season.

Status of the Gray Wolf Habitat/Distribution on the Shoshone

The gray wolf was delisted (from non-essential experimental) in Wyoming as of September 30, 2012. During the 2012 calendar year, USFWS monitored and managed wolves in Wyoming from January 1, 2012 through September 29, 2012. The WGFD monitored and managed wolves following delisting in Wyoming outside of YNP, Grand Teton National Park (GTNP), Wind River Reservation, and the National Elk Refuge (NER) from September 30, 2012 to December 31, 2012.

The species was reintroduced into Yellowstone National Park in 1995 and began dispersing onto the Shoshone in 1999. The Shoshone lies within the Greater Yellowstone Wolf Recovery Area. Concentrations of available prey occur on many areas of the Shoshone. Thirteen (13) wolf packs (Beartooth, Hoodoo, Absaroka, Pahaska, Ishawooa, Carter Mountain, Elk Fork Creek, Greybull River, Gooseberry, Spring Mountain, Washakie, Lava Mountain, and East Fork) have home ranges that overlap NFS land on the Shoshone (Jimenez et al. 2012, Wyoming Game and Fish Department 2013). Den sites for several of these packs have traditionally occurred on the Forest. Table 49 depicts confirmed wolf packs and livestock depredation on the Shoshone in 2012.

Table 49. Composition of confirmed wolf packs on the Shoshone National Forest in 2012 (Jimenez et al. 2012, Wyoming Game and Fish Department 2013)

		Documented mortalities			
Wolf Pack	**Pack size**	**Natural/Human***	**Harvest**	**Control**	**Depredation**
Absaroka	6	1	3	0	0
Beartooth	3	1	2	0	0
Carter Mtn.	8	0	1	0	0
East Fork	5	0	1	0	0
Elk Fork Cr.	4	0	0	1	0
Gooseberry	4	4	2	3	3-cattle
Greybull River	9	2	2	0	0
Hoodoo	4	0	3	3	5-cattle
Lava Mtn.	10	0	2	0	1-cattle
Ishawooa	9	1	1	2	3-cattle
Pahaska	8	2	3	0	0
Spring Mtn.	6	0	1	3	2-cattle
Washakie	6	0	0	1	1-cattle
Total	82	6	25	13	15-cattle,

*Excludes wolves killed in control actions and legal harvest

The availability of stable prey base is the primary habitat requirement for this species. Available prey (in particular elk) does exist as the Shoshone provides year-round habitat for big game species. No trend data are available that is specific to the Shoshone, but data are available for elk herd units that encompass the Forest. Five herd units overlap the Shoshone including: Gooseberry, Cody, Clarks Fork, Wiggins Fork and South Wind River. For the most part, trends for these herds have been relatively stable and population objectives have been at or above herd unit objectives for the past 10 years (see Rocky mountain elk discussion).

Wolf/Livestock Interactions within the Shoshone

The Wyoming Game and Fish Department authorizes the USDA-Wildlife Services to manage wolf/ livestock conflicts and removes the individuals responsible for depredations. There were 15 wolf/livestock conflicts within the Shoshone in 2012. Six of the known packs on the Shoshone depredated on livestock in 2012 and this resulted in the lethal removal of 13 wolves. Cattle depredations followed a seasonal pattern in 2012 with the highest number of depredations occurring in summer/fall from August through October (Jimenez et al. 2012, Wyoming Game and Fish Department 2013). Losses do not reflect lost or missing livestock.

Direct and Indirect Effects

Effects from Livestock Grazing and Big Game on Wolves: Livestock/wolf conflicts are likely to continue. Conflicts may result in direct mortality of individuals responsible for depredations. Since pack social structure is very adaptable and resilient, breeding members can be quickly replaced either from within or outside the pack and pups can be reared by another pack member should their parents die (Packard 2003, p. 38; Brainerd et al. 2008; Mech 2006, p. 1482 in USDI Fish and Wildlife Service 2009). Consequently, wolf populations can rapidly recover from severe disruptions, such as very high levels of human-caused mortality or disease. After severe declines, wolf populations can more than double in just 2 years if mortality is reduced; increases of nearly 100 percent per year have been documented.

The wolf population met its recovery goals in 2002, and wolves continue to increase in number and distribution. The species has been proposed for de-listing. The biggest impact to wolves at this point is management removals due to livestock conflicts, both on public and private land.

The Shoshone grazing program contributes indirectly to these management removals, by providing the livestock that wolves are attracted to as prey. The allotments in this analysis have had conflicts that resulted in management removal of wolves. Generally on the Shoshone, when wolves are removed, they are replaced quickly with offspring dispersing from other packs, so the removals are not leading to overall population decline. This is a short-term population reduction, as recruitment fills in the voids. These removals because of livestock depredation have had a minor effect on the total wolf population.

Alternatives A, B, D, and G. The number of animal unit months (AUMs) would remain unchanged under these alternatives. Conflicts with livestock would likely continue at current levels, and any potential for increase in conflicts would not be a result of increased allotments. Cattle numbers could increase in existing allotments, although any increases would likely be minor. The past level of conflicts and wolf mortalities has not precluded achieving recovery of the gray wolf and, in addition, sheep conflicts have been virtually eliminated due to the lack of domestic sheep grazing.

Alternative C. The number of AUMs would decrease by 47 percent from alternative s A, B, D and G and conflicts with cattle would likely decline as livestock grazing is eliminated on big game winter range.

Similar to alternative A, the past level of conflicts and gray wolf mortalities has not precluded achieving recovery of the gray wolf and, in addition, sheep conflicts have been virtually eliminated due to the lack of domestic sheep grazing.

Alternative E. The number of AUMs would increase by 25 percent over the existing amount of AUMs on the Shoshone. This increase in livestock numbers has the potential to increase the amount of wolf/livestock conflicts in areas that already have had conflicts.

Similar to alternative A, the past level of conflicts and gray wolf mortalities has not precluded achieving recovery of the gray wolf and, in addition, sheep conflicts have been virtually eliminated due to the lack of domestic sheep grazing.

Alternative F. The number of AUMs would increase under this alternative by 26 percent. Seven allotments that are currently vacant would be made available for livestock grazing, adding 40,000 acres. This increase in livestock numbers has the greatest potential to increase wolf/livestock conflicts of all the alternatives.

While it is difficult to predict, nonetheless, recovery of the gray wolf has the potential to be set back under this alternative.

Cumulative Effects

Livestock grazing on State and private land is an identified potential threat to gray wolf conservation that contributes to cumulative adverse effects, due primarily to control actions when wolf/livestock conflicts occur. In Wyoming in 2011, 35 percent of all wolf depredations on livestock occurred on private land. Control actions in response to confirmed livestock depredations include trapping and radio collaring wolves; intensive monitoring; issuing Less-than-Lethal Munitions (rubber bullets) to harass wolves; lethally removing wolves through agency control actions; and issuing 16 Shoot-on-Sight permits to livestock producers. No wolves were killed in 2011, using Shoot-on-Sight permits. Non-lethal control was routinely considered, but was often not applicable or cost effective in many areas in Wyoming due to: (1) specific wolf packs chronically killing livestock year after year; (2) unpredictable travel patterns and movements by wolves; and (3) very large wolf home ranges that cover vast areas including public grazing allotments. When non-lethal control methods were not effective, wolves were killed through agency control actions in an attempt to prevent further livestock depredations (Jimenez et al. 2012).

In 2012, Wyoming held its first public hunting season for wolves, since delisting. Over half of the wolf mortalities in 2012 were a result of this hunting season. It is uncertain at this time of the long term impact of the implementation Wyoming's Wolf Management Plan.

Determination of Effects and Rationale for the Determination

Based on the documented increase in the wolf population throughout the NRM annually since 2002, and related increase in the Wyoming population (see Status of Gray Wolf section) even after numerous management removals due to livestock depredations; the preferred alternative and alternatives to it may continue to result in management removal of wolves responsible for livestock depredation, but these mortalities **"may adversely impact individuals (gray wolves), but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide."**

Hoary bat

Affected Environment

The hoary bat (*Lasiurus cinereus cinereus*) is the most widespread bat in the Americas. They range through the eastern two-thirds of Canada, south through the conterminous United States, Mexico, and South America (NatureServe 2007). During the summer, males occupy the mountains of western North America, while females are found more easterly (Hester and Grenier 2005). In Wyoming, hoary bats occur statewide during the summer, including on the Shoshone. They winter in the southern United States and possibly Mexico.

Historical populations, distribution, or abundance are unknown on the Shoshone. No trend data are available that is specific to the Shoshone or Wyoming. The WGFD surveyed for bats in northwestern Wyoming in 2009, and detected hoary bats on the Shoshone based on acoustic calls and mist netting (WGFD 2010b). Most of the hoary bats detected were males.

Habitat Distribution and Condition on the Forest

Hoary bats are associated with forested habitats. Diverse forest habitats with a mixture of forest and small open areas that provide edges are ideal habitat for this species (Hester and Grenier 2005). Hoary bats usually roost in tree foliage and roosts are usually located near forest edges. In a study in Oregon, hoary bats preferred to roost in mature Douglas-fir (Perkins and Cross 1988).

In a study in south-central Wyoming, Grover (2002) found that hoary bats almost exclusively used mature lodgepole pine for roosting.

Hoary bat foraging and roosting habitat is abundant on the Shoshone. There are about 309,442 acres of spruce/fir, 345,273 acres of Douglas-fir, 382,886 acres of lodgepole pine, and 190,609 acres of whitebark pine on the Shoshone (USDA Forest Service 2012b). Some evidence suggests that lodgepole pine has become less abundant in the last century, while spruce/fir has increased (USDA Forest Service 2012a). Fire suppression reinforces this trend, but increases in wildfire and insect outbreaks may begin to reverse this trend.

Insect outbreaks and wildfires are likely reducing habitat to some degree for hoary bats on the Forest. Climate change increases the potential for more and continued insect outbreaks and also increases the frequency of fires (Rice et al. 2012).

Risk Factors

The primary risk factor from forest management is timber harvest. Other risk factors include pesticides and other containments and human-caused mortality during migration (wind turbines and communication towers). These other risk factors occur off of the Forest.

Natural risk factors would include epidemic insect outbreaks and wildfire.

Since this species is a summer resident in Wyoming and does not appear to use caves, mines, etc., for hibernacula, white-nose syndrome is currently not a risk factor.

Habitat and Population Management Considerations

Maintaining mature conifer forest for roosting and diverse forest habitat for foraging would be the most important forest management emphasis for hoary bats. Hoary bats are known to show fidelity to roosting areas (Grover 2002).

Conservation Measures

In order to provide management for hoary bats and to maintain or improve its potential distribution on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Given the abundance of mature conifer forest on the Shoshone, overall viability risk from forest management to hoary bats is low.

Conservation measures (Hester and Grenier 2005) summarized include:

1. In areas where hoary bats are known to occur, conduct timber harvest activities from October 1 to April 15, if feasible, to avoid impacting breeding and migrating populations.
2. Manage land where hoary bats occur that provides adequate roosting and foraging habitat to maintain stable populations (secure roosting sites and diverse forest habitats with a mixture of forest and small open areas).

Monitoring Considerations

Important monitoring considerations for hoary bats would be to cooperate with the WGFD to continue to survey for bats and determine their distribution on the Shoshone.

Direct/Indirect Effects

Effects from Timber Management: The primary risk factor for the hoary bat from forest management is timber harvest. Other risk factors include pesticides and other containments and human-caused mortality during migration (wind turbines and communication towers). Although not a planned activity, wildland fire use could also potentially influence the marten if large-scale burns reduce suitable habitat components. Differences in projected outputs by alternative for these activities are displayed in table 47.

Alternative A: No action

In regard to activities that could potentially influence the hoary bat, alternative A designates the least amount of suitable timber base (86,300 acres) as compared to alternatives B through G while offering approximately the same amount of suitable habitat (17,000 to 17,900 acres) to active management as alternatives B through D and G; less acres than alternatives E and F by approximately 2,170 and 5,700 acres respectively, that could potentially alter the habitat components preferred by the species.

As displayed in table 47, the predicted timber harvest output in primary habitat varies from 17,000 to 23,700 acres and is very minimal in all alternatives. These amounts represent about 6 to 8 percent of the total suitable habitat on the Shoshone. The amount of timber harvest in alternative A is therefore expected to have little, if any, influence on hoary bat habitat or populations on the Shoshone. Construction of new roads as result of timber harvest that would remain open to public use is very minimal for all alternatives; estimated between 2 to 4 miles.

Wildland fire use is not a planned output. However, it will be utilized as a tool to allow natural disturbances to occur within suitable hoary bat habitat as opportunities arise. It is estimated that all alternatives may allow from 161,400 to 185,200 acres of wildland fire use. Depending upon fire severity and scale, these outputs could have negative or positive influences on hoary bat.

Action Alternatives: Alternatives B through G

As displayed in table 47, there is little difference between no action and alternatives B through G in regard to vegetation treatment acres. The amount of timber harvest in all alternatives is therefore expected to have little, if any, influence on hoary bat habitat or populations on the Shoshone. Construction of new roads as result of timber harvest that would remain open to public use is very minimal for all alternatives; estimated between 2 to 3 miles. Alternative F offers the greatest amount of vegetation treatment area where this activity may occur. However, all alternatives influence suitable hoary bat habitat (288,807 acres of mature habitat) from 6 to 8 percent and are expected to have no detectable effect on the species.

As with the no action, it is estimated that wildland fire use may be used as a management tool on 161,400 to 185,200 acres in all action alternatives. Depending upon fire severity and scale, these outputs could have negative or positive influences on hoary bat.

Cumulative Effects

The single-most influential habitat management action undertaken in potential hoary bat habitat on the Shoshone is timber harvesting. As previously discussed, timber harvest occurs at a very small scale compared to the available habitat on the Forest. For the past 10 years (2002 to 2011), approximately 18,751 acres of vegetative treatment has occurred.

A review of management activities and land use designations on the Shoshone suggests that a considerable amount of suitable habitat for the hoary bat is available, and should remain available, throughout and beyond the current planning period (10 to 15 years). Timber management activities may still influence individual hoary bats where it occurs. However, approximately 92 percent (288,807 acres) of the suitable habitat (mature spruce/fir, lodgepole pine, Douglas-fir, whitebark pine), on the Shoshone will not receive planned vegetative treatment.

Some evidence suggests that lodgepole pine has become less abundant in the last century, while spruce/fir has increased (USDA Forest Service 2012a). Fire suppression reinforces this trend, but increases in wildfire and insect outbreaks may begin to reverse this trend.

Determination of Effects and Rationale for Determination – Hoary Bat

All alternatives, including alternative A, “may adversely impact individuals, but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide.” The rationale for this determination follows:

- All alternatives involve projected timber harvest activities in primary habitat types (spruce/fir, Douglas-fir, lodgepole pine, whitebark pine) that may adversely influence individual hoary bats. However, the projected scope of these activities is very minimal.
- Extensive late-successional primary habitat occurs on the Shoshone National Forest in wilderness where natural processes will dominate.

Forest Birds

Black-backed woodpecker

Affected Environment

Black-backed woodpeckers (*Picoides arcticus*) are associated with mature coniferous forests. They are often associated with recent burns and insect outbreaks. They have irruptive populations that increase locally following an insect outbreak or wildfire.

The black-backed woodpecker is found only in North America. They range from Alaska, through Canada and as far south as California, Wyoming, Minnesota, and Maine. In Wyoming, they occur in the western mountains and the Black Hills. On the Shoshone, black-backed woodpeckers would be considered rare. Only one bird was observed during surveys from 2002 to 2008 by the Rocky Mountain Bird Observatory (Hanni et al. 2009). Historical populations, distribution, or abundance are unknown on the Forest, and no population trend data specific to the Forest are available.

Habitat Distribution and Condition on the Shoshone

Black-backed woodpeckers are primarily associated with mature conifer forests. There are about 309,442 acres of spruce/fir, 345,273 acres of Douglas-fir, 382,886 acres of lodgepole pine, and 190,609 acres of whitebark pine on the Shoshone (USDA Forest Service 2012b). Some evidence suggests that lodgepole pine has become less abundant in the last century, while spruce/fir has increased (USDA Forest Service 2012a). Fire suppression reinforces this trend, but increases in wildfire and insect outbreaks may begin to reverse this trend.

Forest inventory data indicate that about 30 percent of the spruce/fir is mature (over 200 years old); about 22 percent of the lodgepole pine is mature (over 150 years old); about 16 percent of the Douglas-fir is mature (over 200 years old); and about 23 percent of the whitebark pine is mature (over 200 years old) (USDA Forest Service 2009). This suggests that there is abundant potential habitat for this woodpecker on the Shoshone.

In recent years, the Forest has experienced large wildfires and insect epidemics. About 115,000 acres have burned in the last 5 years and about 161,500 acres in the last 10 years (USDA Forest Service 2012a).

Over the past 11 years, widespread bark beetle epidemics have occurred on the Shoshone. Table 50 indicates the acres affected and the type of insects involved with the outbreaks.

Insect outbreaks and wildfires are creating ideal habitat for this woodpecker and will continue to do so into the future. Climate change increases the potential for more and continued insect outbreaks and also increases the frequency of fires (Rice et al. 2012).

Table 50. Acres of insect-caused mortality on the Shoshone National Forest, 2000–2009 and 2010

Beetle species	Acres affected 2000 through 2009	Acres affected 2010
Spruce beetle (*Dendroctonus rifipennis*)	256,310	57,362
Douglas-fir beetle (*Dendroctonus pseudotsuqae*)	251, 477	4,705
Mountain pine beetle (*Dendroctonus ponderosae*)	645,671	227,137
Western balsam bark beetle (*Dryocoetes confuses Swaine*)	117,299	39,811
Spruce budworm (*Choristoneura occidentalis*)	11,003	3,743

Timber harvest activity has removed a minor amount of potential habitat (table 51), but an abundance of mature conditions and continued levels of insect outbreaks also indicate the potential for populations to be within a normal range of occurrence. As stated earlier, populations fluctuate naturally in response to prey abundance.

Table 51. Shoshone vegetation treatment history 2002 to 2011 (acres)

Treatment	Acres
Mechanical Only	19,483
Mechanical with Prescribed Fire	20,267
Total	39,750

Risk Factors – Forest Management

Primary risk factors for these woodpeckers from forest management activities include: timber harvest in mature conifer forest; fire salvage logging, and fire suppression. All of these activities reduce the amount of potential habitat.

Habitat and Population Management Considerations

A substantial amount of potential habitat for this woodpecker and areas where natural processes dominate the landscape occurs in wilderness on the Shoshone. Outside of wilderness, management activities will never be able to fully or even effectively control insect outbreaks, fire, or blowdown. Therefore, it’s assumed that habitat would be provided outside of wilderness as well.

Timber harvest has the potential to remove habitat. The highest impact would be post-fire salvage logging and regeneration harvest types. Timber harvest occurs at a very small scale compared to the available habitat on the Shoshone, so overall risks would be low.

Fire suppression has the potential to be a risk, since black-backed woodpeckers rely on fire to create habitat. Allowing wildland fire use would be important for creating and maintaining habitat for these species.

Conservation Measures

To provide management for these species and to maintain or improve its potential distribution on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Given the potential for wildfires and insect epidemics, and a substantial amount of habitat on the forest that would not be affected by timber harvest, viability risk from forest management to black-backed woodpeckers is low.

Conservation measures summarized include:

1. Retain snags in timber harvest units of an adequate size and density, if adjacent forest lacks potential habitat.
2. Allow for wildland fire-use, where appropriate, to provide foraging and nesting habitat in mature conifer areas.

Monitoring Considerations

Of most importance for this species would be the inventory and management of mature conifer stands and distribution on the Forest. This would include the location and extent of insect outbreaks and recent wildfires. Both of which are currently inventoried on an annual basis.

Direct and Indirect Effects

Effects from Timber Management and Fire Management: Forest Service management activities that may affect black-backed woodpecker habitats include timber harvest (salvage logging), fire suppression, removal of fire-killed or insect-infested trees, conversion of mature and late successional forest to young stands with decayed trees, and human disturbance near nest sites. Differences in projected outputs by alternative for these activities are displayed in table 52.

Alternative A: No action

In regard to activities that could potentially influence the blacked-back woodpecker, alternative A designates the least amount of suitable timber base (86,300 acres) as compared to alternatives B through G, while offering approximately the same amount of suitable habitat (17,000 to 17,900 acres) to active management as alternatives B through D and G; and fewer acres than alternatives E and F by approximately 2,170 and 5,700 acres, respectively, that could potentially alter the habitat components preferred by the species.

As displayed in table 52, the predicted timber harvest output in primary habitat varies from 17,700 to 23,700 acres and is very minimal in all alternatives. These amounts represent about 6 to 8 percent of the total suitable habitat on the Shoshone. The amount of timber harvest in alternative A is, therefore, expected to have little, if any, influence on blacked-back woodpecker habitat or populations on the Shoshone. Construction of new roads as result of timber harvest that would remain open to public use is very minimal for all alternatives; estimated between 2 to 4 miles.

Wildland fire use is not a planned output. However, it will be utilized as a tool to allow natural disturbances to occur within suitable blacked-back woodpecker habitat as opportunities arise. It is estimated that all alternatives may allow from 161,400 to 185,200 acres of wildland fire use.

Depending upon fire severity and scale, these outputs could have negative or positive influences on blacked-back woodpecker.

Table 52. Activities and outputs that could Influence the black-backed woodpecker by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Suitable Timber base acres	86,300	127,000	122,100	124,500	179,700	251,200	127,000
Vegetation Treatment Acres Mechanical and Mechanical w/Prescribed Fire(Total)	15,500	15,600	14,500	15,100	17,900	21,700	15,600
Douglas-fir	2,920	2,740	2,340	2,630	3,180	4,250	2,740
Spruce/fir	1,410	1,400	1,060	1,260	1,550	1,770	1,400
Lodgepole pine	5,290	5,330	5,640	5,360	7,060	9,210	5,330
Limber pine	610	620	550	580	640	670	620
Whitebark pine	540	540	270	510	540	550	540
Aspen	620	630	530	620	640	660	630
Vegetation Treatment Acres Prescribed Fire(Total)	23,600	23,300	23,300	23,300	22,800	21,900	23,300
Douglas-fir	4,950	4,870	4,840	4,870	4,750	4,590	4,870
Spruce/fir	550	540	500	530	550	570	540
Lodgepole pine	1,970	1,970	2,020	1,980	2,190	2,450	1,970
Limber pine	1,740	1,720	1,720	1,720	1,660	1,540	1,720
Whitebark pine	340	340	300	340	330	310	340
Aspen	920	910	900	910	880	820	910
Wildfire Acres	185,200	182,900	184,100	183,700	175,000	161,400	182,900

Action Alternatives: Alternatives B through G

As displayed in table 52, there is little difference between no action and alternatives B through G in regard to vegetation treatment acres. The amount of timber harvest in all alternatives is, therefore, expected to have little, if any, influence on black-backed woodpecker habitat or populations on the Shoshone. Construction of new roads as result of timber harvest that would remain open to public use is very minimal for all alternatives; estimated between 2 to 3 miles. Alternative F offers the greatest amount of vegetation treatment area where this activity may occur. However, all alternatives influence suitable black-backed woodpecker habitat (288,807 acres of mature habitat) from 6 to 8 percent and are expected to have no detectable effect on the species.

As with no action, it is estimated that wildland fire use may be used as a management tool on 161,400 to 185,200 acres in all action alternatives. Depending upon fire severity and scale, these outputs could have negative or positive influences on woodpeckers.

Cumulative Effects

The single-most influential habitat management action undertaken in potential black-backed woodpecker habitat on the Shoshone is timber harvesting. As previously discussed, timber harvesting occurs at a very small scale compared to the available habitat on the Forest. For the past 10 years (2002 to 2011), approximately 18,751 acres of vegetative treatment has occurred.

A review of management activities and land use designations on the Shoshone suggests that a considerable amount of suitable habitat for the black-backed woodpecker is available, and should remain available, throughout and beyond the current planning period (10 to 15 years). Timber management activities may still influence individual black-backed woodpeckers where it occurs. However, approximately 92 percent of the suitable habitat (mature spruce/fir, Douglas-fir, lodgepole pine, whitebark pine) on the Shoshone will not receive planned vegetative treatment.

Some evidence suggests that lodgepole pine has become less abundant in the last century, while spruce/fir has increased (USDA Forest Service 2012a). Fire suppression reinforces this trend, but increases in wildfire and insect outbreaks may begin to reverse this trend.

Determination of Effects and Rationale for the Determination – Black-backed Woodpecker

All alternatives, including alternative A, **“may adversely impact individuals (black-backed woodpeckers), but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide.”** The rationale for this determination is as follows:

- All alternatives involve projected timber harvest activities in primary habitat types (spruce/fir, Douglas-fir, lodgepole pine, whitebark pine) that may adversely influence individual woodpeckers. However, the projected scope of these activities is very minimal.
- Extensive late-successional primary habitat occurs on the Shoshone National Forest in wilderness and other back country designations where natural processes will dominate.
- Planned wildland fire use activities will provide benefits to the black-backed woodpecker.

Boreal owl

Affected Environment

Boreal owls (*Aegolius funereus*) are found within the boreal forest zone of North America from Alaska, through Canada, to New Mexico. In Wyoming, they are known to occur in the western mountainous regions. Boreal owls have been found on the Shoshone based on past surveys (WGFD 2009). Historical populations, distribution, or abundance are unknown on the Forest, and no trend data specific to the Shoshone are available.

Areas previously surveyed on the Shoshone were resurveyed in 2008 to 2009, but no boreal owls were located. WGFD (2009) suspect that the lack of boreal owl responses was due to (1) a noticeable increase in snowmobile use between the earlier surveys and the winter of 2008 to 2009 that may have caused a shift in habitat occupancy due to noise and disturbance factors, (2) habitat suitability changes due increase in beetle-killed conifer trees, and/or (3) the timing of the surveys, which may have occurred toward the end of the breeding season, so males may not have been as vocal as they would have been earlier in the season.

Habitat Distribution and Condition on the Forest

In the Rocky Mountain region, boreal owls typically inhabit mature, high-elevation subalpine forests composed of Englemann spruce, subalpine fir, and mature lodgepole pine, with some mature aspen stands interspersed with the conifer species listed above (Garber et al. 1991). Based on 31 records, the elevational range for boreal owls in Wyoming during the breeding season is 6,560 to 10,630 feet (2,000 to 3,240 meters) (Garber et al. 1991).

On the Shoshone, there are about 309,442 acres of spruce/fir and 382,886 acres of lodgepole pine (USDA Forest Service 2012b). Some evidence suggests that lodgepole pine has become less abundant in the last century, while spruce/fir has increased (USDA Forest Service 2012a). Fire suppression reinforces this trend, but increases in wildfire and insect outbreaks may begin to reverse this trend. About 178,678 acres of spruce/fir and 110,750 acres of lodgepole pine are within wilderness.

Forest inventory data indicate that about 30 percent of the spruce/fir is mature (over 200 years old) and about 22 percent of the lodgepole pine is mature (over 150 years old) (USDA Forest Service 2009). This suggests that there is abundant potential habitat for boreal owls on the Shoshone.

Aspen has a limited distribution on the Forest and covers roughly 23,295 acres. Field observations indicate that most aspen is mature (USDA Forest Service 2009).

In recent years, the Shoshone has experienced insect epidemics. Over the past 11 years, widespread bark beetle epidemics have occurred on the Forest. Table 50 shows the acres affected and the type of insects involved with the outbreaks (USDA Forest Service 2012a). Insect outbreaks may be reducing habitat for boreal owls and will continue to do so into the future. Climate change increases the potential for more and continued insect outbreaks and also increases the frequency of fires (Rice et al. 2012).

Risk Factors

The primary risk factor from forest management is timber harvest in mature spruce/fir habitat. Other risk factors include epidemic insect outbreaks in spruce/fir habitat and stand-replacement wildfires in spruce/fir habitat

Habitat and Population Management Considerations

Retaining adequate snags and large-diameter trees would be an important management emphasis in silvicultural prescriptions in spruce/fir forest types. As boreal owls prefer these forest types, uneven-aged management should be used to retain mature overstory and a diverse understory component (Hayward and Hayward 1993).

Since boreal owls use aspen to some degree, any management activity that sought to perpetuate and/or expand aspen would be beneficial.

From a population standpoint, increased inventory would need to occur to confirm presence or absence and improve distribution information.

Conservation Measures

To provide management for this species to maintain or improve its potential distribution on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Given the substantial amount of habitat on the forest that would not be affected by timber harvest, viability risk from forest management to boreal owls is low.

Conservation measures summarized include:

1. Where appropriate, utilize uneven-aged management within harvest units in mature spruce/fir habitat. This will provide adequate snags and large-diameter trees to maintain habitat within the harvest units.

2. Manage aspen for retention and expansion over current levels.
3. Should active owl nests be found, protect the nest site with a timing restriction and appropriate buffer. Nest stands from 4 to 35 acres have been reported for boreal owls (Hayward and Hayward 1993).

Monitoring Considerations

Continue to cooperate with the WGFD to periodically complete boreal owl surveys on the Shoshone.

Habitat monitoring should include the inventory and management of mature conifer stands and distribution on the Forest. This would include the location and extent of insect outbreaks and recent wildfires. Both of which are currently inventoried on an annual basis.

Direct and Indirect Effects

Effects from Timber Management: Plan direction that could potentially influence the boreal owl primarily involves timber management. Although not a planned activity, wildland fire use could also potentially have negative influences on the boreal owl because of reduced forest cover, snags, and food resources. Differences in projected outputs by alternative for these activities are displayed in table 53.

Alternative A: No action

In regard to activities that could potentially influence the boreal owl, alternative A designates the least amount of suitable timber base (86,300 acres) as compared to alternatives B through G while offering approximately the same amount of suitable habitat (approximately 1,960 acres of spruce/fir) to active management as alternatives B, D, and G more acres then alternative C, but fewer acres (approximately 140 and 380 acres) than alternatives E and F, respectively, that could potentially alter the habitat components preferred by the species.

As displayed in table 53, the predicted timber harvest output in primary habitat varies from 1,560 to 2,340 acres and is very minimal in all alternatives. These amounts represent about 2 to 3 percent of the total suitable habitat on the Shoshone. The amount of timber harvest in alternative A is, therefore, expected to have little, if any, influence on boreal owl habitat or populations on the Shoshone. Construction of new roads as result of timber harvest that would remain open to public use is very minimal for all alternatives; estimated between 2 to 3 miles. Additional fragmentation effects may be associated with these activities, but are expected to be minor because of the large amount of unroaded area that remains undeveloped.

Wildland fire use is not a planned output. However, it will be utilized as a tool to allow natural disturbances to occur within suitable boreal owl habitat as opportunities arise. It is estimated that all alternatives may allow from 161,400 to 185,200 acres of wildland fire use. Depending upon fire severity and scale, these outputs could have negative or positive influences on boreal owls.

Table 53. Activities and projected outputs that could potentially Influence the boreal owl, by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Suitable Timber base acres	86,300	127,000	122,100	124,500	179,700	251,200	127,000
Vegetation Treatment Acres Mechanical and Mechanical w/Prescribed Fire (Total)	15,500	15,600	14,500	15,100	17,900	21,700	15,600
Spruce/fir	1,410	1,400	1,060	1,260	1,550	1,770	1,400
Vegetation Treatment Acres Prescribed Fire(Total)	23,600	23,300	23,300	23,300	22,800	21,900	23,300
Spruce/fir	550	540	500	530	550	570	540
Wildfire Acres	185,200	182,900	184,100	183,700	175,000	161,400	182,900

Action Alternatives: Alternatives B through G

As displayed in table 53, there is little difference between no action and alternatives B through Gin regard to vegetation treatment acres in suitable boreal owl habitat (92,832 acres). Alternative F offers the greatest amount of vegetation treatment area where this activity may occur. However, less than 3 percent of suitable boreal owl habitat is influenced by all alternatives and is expected to have no detectable effect on this species.

As with no action, it is estimated that wildland fire use may be used as a management tool on 161,400 to 185,200 acres in all action alternatives. Depending upon fire severity and scale, these outputs could have negative or positive influences on boreal owls.

Cumulative Effects

No cumulative effects on the boreal owl are anticipated because of the minimal amount of activities projected to occur in primary habitat and the large amount of undeveloped area that will remain on the Forest well into the future.

Determination of Effects and Rationale for the Determination – Boreal Owl

All alternatives, including alternative A, **"may adversely impact individuals, but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide."** The rationale for this determination is as follows:

- All alternatives involve projected timber harvest activities in primary habitat types (spruce/fir) that may adversely influence individual boreal owls. However, the projected amount of these activities is very minimal.
- Extensive late-successional primary habitat occurs on the Shoshone National Forest in wilderness and other back country designations where natural processes will dominate and provide excellent habitat for the boreal owl.

Northern goshawk

Affected Environment

Northern goshawks (*Accipter gentilis atricapillus*) are a circumboreal species. In North America, they range from Alaska, through most of Canada, south to Mexico, Wisconsin, and the New England States (Squires and Reynolds 1997). Goshawks are known to occur throughout most of Wyoming where suitable habitat exists, except the far southeastern portion of the state (Smith and Keinath 2004). Goshawks are known to breed on the Shoshone. Historical populations, distribution, or abundance on the Forest are unknown.

No trend data are available that is specific to the Shoshone or Wyoming. In 2004, Wyoming Natural Diversity Database personnel surveyed 13 historic nest sites on the Shoshone. Only two nest sites were found to be active (Smith et al. 2005). More recent surveys in 2006 and 2009 that followed the National Goshawk Protocol indicated two active territories within five habitat blocks in 2006, and three active territories within 10 habitat blocks in 2009 (USDA Forest Service 2010d).

Habitat Distribution and Condition on the Shoshone

Across a goshawk's territory, their habitat often contains multiple forest age classes as well as natural openings. Nest sites require more specific habitat requirements. Goshawk nests in the central Rocky Mountains are typically in lodgepole pine (*Pinus contorta*), mixed conifer, and quaking aspen (*Populus tremuloides*) (Squires and Ruggiero 1996). On the Targhee National Forest, goshawks nest were all located in Douglas-fir (*Pseudotsuga menziesii* var. *glauca*) and lodgepole pine stands.

Potential goshawk nest habitat is relatively abundant on the Shoshone. There are about 382,886 acres of lodgepole pine, 345,273 acres of Douglas-fir, and 23,295 acres of aspen (USDA Forest Service 2012b). Some evidence suggests that lodgepole pine has become less abundant in the last century, while spruce/fir has increased (USDA Forest Service 2012a). Fire suppression reinforces this trend, but increases in wildfire and insect outbreaks may begin to reverse this trend.

Forest inventory data indicate that about 16 percent of the Douglas-fir is mature (over 200 years old) and about 22 percent of the lodgepole pine is mature (over 150 years old) (USDA Forest Service 2009). Field observations indicate that most of the aspen is mature as well.

In recent years, the Shoshone has experienced insect epidemics. Over the past 11 years, widespread bark beetle epidemics have occurred on the Forest. Table 50 shows the acres affected and the type of insects involved with the outbreaks (USDA Forest Service 2012a). Insect outbreaks may be reducing habitat for northern goshawks and will continue to do so into the future. Climate change increases the potential for more and continued insect outbreaks and also increases the frequency of fires (Rice et al. 2012).

Timber harvest activity has removed a minor amount of potential nesting habitat.

Risk Factors

The primary risk factors from forest management are timber harvest and fire suppression. Other risk factors include falconry and human disturbance at nest sites.

Natural risk factors include epidemic insect outbreaks and wildfire. Both of which can reduce potential habitat for the long term.

Habitat and Population Management Considerations

Maintaining mature forest conditions around known nests would be the most important forest management emphasis for goshawk habitat. Forest management can impact the structure, function and quality of nesting and post-fledging habitat by modifying or removing entire nest stands and reducing habitat suitability (Reynolds et al. 1992, Kennedy 2003).

Fire suppression has likely made goshawk habitat more susceptible to catastrophic wildfire. Fires now burn over larger areas, are more intense, and more devastating than in earlier times. Crown fires are now common because of ladder fuels and the high amount of recent tree mortality due to epidemic insect outbreaks.

Reducing human disturbance around known active nests is also important.

Conservation Measures

To provide management for goshawks and to maintain or improve the species' potential distribution on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Given the relatively high amount of habitat on the Forest and by protecting known nest sites, overall viability risk from forest management to goshawks is low.

Conservation measures summarized include:

1. Within known goshawk territories, maintain at least a 30-acre buffer of mature forest around known nest sites.
2. Within known goshawk territories, maintain at least 60 percent of the goshawk habitat in a mature condition within the post-fledging area. The post-fledging area should include all known alternate nests. Suitable goshawk habitat consists of mature lodgepole pine, Douglas-fir, and quaking aspen. The PFA ranges in size from 200 to 425 acres (Kennedy 2003).
3. If an active nest is located, avoid project activities within 0.25 mile that would disturb nesting goshawks from April 1to August 31.
4. If project activities will reduce potential nesting habitat within a known goshawk territory, identify and manage alternative and replacement nest sites within the territory.
5. Manage aspen for retention and expansion over current levels.

Monitoring Considerations

Important monitoring considerations for goshawks would be the continued monitoring of known nest sites to determine territory occupancy, nest success, and productivity. Also, continue to cooperate with the monitoring of goshawks at the bioregional scale.

Direct and Indirect Effects

Effects from Timber Harvest, Fuels Treatments, Wildlife Management Activities, Motorized and Non-motorized Recreation: Plan direction that could potentially influence the northern goshawk primarily involves timber harvest, fuels treatments, and wildlife management activities. Motorized and non-motorized recreation could possibly influence nesting in some locations. Differences in projected outputs by alternative for these activities are displayed in table 54.

Table 54. Activities and outputs that could Influence the northern goshawk by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Suitable Timber base acres	86,300	127,000	122,100	124,500	179,700	251,200	127,000
Vegetation Treatment Acres Mechanical and Mechanical w/ Prescribed Fire (Total)	15,500	15,600	14,500	15,100	17,900	21,700	15,600
Douglas-fir	2,920	2,740	2,340	2,630	3,180	4,250	2,740
Lodgepole pine	5,290	5,330	5,640	5,360	7,060	9,210	5,330
Aspen	620	630	530	620	640	660	630
Vegetation Treatment Acres Prescribed Fire (Total)	23,600	23,300	23,300	23,300	22,800	21,900	23,300
Douglas-fir	4,950	4,870	4,840	4,870	4,750	4,590	4,870
Lodgepole pine	1,970	1,970	2,020	1,980	2,190	2,450	1,970
Aspen	920	910	900	910	880	820	910
Road Construction Miles-Timber	2	2	2	2	3	4	2
Wildfire Acres	185,200	182,900	184,100	183,700	175,000	161,400	182,900
Motorized Recreation-Summer (Acres available)	570,000	570,300	321,800	350,000	655,900	823,300	529,000

Alternative A: No Action

In regard to activities that could potentially influence the northern goshawk, alternative A designates the least amount of suitable timber base (86,300 acres) as compared to alternatives B through G, while offering approximately the same amount of suitable habitat (16,300 to 16,700 acres) to active management as alternatives B through D and G; and fewer acres than alternatives E and F by approximately 1,140 and 5,300 acres, respectively, that could potentially alter the habitat components preferred by the species. Potential impacts are expected to be minimal and localized.

Treatments in aspen are also similar across alternatives, but may impact individual goshawks because of the intensive treatments involved. Older aspen stands that currently contain the structural characteristics needed to support nest platforms may be targeted for regeneration. Conversely, however, long-term benefits may be associated with regenerating stand conditions.

As displayed in table 54, the predicted timber harvest output in primary habitat (approximately 162,774 acres) varies from 16,300 to 22,000 acres and is very minimal in all alternatives. These amounts represent about 10 to 14 percent of the total suitable habitat on the Shoshone. The amount of timber harvest in alternative A is, therefore, expected to have little, if any, influence on northern goshawk habitat or populations on the Shoshone. Construction of new roads as result of timber harvest that would remain open to public use is very minimal for all alternatives; estimated between 2 to 3 miles.

The use of prescribed fire is expected to help restore habitat conditions for the northern goshawk due to a reduction in small-diameter trees that could inhibit effective foraging. The use of prescribed fire is also expected to provide benefits by reducing fuel loads that could result in a high-intensity wildfire that could render habitat unsuitable. Benefits to prey species are also anticipated, as small mammals and birds respond to the burn areas. Some impacts may occur to individual goshawks if nesting occurs within a prescribed fire area. The use of prescribed fire is projected to occur on approximately 23,600 acres under alternative A and does not vary across alternatives B through E and G. Alternative F proposes the least amount of prescribed fire.

Wildland fire use is not a planned output. However, it will be utilized as a tool to allow natural disturbances to occur within suitable northern goshawk habitat as opportunities arise. It is estimated that all alternatives may allow from 161,400 to 185,200 acres of wildland fire use. Depending upon fire severity and scale, these outputs could have negative or positive influences on northern goshawk.

Alternatives A and B offer the third highest amount of motorized recreation compared to the other alternatives. This difference could potentially allow greater disturbances to the northern goshawk during nesting season, depending upon the type, timing, and scope of the activity.

Alternatives B through G

As displayed in Table 54, there is little difference between no action and alternatives B, C,D, and G in regard to timber harvest. Alternative F offers the greatest amount of projected timber activities in all cover types that may be utilized by the northern goshawk. However, all alternatives influence preferred northern goshawk habitat from 10 to 14 percent and are expected to have minimal and localized effect on the species.

As displayed in table 54, alternative C offers fewer potential disturbances than the other alternatives from summer motorized recreation because of decreases in the amount of motorized use area. Alternative D offers the next fewest motorized acres, while alternative F offers the highest amount of acreage. Alternatives B, E, and G offer a balance between the other action alternatives, but provide less solitude habitat than no action. Reductions in open motorized areas should decrease the potential for displacement or disturbances while nesting.

The use of prescribed fire is projected to occur on approximately 23,600 acres and does not appreciatively vary across alternatives B through E and G. Alternative F proposes the least amount of prescribed fire. Wildland fire use may be used as a management tool from 161,400 to 185,200 acres in all alternatives. This could impact individual goshawks if fire occurs in nesting areas.

Cumulative Effects

A review of management activities and land use designations on the Shoshone suggests that a considerable amount of suitable habitat for the northern goshawk is available, and should remain available, throughout and beyond the current planning period (10 to 15 years). Timber management activities may still influence individual goshawk where it occurs. No cumulative effects are expected. Natural fire events would improve habitat conditions.

Determination of Effects and Rationale for Determination – Northern Goshawk

All alternatives, including alternative A, **“may adversely impact individuals, but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide.”** The rationale for this determination follows:

- All alternatives involve projected timber harvest activities in primary habitat types (Douglas-fir, lodgepole pine, aspen) that may adversely influence individual goshawk. However, the projected scope of these activities is very minimal.
- Extensive late-successional primary habitat occurs on the Shoshone National Forest in wilderness and other backcountry designations where natural processes will dominate.

Olive-sided flycatcher

Affected Environment

Olive-sided flycatchers (*Contopus cooperi*) are neotropical migrants that summer in the conifer forest zone of North America from Alaska south through Canada to California, New Mexico, Michigan, and the New England states. They winter in Central and South America (Altman and Sallabanks 2000). In Wyoming, olive-sided flycatchers likely occur within the conifer forests of western Wyoming, including the Shoshone and possibly within the Medicine-Bow and Bighorn National Forests (Kotliar 2007). Historical populations, distribution or abundance are unknown for this species on the Forest.

They likely occur Forest-wide in typical low abundance within suitable habitat based on recent surveys by the Rocky Mountain Bird Observatory from 2002 to 2008 (Hanni et al. 2009). From 2002 to 2009, the Rocky Mountain Bird Observatory detected 52 olive-sided flycatchers (Hanni et al. 2009, Rehm-Lorber et al. 2010).

Trend data are not available for olive-sided flycatchers on the Shoshone or in Wyoming. This is likely due to their low occurrence rate on survey routes.

Habitat Distribution and Condition on the Shoshone

In Region 2, olive-sided flycatchers are most often found in higher elevation spruce/fir forests. They are typically not found in even-aged lodgepole pine stands (Kotliar 2007). They typically nest in post-fire early successional forests. They could be considered a fire obligate species.

There are about 309,442 acres of spruce/fir on the Shoshone (USDA Forest Service 2012b). Some evidence suggests that lodgepole pine has become less abundant in the last century, while spruce/fir has increased (USDA Forest Service 2012a). Fire suppression reinforces this trend, but increases in wildfire and insect outbreaks may begin to reverse this trend. Forest inventory data indicates that about 30 percent of the spruce/fir is mature (over 200 years old).

In recent years, the Forest has experienced large wildfires. About 115,000 acres have burned in the last 5 years and about 161,500 acres in the last 10 years (USDA Forest Service 2012a). Wildfires are creating ideal habitat for olive-sided flycatchers, and will continue to do so into the future.

The current epidemic insect outbreaks may be creating additional habitat, but this has yet to be documented (Kotliar 2007).

Risk Factors

The primary risk factors from forest management are timber harvest and fire suppression. Another primary risk factor is loss of wintering habitat (Kotliar 2007).

Habitat and Population Management Considerations

A substantial amount of potential habitat (178,678 acres of spruce/fir habitat) for olive-sided flycatchers and areas where natural processes dominate the landscape occurs in wilderness on the Shoshone. Habitat is being created in stand-replacement wildfires.

Timber harvest has the potential to create habitat, but this type of habitat may be detrimental to the species. Although olive-sided flycatchers regularly use small forest openings created by logging, they may actually be ecological traps (Kotliar 2007, Altman and Sallabanks 2000).

Timber harvest occurs at a very small scale compared to the available habitat on the Forest, so overall risks would be low.

Fire suppression has the potential to be a risk, since olive-sided flycatchers appear to rely on fire to create preferred habitat. Allowing wildland fire use would be important for creating and maintaining habitat for this species. High-severity fires create the best olive-sided flycatcher habitat (Kotliar 2007).

Conservation Measures

To maintain and improve potential habitat for olive-sided flycatchers on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Since this species is not of viability concern, these measures would continue to maintain and improve potential habitat for this species.

Conservation measures summarized include:

1. Allow for wildland fire-use, where appropriate, to provide foraging and nesting habitat.

Monitoring Considerations

Of most importance for this species would be the inventory and management of spruce/fir stands and distribution on the Shoshone. This would include age class distribution of spruce/fir and the location and extent of wildfires. Wildfires are currently inventoried on an annual basis.

Direct and Indirect Effects

Effects from Timber Management and Fuels Management: Plan direction that could potentially influence the olive-sided flycatcher primarily involves timber harvest and possibly fuels treatment activities. Differences in projected outputs by alternative for these activities are displayed in table 55.

Table 55. Activities and outputs that could Influence the olive-sided flycatcher by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Suitable Timber base acres	86,300	127,000	122,100	124,500	179,700	251,200	127,000
Vegetation Treatment Acres Mechanical and Mechanical w/ Prescribed Fire (Total)	15,500	15,600	14,500	15,100	17,900	21,700	15,600
Spruce/fir	1,410	1,400	1,060	1,260	1,550	1,770	1,400
Vegetation Treatment Acres Prescribed Fire (Total)	23,600	23,300	23,300	23,300	22,800	21,900	23,300
Spruce/fir	550	540	500	530	550	570	540
Wildfire Acres	185,200	182,900	184,100	183,700	175,000	161,400	182,900

Alternative A: No action

As displayed in table 55, the predicted timber harvest output in primary olive-sided flycatcher habitat varies from 1,550 to 2,330 acres and is very minimal in all alternatives. These amounts represent less than 3 percent of the total suitable habitat on the Shoshone. The amount of timber harvest in alternative A is, therefore, expected to have little influence on the olive-sided flycatcher or populations on the Shoshone.

Wildland fire use is not a planned output. However, it will be utilized as a tool to allow natural disturbances to occur in high-elevation forest types as opportunities arise. It is estimated that all alternatives may allow from 161,400 to 185,200 acres of wildland fire use. All wildland fire use activities can be expected to have negative influences on the olive-sided flycatcher because of a decrease in habitat components preferred by the species. However, these influences would vary significantly depending upon the size and severity of a wildfire.

Action Alternatives: Alternatives B through G

As displayed in table 55, there is little difference between no action and alternatives B, C, D, E, and G in regard to timber harvest. Alternative F offers the greatest amount of projected timber output. However, all alternatives influence preferred olive-sided flycatcher habitat (approximately 92,832 acres) by 2 to 3 percent and are expected to have no detectable effect on the species. The large amount of back country and wilderness remaining on the Shoshone in all alternatives can be expected to provide mature trees, which is primary nesting habitat for the olive-sided flycatcher.

As with the no-action alternative, it is estimated that wildland fire use may be used as a management tool on 161,400 to 185,200 acres in all action alternatives. Benefits can be expected from any Fire Use activities that permit wildfires to occur.

Cumulative Effects

No cumulative effects on the olive-sided flycatcher are anticipated because of the minimal amount of activities projected to occur in primary habitat and the large amount of undeveloped area that will remain on the Forest well into the future.

Determination of Effects and Rationale for Determination – Olive-sided Flycatcher

All alternatives, including alternative A, “may adversely impact individuals, but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide.” The rationale for this determination is as follows:

- All alternatives involve projected timber harvest activities in primary habitat types (spruce/fir) that may adversely influence individual olive-sided flycatchers. However, the projected amount of these activities is very minimal.
- Extensive late-successional primary habitat occurs on the Shoshone National Forest in wilderness and other back country designations where natural processes will dominate and provide excellent habitat for the olive-sided flycatchers.

Grassland/sagebrush mammals

Rocky Mountain bighorn sheep

History, Status, and Distribution on the Forest

Rocky Mountain bighorn sheep (*Ovis canadensis Canadensis*) have a natural heritage ranking of G4/S3. They are considered a big game animal in Wyoming.

Rocky Mountain bighorn sheep are found scattered throughout the mountainous regions of western North America from British Columbia and Alberta south to New Mexico and Arizona

(Beecham et al. 2007). In Wyoming, they primarily occur in the northwestern part of the state with re-introduced populations in the Bighorn Mountains and several mountain ranges in the southeastern part of the state.

The Shoshone is occupied by six of the eight core native bighorn sheep herds in Wyoming. These core herds include: Francs Peak, Younts Peak, Whiskey Mountain, Trout Peak, Wapiti Ridge, and Clarks Fork (map 12). These core herds currently occupy 67 percent (1.65 million acres) of the Forest. Also, a small portion of the Washakie Ranger District is occupied by the Temple Peak herd. This herd is not a core herd. It is classified as a remnant herd. Also it's considered a transplant herd and is managed within a "Cooperative Review Area" (Wyoming State-wide Bighorn/Domestic Sheep Interaction Working Group 2004b). Cooperative Review Areas are areas of suitable bighorn sheep range where proposed changes in bighorn sheep management or domestic sheep use will be cooperatively evaluated.

Francs Peak Bighorn Sheep Herd

This core native herd occupies portions of the Shoshone and the Wind River Indian Reservation within the Absaroka and Owl Creek mountain ranges. This herd includes WGFD Hunt Areas 5 (Francs Peak) and 22 (Dubois Badlands), as well as the Owl Creek Mountains in the northern portion of the Wind River Indian Reservation (Beecham et al. 2007).

The population objective for this herd is 1,360 sheep. Current model estimates put the population at 1,424 sheep, or near objective (WGFD 2012a). Even though the 2011 lamb:ewe ratio of 17:100 was low compared to the 10-year average of 29:100, this sheep herd is considered very healthy and the population has remained stable for the past 6 years. Ram:ewe ratio in 2011 was 43:100, also below the 10-year average of 48:100.

No domestic sheep grazing occurs within this herd unit. Domestic sheep/goat grazing on public lands closest to the Francs Peak Herd is approximately 3.2 kilometers (2 miles) to the east on BLM lands. Because of the concern of disease transmission, five bighorn sheep ewes were removed from the population upon grazing on private land used by domestic sheep (WGFD, personal communication 2012b). Closest domestic sheep/goat grazing on the Shoshone National Forest is approximately 112.7 kilometers (70 miles) south of the Francs Peak Herd (Wyoming: Bighorn Sheep Occupied Habitat and Domestic Sheep Grazing Allotments Map, February 29, 2012 draft).

No pack goat use occurs within this core native herd home range.

Younts Peak Bighorn Sheep Herd

This herd occupies portions of the Shoshone and Bridger-Teton National Forests, primarily within the Absaroka Mountain Range. Younts Peak is the most remote bighorn sheep herd in Wyoming. While much of the Younts Peak herd is non-migratory and resides year-round on high-elevation ridges (WGFD 2009a), segments of the herd do migrate to low-elevation winter range in the South Fork of the Shoshone River. This makes them prone to periodic high mortality losses because of severe winter weather.

The population for this herd is estimated to be 750, which is below the objective of 900 sheep. The March 2011 lamb:100 ewe ratio was 17:100, and ram:100 ewe ratio was 48:100. The lamb:ewe ratio was well below the 5-year (2006 to 2010) average of 24:100 for this herd, as was the ram:ewe ratio that averages 45:100 for this herd (WGFD 2012a). No domestic sheep grazing occurs within this herd unit. Domestic sheep/goat grazing on public lands closest to the Younts

Peak Herd is approximately 41.8 kilometers (26 miles) east on BLM lands. Closest domestic sheep/goat grazing on the Shoshone is approximately 136.8 kilometers (85 miles) southeast of the Younts Peak Herd (Wyoming: Bighorn Sheep Occupied Habitat and Domestic Sheep Grazing Allotments Map, February 29, 2012 draft).

No pack goat use occurs within this core native herd range.

Whiskey Mountain Bighorn Sheep Herd

This core native herd occupies portions of the Shoshone and Bridger-Teton National Forests and the Wind River Indian Reservation within the Wind River Mountain Range. This herd includes WGFD Hunt Areas 8, 9, 10, and 23 (Beecham et al. 2007).

The population objective for this herd is 1,350 sheep. After a disease-related die-off in 1990-1991, the population has yet to recover and has been in a decline for the past 20 years. Current population estimate is about 613 sheep (WGFD 2012b). In 2009, the lamb:ewe ratio of 30:100 was the highest observed in the past 20 years (WGFD 2009b). In 2011, the ratio was 26:100 lamb:ewes. The ram:ewe ratio for this herd has been more stable. In 2011, the ratio was 44:100, below the 2006 to 2011 average of 36:100 (WGFD 2012b).

It is suggested that the high concentration of wintering sheep contributed to the severity and lasting impacts of the pneumonia outbreak in 1991. As a result, it’s been suggested that the Whiskey Mountain Bighorn Sheep Technical Committee review the population objective for this herd to try to avoid the scenario that occurred in 1991 (WGFD 2009b).

In 2010, WGFD personnel spent a significant amount of time observing sheep in early fall as they arrived on winter range. Many lambs were observed coughing violently and showing symptoms of pneumonia. Eleven sheep were euthanized throughout the fall and examined at the State veterinary lab to document the presence of disease. Examinations revealed *Mycoplasma ovipneumoniae* in all the sheep that had been seen coughing violently. It appears likely persistent, low, annual recruitment in this population can be traced to chronic bacterial infection resulting in significant lamb mortality as sheep migrate onto winter range in the fall. Despite low recruitment, the population is declining very slowly and it appears a small increase in lamb recruitment will stabilize this population. Unfortunately managers do not have any effective tools to mitigate the persistent presence of bacterial pneumonia that is impacting lambs annually (WGFD 2010c).

No domestic sheep grazing occurs within this herd unit. Domestic sheep/goat grazing on public lands closest to the Whiskey Mountain Herd is approximately 9.7 kilometers (6 miles) west on the Bridger-Teton National Forest. Four domestic sheep were removed (shot) in Hunt Area 8 that had strayed onto core native bighorn sheep habitat on the Bridger-Teton National Forest due to concerns over disease transmission (WGFD, personal communication 2012b). Closest domestic sheep/goat grazing on the Shoshone is approximately 80.5 kilometers (50 miles) southeast of the Whiskey Mountain Herd (Wyoming: Bighorn Sheep Occupied Habitat and Domestic Sheep Grazing Allotments Map, February 29, 2012 draft).

Pack goat use occurs within occupied habitat of this core native herd. The only pack goat outfitter to operate in this area was bought out in 2007.

Trout Peak Bighorn Sheep Herd

This core native herd occupies portions of the Shoshone, within the Absaroka Mountain Range. Sheep move between this herd unit and Yellowstone National Park (Beecham et al. 2007). This herd includes WGFD Hunt Area 2.

The population objective for the Trout Peak herd is 750. The present population is estimated to be about 600 sheep (WGFD 2012a). The lamb:ewe ratios were average for this herd in 2007 (30:100) and 2009 (29:100), but were low in 2008 (19:100) and 2010 and 2011 (26:100). The ram:ewe ratios were average for this herd in 2007 (30:100) and 2009 (33:100), slightly higher in 2010 and 2011 (41:100), but were substantially higher in 2008 (65:100) (WGFD 2012a). No domestic sheep grazing occurs within this herd unit. Domestic sheep/goat grazing on public lands closest to the Trout Peak Herd is approximately 19.3 kilometers (12 miles) east on BLM lands. Closest domestic sheep/goat grazing on the Shoshone is approximately 220.8 kilometers (138 miles) south of the Trout Peak Herd (Wyoming: Bighorn Sheep Occupied Habitat and Domestic Sheep Grazing Allotments Map, February 29, 2012 draft).).

No pack goat use occurs within this core native herd range.

Wapiti Ridge Bighorn Sheep Herd

This core native herd occupies portions of the Shoshone and Bridger-Teton National Forests within the Absaroka Mountain Range. Sheep move between this herd unit and Yellowstone National Park (Beecham et al. 2007). This herd includes WGFD Hunt Area 3.

The population objective for the Wapiti Ridge herd is 1,000 sheep with the present population estimated at 900 (WGFD 2012a). In 2011, the lamb:ewe ratio was 12:100, which is below the 2006 to 2011 average of 27:100. The ram:ewe ratios were average in 2008 (40:100) and 2011 (36:100), but were slightly below average (38:100) in 2009 and 2010 at 32:100 rams:ewes (WGFD 2012a). No domestic sheep grazing occurs within this herd unit. Domestic sheep/goat grazing on public lands closest to the Wapiti Ridge Herd is approximately 29.0 kilometers (18 miles) east on BLM lands. Closest domestic sheep/goat grazing on the Shoshone is approximately 179.2 kilometers (112 miles) south of the Wapiti Ridge Herd (Wyoming: Bighorn Sheep Occupied Habitat and Domestic Sheep Grazing Allotments Map, February 29, 2012 draft).

No pack goat use occurs within this core native herd range.

Clarks Fork Bighorn Sheep Herd

This core native herd occupies portions of the Shoshone and the Gallatin and Custer National Forests in Montana. They range across the Absaroka Mountain Range and the Beartooth Plateau. Sheep from this herd, primarily rams, move in and out of Yellowstone National Park. This herd includes WGFD Hunt Area 1 (Beecham et al. 2007).

The population objective for the Clarks Fork herd is 500 with the present population about the same (WGFD 2012a). The lamb:ewe ratio of 52:100 in 2011, was back to more normal numbers compared to 2009 when lamb counts of 32:100 were one of the lowest recorded for this herd. The ram:ewe ratio of 42:100 was lower than recent surveys in 2005 and 2006, but still within the range seen from 2003 to 2011 (WGFD 2012a). No domestic sheep grazing occurs within this herd unit. Domestic sheep/goat grazing on public lands closest to the Clarks Fork Herd is approximately 20.9 kilometers (13 miles) east on BLM lands. Closest domestic sheep/goat grazing on the Shoshone is approximately 240.0 kilometers (150 miles) south of the Clarks Fork

Herd ((Wyoming: Bighorn Sheep Occupied Habitat and Domestic Sheep Grazing Allotments Map, February 29, 2012 draft).).

No pack goat use occurs within this core native herd range.

Temple Peak Bighorn Sheep Herd

This cooperative review herd is an indigenous population of the Bridger-Teton and Shoshone National Forests. This herd currently occupies a very small portion of the Shoshone along the Lander Front in the southern end of the Wind River Range. The distribution of bighorns with this unit is scattered, with known wintering areas in the North Fork of the Popo Agie River, Sinks Canyon, and the Little Popo Agie River. This herd includes WGFD Hunt Area 11 (Beecham et al. 2007). This herd no longer has a hunt area assigned to it and is not discussed in the WGFD 2010 Annual Big Game Herd Unit Reports.

Historically, segments of the Temple Peak herd have been known to migrate to ranges near the Continental Divide. A total of 23 records were recorded between 1978 and 1991. In addition, 10 records of bighorn sheep tracks were recorded in these same areas from 1980 to 1984. No observations of bighorn sheep have been recorded on alpine ranges near the Continental Divide since 9/09/1991. Group sizes of these observations ranged from 1 to 16 sheep, with an average group size of 3.4 sheep. The largest number of sheep seen (16) was on 8/25/1978 at Baptiste Lake (Wyoming Game and Fish Department 2013).

Three winter range segments have been identified for the Temple Peak herd; North Fork Canyon, Sinks Canyon, and Wolf Point.

- <u>North Fork Canyon</u> – A total of 24 observations of bighorn sheep have been made on the North Fork Canyon winter range complex from 1978 to 2006. The maximum number of sheep seen on this winter range went from 15 sheep in 1978 to 18-23 from 1987-90 following a 1987 transplant there. Sheep numbers declined from that point and by 1992 to 2006 ranged between 0 and 14 animals. No observations have been recorded since 2006.
- <u>Sinks Canyon</u> – A total of 64 observations of bighorn sheep have been made on the Sinks Canyon winter range complex from 1977 to 2009. The maximum number of sheep seen on this winter range went from 5 sheep in 1977 to 56 in 1987 following a 1987 transplant there. Sheep numbers declined from that point and by 1993 to 2009 ranged between 0 and 7 animals. No observations have been recorded since 2010.
- <u>Wolf Point</u> – A total of 22 observations of bighorn sheep have been made on the Wolf Point winter range complex from 1977 to 1992. The maximum number of sheep seen on this winter range was 15-17 sheep in 1977-78 following a1971-72 transplant there. Sheep numbers declined from that point and by 1982 to 1992 ranged between 0 and 12 animals. No observations have been recorded since 1992.
- <u>Other Winter Range Observations</u> – Movement of animals between these winter range complexes has been documented and observations of sheep in areas between them have been made. Between 1977 and 1993, 4 observations of bighorn sheep between North Fork Canyon and Sinks canyon were made, ranging from 1 to 5 individuals. Between 1980 and 2009, 8 observations of sheep between Sinks Canyon and Wolf Point were made, ranging between 1 and 24 sheep (Wyoming Game and Fish Department 2013).

Poor adult survival and poor lamb recruitment in the Temple Peak herd have caused the population to continue to decline. The average number of sheep seen during the most recent 11-

year period (2001–2011) is 10.6 (maximum # = 11), although no observations were made in 3 of these years. The average number of sheep seen during the most recent 5-year period (2007 to 2011) is 2.8 (maximum # = 5). No observations have been made since 2010 (WGFD 2013).

This herd experienced an all-age pneumonia die-off in 1992 and has never recovered (WGFD 2006). The current population is suspected to be about 25 sheep. The population objective is 250 sheep. Singer et al. (2001) identified bighorn sheep populations that fall below 30 sheep as "quasi-extirpation" meaning that the population is unlikely to ever recover. This quasi-extirpation herd is likely to eventually go extinct. Due to the low population, no population data are currently being collected by the WGFD.

Domestic sheep grazing occurs on both the Shoshone and Bridger-Teton National Forests within this herd's historic summer range, but not within currently occupied herd range. Suitable bighorn sheep habitat within the domestic sheep allotments on the Shoshone is very limited as a vast majority of the land is forested. In addition, a large portion of the land between the allotments on the two national forests and the bighorn sheep occupied habitat, is forested. This herd's current occupied range is very confined, suggesting that they no longer are a migratory herd or have little, if any interchange with bighorns in the Whiskey Mountain or Wind River Indian Reservation populations (Beecham et al. 2007).

Closest domestic sheep/goat grazing on public lands to the Temple Peak Herd is approximately 9.7 kilometers (6 miles) east on Bureau of Land Management lands. Closest domestic sheep/goat grazing on the Shoshone National Forest is approximately 28.9 kilometers (18 miles) southeast of the Temple Peak Herd (Wyoming: Domestic Sheep and Bighorn Sheep Distribution 2011). Closest domestic sheep/goat grazing on the Bridger-Teton National Forest to the Temple Peak Herd is approximately 3.2 kilometers (2 miles) west. To reduce the risk of transmission, at least one bighorn sheep ram was removed after it made a foray onto private land.

Pack goat use occurs within occupied habitat of this cooperative review herd. The only pack goat outfitter to operate in this area was bought out in 2007.

Bighorn Sheep Population Trends on the Forest

Recent population trends for the core bighorn sheep herds have been fairly steady. The Whiskey Mountain herd appears to have stabilized since the last pneumonia caused die-off that started in the 1990s (figure 16).

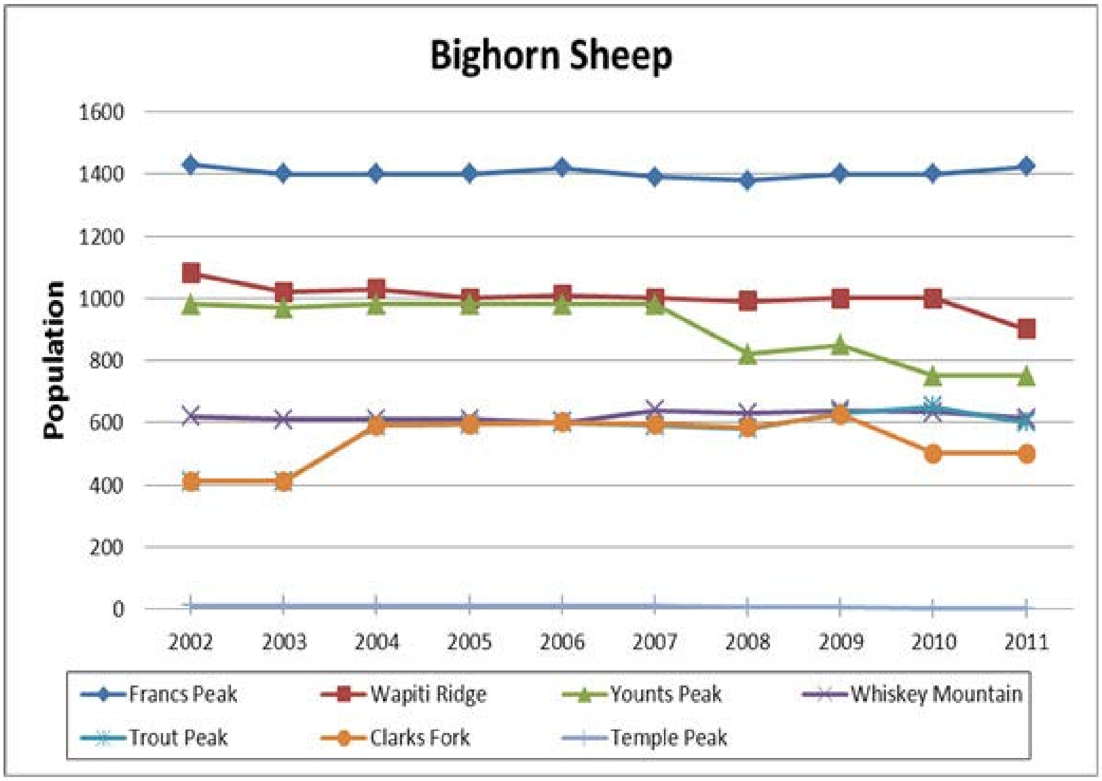


Figure 16. Population trends for bighorn sheep herd units that encompass the Shoshone National Forest

Habitat Distribution and Condition on the Shoshone

Habitat for bighorn sheep is abundant on the Shoshone. There are approximately 819,430 acres of grass/forb/sedge meadow habitat and approximately 328,170 acres of potential escape cover (rock). Additional habitat may be available in some sagebrush cover types at lower elevations on winter range. Crucial bighorn sheep winter range is the most important habitat on the Shoshone (map 13). The Shoshone contains about 663,320 acres of crucial winter range.

In recent years, the Shoshone has experienced large wildfires. About 115,000 acres have burned in the last 5 years, and about 161,500 acres in the last 10 years (USDA Forest Service 2012). Wildfires create ideal seasonal habitat for bighorns and help to reduce conifer and shrub encroachment within their preferred habitat.

No domestic sheep grazing occurs within or near occupied core bighorn sheep habitat on the Shoshone. The closest core herd, Whiskey Mountain, is about 80 kilometers from the domestic sheep allotments on the southern end of the Forest. There currently is recreational goat pack use within this herd's occupied habitat.

Domestic sheep grazing does occur within about 28.9 kilometers of the remnant Temple Peak herd on the Shoshone. These sheep allotments are mostly forested, so they provide very little potential habitat for bighorns. This results in a low likelihood that foraying bighorns would utilize these allotments.

Although scientific literature is lacking specifically for the risk of disease transmission between pack goats and bighorn sheep, some information is available for domestic goats and bighorn sheep (Rudolph et al. 2003, Foreyt et al. 2009). Until further scientific information is available to prove otherwise, the risk to bighorn sheep is far too great to allow pack goat use within occupied core bighorn sheep habitat. Even one disease transmission event could be catastrophic to a core bighorn sheep herd. (See *Risk Analysis of Disease Transmission Between Domestic Sheep and Goats and Rocky Mountain Bighorn Sheep, Shoshone National Forest 2013*.)

Risk Factors

The primary risk factors from forest management are domestic sheep grazing, recreational goat-packing, human disturbance during critical time periods (winter), and fire suppression.

Habitat and Population Management Considerations

Maintaining diverse and productive seasonal habitats away from domestic sheep and goats would be the most important forest management emphasis for bighorn sheep.

Limiting human access to bighorn sheep wintering areas also would be important to reduce potential disturbance during this critical time period.

Conservation Measures

To provide management for bighorn sheep and to maintain or improve their potential distribution on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Incorporating conservation measures to maintain and improve habitat for bighorn sheep and reduce potential for disease transmission between domestic goats and bighorns results in an overall low viability risk for core bighorn sheep herds on the Shoshone. The Temple Peak herd will continue to be managed within the Cooperative Review Area as a remnant herd. Any change in management of this herd would be cooperatively agreed upon (Wyoming State-wide Bighorn/Domestic Sheep Interaction Working Group 2004a).

Conservation measures summarized include:

1. Close all occupied core native bighorn sheep (BHS) habitat to pack goat use (see map 14). This is needed to protect core native bighorn sheep herds from the potential for contact with pack goats. This measure effectively closes the entire Shoshone National Forest, except the Washakie Ranger District to pack goat use.
2. Coordinate with the WGFD to seasonally close motorized access to crucial bighorn sheep winter range during critical time periods.
3. Conduct management activities that disturb wintering bighorn sheep outside of the critical time period except when the project is designed to maintain or improve crucial winter range conditions (i.e., prescribed fire).
4. Utilize prescribed fire and mechanical treatments to maintain and improve bighorn sheep seasonal ranges.
5. Allow for wildland fire use, where appropriate, to maintain and improve bighorn sheep seasonal ranges.

Monitoring Considerations

The WGFD annually monitors bighorn sheep populations. The Shoshone will continue to rely on their data.

Direct and Indirect Effects

Effects from Domestic Sheep Grazing, Recreation Pack Goat Use, and Wildlife Management: Plan direction that could potentially influence the Rocky Mountain bighorn sheep primarily involve domestic sheep grazing, recreational pack goat use and wildlife management activities (i.e., big game winter range improvements). Differences in projected outputs by alternative for these activities are displayed in table 56.

Table 56. Activities and projected outputs that could potentially influence the Rocky Mountain bighorn sheep (BHS), by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Permitted AUMs (Sheep only)	410	410	410	410	410	410	410
Suitable Acres (Total)	15,780	15,780	15,780	15,780	15,780	15,780	15,780
Permitted commercial livestock and domestic pack goat use	No permitted domestic sheep and a temporary closure for pack goats in Core Native BHS Habitat on Clarks Fork, Wapiti, Greybull and Wind River Ranger Districts	No domestic goats (including pack goats) in Core Native BHS Habitat. Livestock allotments closed to domestic sheep grazing in Core Native BHS Habitat.	No domestic goats (including pack goats) on entire Shoshone. Livestock allotments closed to domestic sheep grazing in Core Native BHS Habitat.	No domestic goats (including pack goats) in Core Native BHS Habitat. Livestock allotments closed to domestic sheep grazing in Core Native BHS Habitat.	Domestic goats (including pack goats allowed on entire Shoshone. Livestock allotments closed to domestic sheep grazing in Core Native BHS Habitat.	Domestic goats (including pack goats allowed on entire Shoshone. Livestock allotments closed to domestic sheep grazing in Core Native BHS Habitat.	No domestic goats (including pack goats) in Core Native BHS Habitat. Livestock allotments closed to domestic sheep grazing in Core Native BHS Habitat.

Alternative A: No action

As displayed in table 56, alternative A continues to allocate allotments to domestic sheep grazing, but it is very limited, currently set at 410 AUMs and 15,780 acres. There is no overlap between domestic sheep allotments and core native bighorn sheep habitat. Alternative A would allow a temporary closure to domestic sheep and goat use on four of the five ranger districts to expire, increasing the potential risk of disease transmission to core native bighorn sheep. Although there is no documented case of disease transmittal from domestic sheep and goats to bighorns on the Shoshone, it is possible that a risk would remain for such an event.

Wildlife habitat management to improve big game winter range is projected to occur on 2,000 acres during the life of the Plan. This projection includes elk and other big game species as well as potential projects for bighorn sheep. Benefits can be expected on a site-specific basis.

Action Alternatives: Alternatives B through G

As displayed in table 56, all alternatives maintain the same permitted numbers and area for domestic sheep as alternative A, currently set at 410 AUMs and 15,780 acres. There is no overlap between domestic sheep allotments and core native bighorn sheep habitat. Alternatives, B, C, D, and G would restrict domestic goat use (including pack goats) in core native bighorn sheep habitat. Alternatives E and F allow domestic goat use in core native bighorn sheep habitat. Although the risk of future contact between domestics and bighorn would not be completely eliminated, alternatives B, C, D, and G reduce the potential for a disease transmittal. Although there is no documented case of disease transmittal from domestic sheep and goats to bighorns on the Shoshone, it is possible that a risk would remain for such an event.

As in alternative A, wildlife habitat management to improve big game winter range is projected to occur on 2,000 acres during the life of the Plan. This projection includes elk and other big game species as well as potential projects for bighorn sheep. Benefits can be expected on a site-specific basis.

Cumulative Effects

Both domestic and bighorn sheep have used the Shoshone for several decades. Currently, there are no documented cases of disease transmittal from domestic sheep or goats to bighorns on the planning area. Management of bighorn sheep and domestic sheep and goats (including pack goats) to avoid physical interactions is often complex. It is important that separation of the three species is maintained at all times; however, the distance needed to attain this can be different in each situation, and collaboration among all parties is needed to achieve this. Currently, the Shoshone is working with other State, Federal, and local partners (State-wide Bighorn Sheep/Domestic Sheep Interaction Working group) to better identify where bighorns occur, where they wander, and how they might interact with other herds and domestics. In managing both domestic sheep and goats and bighorns, the Shoshone is using a nationally recognized collaborative process for resolving bighorn/domestic sheep management conflicts. The approach outlined in the process has been incorporated into the management of domestics and bighorn sheep through the Plan design criteria and Plan components. It is anticipated that this approach will help Forest Service range and wildlife specialists work with interested individuals and organizations to develop site-specific solutions to potential conflicts amongst the species. This effort is expected to help reduce potential cumulative effects to bighorn sheep on Shoshone.

Determination of Effects and Rationale for Determination – Bighorn Sheep

Based on this analysis, it is determined that alternatives A, E, and F “may adversely impact individuals, but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide.” Alternatives B, C, D and G could be expected to provide a “Beneficial Impact” to the species. The rationale for this determination follows:

- Bighorn and domestic sheep and goat (including pack goats) ranges overlap on the Shoshone, therefore, a risk of disease transmittal occurs in alternatives A, E, and F.
- To date, there is no documented case of disease transmittals from domestics to bighorns on the Shoshone. However, there is no known “safe distance” between the three species, so the risk of a future transmittal cannot be discounted (see Risk Analysis of Disease Transmission Between Domestic Sheep and Goats and Rocky Mountain Bighorn Sheep, Shoshone National Forest 2013).

- Alternatives B, C, D and G include similar conservation measures to reduce the risk of contact and disease transmittal.

Grassland/sagebrush birds

Brewer's sparrow and sage sparrow

Affected Environment

Brewer's sparrow (*Spizella breweri*) and sage sparrow (*Amphispiza belli*) are grouped into one assessment as they occupy similar sagebrush steppe habitat and are subject to similar threats. Historical populations, distribution, or abundance are unknown for either species on the Shoshone.

Brewer's sparrow is categorized as G5/S5 while the sage sparrow is categorized as G5/S3 species through the natural heritage program ranking. They are also ranked as level I priority species (conservation action) by Wyoming Partners in Flight for shrub-steppe habitat, and are Forest Service Region 2 sensitive species.

Nests for both species are typically constructed in the bottom portion of live sagebrush plants, typically in the taller shrubs. Both sparrows winter in the southwestern United States and north-central Mexico. They do not appear to have elevation limits in their breeding range.

Brewer's sparrows are well distributed within the Great Basin and other sagebrush habitats in northwestern North America. They breed throughout Wyoming (Rotenberry et al. 1999). They likely occur Forest-wide within suitable habitat based on recent surveys by the Rocky Mountain Bird Observatory from 2002 to 2008 (Hanni et al. 2009). From 2002 to 2009 the Rocky Mountain Bird Observatory detected 640 Brewer's sparrows (Hanni et al. 2009, Rehm-Lorber et al. 2010). There are currently no known population estimates or trends for the species on the Shoshone. At the State level, breeding bird surveys indicate a slight declining trend (- 0.7), but the trend is not significant ($p = 0.37$) (WGFD 2010b).

Sage sparrows are distributed across the Great Basin and other sagebrush habitats in the western United States. They primarily breed in portions of central and western Wyoming (Martin et al. 1998). Based on Rocky Mountain Bird Observatory surveys, sage sparrows are rare on the Shoshone. Rocky Mountain Bird Observatory surveys only detected three birds from 2002 to 2009 (one in 2007, two in 2009) (Hanni et al. 2009, Rehm-Lorber et al. 2010). There are currently no known population estimates or trends for the species on the Forest. At the State level, breeding bird surveys indicate a slightly increasing trend (0.8), but the trend is not significant ($p = 0.72$) (WGFD 2010b).

With fluctuations in natural ranges of habitat, it is difficult to determine if populations of these species on the Shoshone are similar to historic levels or not. Regional declines reported in breeding bird survey results for most of the West indicate they are not (Paige and Ritter 1999), and significant acreages of sagebrush habitat have been lost throughout the West due to European settlement influences, such as conversion to agriculture, urban development, or losses due to cheatgrass invasion. These changes are likely having an effect on Brewer's and sage sparrow populations, though these effects currently are not occurring to a significant extent on the Forest compared to surrounding lands.

Habitat Distribution and Condition on the Shoshone

Both sparrows are dependent on sagebrush habitats, tending towards mature stands and larger stand sizes which make them sensitive to habitat fragmentation (Paige and Ritter 1999). Food sources are primarily insects in the summer, with seeds of grasses and shrubs a secondary source. Across the Shoshone, there are approximately 38,784 acres of sagebrush, representing 2.0 percent of the Forest (USDA Forest Service 2012b). This acreage includes all types of sagebrush. Mountain big sagebrush dominates the montane shrublands throughout the Absaroka Mountains. Black sagebrush, Wyoming sagebrush, and basin big sagebrush occur on the eastern margins of the Forest. The most extensive of these stands are found in the North and South Fork Shoshone River valleys and along the Beartooth front. On the Washakie Ranger District, mountain big sagebrush is mixed with bitterbrush and mountain snowberry. Additional sagebrush habitat likely occurs within some stands classified as grassland on the Forest.

In general, most of the sagebrush stands on the Shoshone are likely in a mature condition. This is largely due to fire suppression, especially at the lower elevations on the Forest. Fire suppression can cause increases in shrub cover and tree encroachment, but on the Shoshone, the change is not large enough to be outside of the historic range of variability at the stand or landscape level (low confidence) (Meyers et al. 2006). There appears to be adequate habitat to support viable populations of these species on the Forest.

Roads on the Shoshone have likely fragmented some sagebrush stands. To what extent is currently unknown.

Livestock grazing can influence sagebrush ecosystems. High stocking rates typically result in an increase of mature sagebrush, due to the removal of understory herbaceous vegetation. Trampling of nests is not thought to be of concern as both sparrows nest in the canopy of sagebrush. Nest parasitism from cowbirds may have an impact, as cowbirds tend to follow livestock herds (Paige and Ritter 1999). However, both rotational grazing systems and the later turn-out date of most livestock operations likely provides adequate areas of little influence from this effect. Livestock may also increase the risk for the introduction of invasive plants.

Data on the effects of livestock grazing in shrubsteppe habitat, on migratory birds including the Brewer’s and sage sparrow are limited, Bock et al.(1993) found that of 23 bird species studied, only 3 were positively affected, while 13 species were negatively affected. Brewer’s sparrow was one of the species negatively affected while the sage sparrow was positively affected. These effects were the result of increased shrub cover, decreased cover of native perennial grasses, and increased cover of exotic annuals.

Invasive plants are currently limited to localized concentrations and are primarily located along major travel corridors (roads and trails). Similarly, cheatgrass has yet to invade large or broad proportions of the Shoshone. However, the threat of habitat loss remains high. Cheatgrass alters the fire regime and increases the probability for more frequent fires. This reduces the chance for sagebrush and native bunchgrasses to get re-established following a fire.

Risk Factors

Primary risk factors from forest management include: habitat fragmentation, prescribed fire, livestock grazing, and invasion by invasive plants.

Climate change has the potential to increase the risk of invasive plant invasion and could result in more frequent stand-replacement fires.

Habitat and Population Management Considerations

Retention of stands of mature sagebrush habitat at a watershed scale would provide for ensured habitat for populations of these species. Although to what level is unknown, it is assumed that within a range of what likely historically occurred is reasonable. This would also facilitate management toward ensuring sustainable and diverse habitat conditions. If sagebrush was managed only for mature high canopy cover stands, the habitat is more at risk for losses due to wildfire, and do not provide the needed diversity of grasses/forbs for other species. Mosaics created by prescribed burning may be most beneficial, though this could also be accomplished through other methods.

Paige and Ritter (1999) recommend small scale, patchy prescribed burns for habitat diversity considerations, and should be conducted in the late spring or fall. The guidelines developed for vegetation management in sage grouse habitat (WGFD 2003) would likely be adequate for these species.

As mentioned previously, activities that have potential to expand cheatgrass or other invasive plants should be closely monitored to ensure further loss of habitat does not occur. Climate change has the potential to increase the spread of invasive weeds into sagebrush and alter fire regimes.

Roads can have negative effects on these species. Roads can reduce patch size, increase the potential for displacement by other species more adapted to roads and edge (horned larks), and increase the risk for introduction of invasive plants. Additional road construction in large stands of sagebrush should be minimized.

Conservation Measures

For continued and improved management for these species and their habitat, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Inclusion of these measures would continue to provide adequate habitat for these species and other sagebrush-associated species, resulting in a low viability risk to these species. Birds in a Sagebrush Sea (Paige and Ritter 1999), Brewer’s Sparrow (*Spizella breweri*): A Technical Conservation Assessment (Holmes et al. 2005b), Sage Sparrow (*Amphispiza belli*): A Technical Conservation Assessment (Holmes et al. 2005a), and the Wyoming Greater Sage-Grouse Conservation Plan (WGFD 2003) were reviewed to determine habitat needs.

Conservation measures summarized include:

1. Prevent or reduce the risk for large stand-replacement fires in sagebrush habitat. Conduct prescribed burns that are small and patchy and maintain habitat diversity. Retain areas of large expanses of sagebrush habitat (minimize edge created).
2. In areas with cheatgrass and other invasive plants, avoid prescribed burns to reduce the risk of further spread.
3. Maintain native grasses and forbs through proper grazing limitations. Use rotational grazing systems to provide rest and areas with reduced potential for cowbird parasitism. Provide for retention of about 50 percent of current year’s growth of herbaceous vegetation for nesting cover in the following season.
4. Consider resting burned areas from grazing to provide adequate regeneration of native vegetation.

5. Prioritize and aggressively treat invasive weeds to prevent additional loss of sagebrush habitats.
6. Limit the number of new roads. Reclaim old roads that are not being used. Discourage road construction and other developments where it would reduce sagebrush habitat patch size.
7. Retain sagebrush habitat (no type conversions).
8. Re-establish sagebrush and native bunch grasses in habitat now dominated by invasive plants.
9. Provide a mosaic of open (5 percent) to moderate (25 percent) shrub canopy cover on the landscape.

Monitoring Considerations

Sparrows can be monitored in conjunction with avian point count surveys, as they are easily detected. About 5 years of data collection would be needed to establish baseline trends. Habitat inventory and monitoring should also be considered in conjunction with population monitoring.

Direct and Indirect Effects

Effects from Fuels Management and Livestock Grazing and Invasive Plants: Plan direction that could potentially influence the Brewer’s and sage sparrows primarily involves fuels treatment activities, livestock grazing, and invasive plants. Differences in projected outputs by alternative for these activities are displayed in table 57.

Table 57. Activities and projected outputs that could potentially influence Brewer’s sparrow and sage sparrow, by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Vegetation Treatment Acres Prescribed Fire (Total)	23,600	23,300	23,300	23,300	22,800	21,900	23,300
Grass	910	910	910	910	940	970	910
Sagebrush	2,730	2,700	2,720	2,710	2,600	2,420	2,700
Wildfire Acres	185,200	182,900	184,100	183,700	175,000	161,000	182,900
Livestock							
Permitted AUMs (Cattle only)	55,500	55,500	31,000	55,500	57,890	61,100	55,500
Suitable Acres (Cattle only)	359,600	359,600	201,000	359,600	359,600	399,600	359,600

Alternative A: No action

As displayed in table 57, alternative A provides for a similar amount of fuels treatment in mixed-shrubland as alternatives B through G. These treatments primarily involve prescribed fire to reduce fuels hazards associated with mature, medium-density shrublands, including sagebrush. Because sagebrush is not a target species for fuels reduction on the planning area, potential impacts to Brewer’s and sage sparrows from fuels reduction activities on the Shoshone are expected to be minor, but cannot be completely discounted.

As displayed in table 57, the permitted amount and area for cattle grazing does not differ among alternatives A, B, D, and G. These activities are, therefore, predicted to have potential negative influences on individual breeding pairs of Brewer’s and sage sparrows where activities and habitat overlap. On NFS land, however, these activities are expected to be minor because of the small amount of acreage involved and the conservation measures developed to minimize potential impacts. These conservation measures are similar across alternatives.

Action Alternatives: Alternatives B through G

All alternatives provide for a similar amount of fuels treatment in mixed-shrubland, with a slight decrease in alternative E, and greater decrease in alternative F. Because sagebrush is not a target species for fuels reduction of NFS land, potential influences on Brewer's and sage sparrows and other sage-associated species are expected to be similar to alternative A.

As displayed in table 57, alternatives B, D, and G provide for the same amount of livestock grazing as alternative A. There are slight reductions in AUMs and area in alternative C, and a slight increase in AUMs in alternative D. The decrease in grazing area and stocking rates in alternative C may provide some secondary benefits to species such as the Brewer's and sage sparrow, while the increase in alternative D may be associated with a higher degree of habitat impacts to the species. Alternatives E and F maintain the highest permitted forage allocation to livestock and are, therefore, assumed to have a potential for negative impacts to Brewer's and sage sparrow habitat if the activities overlap. Overall, however, potential impacts are expected to be similar and based on site-specific areas where conservation measures are available to alleviate identified problems. The conservation measures are similar across all alternatives.

Cumulative Effects

There is little to no management activity that occurs in sagebrush on the Shoshone, except for grazing. Although sagebrush has a limited distribution across the Forest, livestock grazing effects have occurred where grazing activities occur within active allotments. Fuels management may occur in areas, which include small stands of sagebrush, but otherwise are dominated by other vegetation types. Management actions are conducted in sagebrush grasslands on the adjacent BLM lands where the objectives include opening up decadent stands to improve the grass/forb understory, to increase the age class diversity, to improve forage conditions, and habitat improvement. Overall, little influence or cumulative effects on sagebrush-associated species is expected on the Shoshone as a whole because of limited activities in this habitat type.

Determination of Effects and Rationale for Determination – Brewer's Sparrow and Sage Sparrow

All alternatives, including alternative A, "may adversely impact individuals, but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide." The rationale for this determination follows:

- The primary threats to Brewer's and sage sparrow populations associated with the Shoshone involve habitat conversions and activities on private lands.
- Some activities could overlap occupied Brewer's and sage sparrow habitat and have negative influences on the species.
- The Shoshone Plan incorporated guidance provided to maintain and improve sagebrush habitat conditions.

Ferruginous hawk

Affected Environment

The ferruginous hawk (*Buteo regalis*) has a natural heritage ranking of G4/S4B/S5N. There are two State rankings for breeding and non-breeding (winter) birds. Historical populations, distribution, or abundance are unknown on the Shoshone.

Ferruginous hawks are found in arid and open landscapes in western North America from southern Canada, through the western Great Plains, and Great Basin, south to Arizona and New Mexico (Bechard and Schmutz 1995). Ferruginous hawks are considered a common resident in Wyoming (WGFD 2010b). Ferruginous hawks are rare on the Shoshone as habitat is very limited. No known nests occur on the Forest. They probably only occasionally forage on the Shoshone.

The Rocky Mountain Bird Observatory completed bird surveys from 2002 to 2009 on the Shoshone. They detected one hawk in 2007 and one in 2009 (Hanni et al. 2009, Rehm-Lorber et al. 2010). Due to their low occurrence on the Shoshone, no trend data are available. In Wyoming, overall populations are thought to be stable or increasing. Local declines are assumed to have occurred near major disturbances such as urban development, large active surface mines, and intensively developed petroleum fields (Travsky and Beauvais 2005).

Habitat Distribution and Condition on the Shoshone

Ferruginous hawks nest in open flat to rolling terrain dominated by grass and shrubs. They require large tracts of relatively undisturbed rangeland. Nests are located on rock outcrops, on the ground, cutbanks, cliff ledges, or trees (WGFD 2010a). This type of habitat is rare on the Shoshone, and is most likely to occur in grassland areas along the forest boundary. Based on currently known distribution and distribution modeling (Keinath et al. 2010), ferruginous hawks have a low probability of occurring on most of the Shoshone.

Risk Factors

The primary risk factors from forest management are livestock grazing and fire suppression. Other risk factors include cover type conversion to cropland, urban development, and extensive petroleum field development. These risks are impacting habitat adjacent to the Shoshone.

Habitat and Population Management Considerations

Retention of large blocks of grassland habitat at a watershed scale would provide for ensured habitat for populations of this species. Although to what level is unknown, it is assumed that within a range of what likely historically occurred is reasonable.

The use of prescribed fire and wildfire are important to reduce the impacts from shrub and tree encroachment into grasslands and to create a mosaic of habitats.

Conservation Measures

To maintain and improve potential habitat for ferruginous hawks on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Inclusion of these measures would continue to provide adequate habitat for this species and other grassland-associated species, resulting in a low viability risk to these species. These conservation measures would apply to the low-elevation arid grasslands on the Shoshone.

Conservation measures summarized include:

1. Allow for wildland fire use, where appropriate, to create a mosaic of habitats and reduce encroachment from shrubs and trees into grasslands.
2. Utilize prescribed fire to create a mosaic of habitats and to reduce tree and shrub encroachment.
3. Maintain native grasses and forbs through proper grazing limitations. Use rotational grazing systems to provide rest.
4. Consider resting burned areas from grazing to provide adequate regeneration of native vegetation.
5. Prioritize and aggressively treat invasive weeds to prevent additional loss of grassland habitats.
6. Retain grassland habitat (no type conversions).
7. Re-establish native bunch grasses in habitat now dominated by invasive plants.

Monitoring Considerations

Since ferruginous hawks are not currently known to nest on the Shoshone, inventorying potential nesting habitat that occurs on the Forest would be important. This could help to determine if the ferruginous hawk should be retained as a sensitive species on the Shoshone.

Direct and Indirect Effects

Effects from Motorized and Non-motorized Recreation, and Livestock Grazing: Plan direction that could potentially influence the ferruginous hawk primarily involves motorized and non-motorized recreation, and possibly livestock grazing.

Alternative A: No action

The ferruginous hawk is a migratory species with individuals that occur sporadically during the winter period. No breeding or nesting pairs are known to occur on the Shoshone. Potential effects to this species are, therefore, most likely limited to possible disturbances from motorized vehicles or recreational activities.

Action Alternatives: Alternatives B through G

Potential effects from the action alternatives are expected to be similar to no action. Potential effects to this species are expected to be limited to possible disturbances from motorized vehicles or recreational activities on migratory non-breeding individuals.

Cumulative Effects

The ferruginous hawk has suffered habitat loss and negative effects throughout much of its range in the western United States. However, all of the alternatives associated with the Plan revision are expected to have no cumulative effects on this species, because the Shoshone does not measurably contribute to the conservation of the species. All individuals are migratory with no important breeding habitats known.

Determination of Effects and Rationale for Determination – Ferruginous Hawk

All alternatives, including alternative A, are expected to have **No Impact** on the ferruginous hawk or its primary habitat. The rationale for this determination follows:

- The ferruginous hawk is a migratory species that is not known to breed locally.
- Although localized disturbances may occur to migratory individuals, there is no measurable effect on the reproductive output or overall conservation status of the species.

Grasshopper sparrow

Affected Environment

Grasshopper sparrows (*Ammodramus savannarum*) are considered a G4/S4 species by the State Natural Heritage ranking for Wyoming. Historical populations, distribution or abundance are unknown for this species on the Shoshone.

Grasshopper sparrows breed across extreme southern Canada and much of the eastern two-thirds of the United States, with scattered populations in Idaho, Utah, California, and Washington (Vickery 1996). They winter in the southern United States and Mexico. In Wyoming, they breed mostly in the short-grass prairies (Slater 2004). The Shoshone contains very little, if any, short-grass prairie habitat. The Wyoming Natural Diversity Database (WYNDD) modeled very low probability of grasshopper sparrows occurring on the Shoshone (Keinath et al. 2010).

During surveys on the Shoshone from 2002 to 2008, the Rocky Mountain Bird Observatory detected three birds in 2006 (Hanni et al. 2009). Trend data are not available for grasshopper sparrows on the Shoshone or in Wyoming. This is due to the low occurrence of grasshopper sparrows on survey routes.

Habitat Distribution and Condition on the Shoshone

In Wyoming, grasshopper sparrows are found in mixed and northern short-grass prairies and open sagebrush grasslands (Slater 2004). They appear to be area sensitive, thus preferring large unfragmented patches of habitat (Vickery 1996).

There are about 459,000 acres classified as grassland on the Shoshone (USDA Forest Service 2012b). Grasshopper sparrows are most likely to occur in the lowest elevation arid type grasslands. These grasslands are dominated by bunchgrasses and occur in the South Fork of the Shoshone River drainage and in Sunlight Basin (USDA Forest Service 2009).

The grassland cover type may be declining relative to sagebrush habitat. This may be due to fire suppression. However, the sagebrush cover type may not be above its historic range of variability (USDA Forest Service 2012a). Also, in some areas prescribed fire may be reducing the advancement of sagebrush and trees into grassland habitat.

Grasshopper sparrow is associated with mixed and short-grass prairies habitats, which are incidental on the Shoshone. Overgrazing in these habitats is a major threat to grasshopper sparrow. Most grazing causes the vegetation to become too short and open for grasshopper sparrows to utilize (Slater 2004). However, both rotational grazing systems and the later turn-out date of most livestock operations likely provide adequate areas of little influence from this effect. Livestock grazing and other ground-disturbing activities may also increase the risk for the introduction of invasive plants.

Data on the effects of livestock grazing in shrubsteppe habitat, on migratory birds including the grasshopper sparrow are limited, Bock et al. (1993) found that of 23 bird species studied, only three were positively affected, while 13 species were negatively affected. The grasshopper sparrow was one of the species negatively affected. These effects were the result of increased shrub cover, decreased cover of native perennial grasses, and increased cover of exotic annuals.

Risk Factors

The primary risk factors from forest management are livestock grazing, fire suppression and invasive plants. Other risk factors include cover type conversion to cropland and urban development. Both of these risk factors impact grasshopper sparrow habitat off of the Shoshone.

Habitat and Population Management Considerations

Retention of large blocks of grassland habitat at a watershed scale would provide for ensured habitat for populations of this species. Although to what level is unknown, it is assumed that within a range of what likely historically occurred is reasonable.

The use of prescribed fire and wildfire are important to reduce the impacts from shrub and tree encroachment into grasslands and to create a mosaic of habitats.

Activities that have potential to expand cheatgrass or other invasive plants should be closely monitored to ensure further loss of habitat does not occur. Climate change has the potential to increase the spread of invasive weeds into grasslands and alter fire regimes.

Conservation Measures

To maintain and improve potential habitat for grasshopper sparrows on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Inclusion of these measures would continue to provide adequate habitat for this species and other grassland-associated species, resulting in a low viability risk to these species. These conservation measures would apply to the low-elevation arid grasslands on the Shoshone.

Conservation measures summarized include:

1. Allow for wildland fire use, where appropriate, to create a mosaic of habitats and reduce encroachment from shrubs and trees into grasslands.
2. Utilize prescribed fire to create a mosaic of habitats and to reduce tree and shrub encroachment.
3. To reduce the risk of further spread, prescribed burns should not occur in areas with cheatgrass and other invasive plants.
4. Maintain native grasses and forbs through proper grazing limitations. Use rotational grazing systems to provide rest and areas with reduced potential for cowbird parasitism. Provide for retention of about 50 percent of the current year’s growth of herbaceous vegetation for nesting cover in the following season.
5. Consider resting burned areas from grazing to provide adequate regeneration of native vegetation.
6. Prioritize and aggressively treat invasive weeds to prevent additional loss of grassland habitats.
7. Retain grassland habitat (no type conversions).
8. Re-establish native bunch grasses in habitat now dominated by invasive plants.

Monitoring Considerations

Of most importance for this species would be to attain distribution information for the Shoshone. This could be completed utilizing point count surveys within suitable habitat. Currently, suitable habitat is estimated to only occur in the arid grasslands in the South Fork Shoshone River drainage and Sunlight Basin.

Direct and Indirect Effects

Effects from Fire Management and Livestock Grazing: Plan direction that could potentially influence the grasshopper sparrow primarily involves fire suppression and livestock grazing. Differences in projected outputs by alternative for these activities appear in table 58.

Table 58. Activities and projected outputs that could potentially influence grasshopper sparrow, by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Vegetation Treatment Acres Prescribed Fire (Total)	23,600	23,300	23,300	23,300	22,800	21,900	23,300
Grass	910	910	910	910	940	970	910
Sagebrush	2,730	2,700	2,720	2,710	2,600	2,420	2,700
Wildfire Acres	185,200	182,900	184,100	183,700	175,000	161,400	182,900
Livestock Grazing							
Permitted AUMs (Cattle only)	55,500	55,500	31,000	55,500	57,890	61,100	55,500
Suitable Acres (Cattle only)	359,600	359,600	201,000	359,600	359,600	399,600	359,600

Alternative A: No action

As displayed in table 58, alternative A provides for a similar amount of fuels treatment in mixed-shrubland as alternatives B through G. These treatments primarily involve prescribed fire to reduce fuels hazards associated with mature, medium-density shrublands, including sagebrush. Because sagebrush is not a target species for fuels reduction on the planning area, potential impacts to grasshopper sparrows from fuels reduction activities on the Shoshone are expected to be minor, but cannot be completely discounted.

Wildland fire use is not a planned output in any of the alternatives. However, it will be utilized as a tool to allow natural disturbances to occur as opportunities arise. It is estimated that all alternatives may allow from 161,400 to 185,200 acres of wildland fire use. Because sagebrush is not a target species for wildland fire use on the planning area, potential impacts to grasshopper sparrows from this activity on the Shoshone are expected to be minor, but cannot be completely discounted.

Cattle grazing on the Shoshone is likely to overlap potential habitat for the grasshopper sparrow. As displayed in table 58, the permitted amount and area for cattle grazing does not differ among alternatives A, B, D, and G. These activities are, therefore, predicted to have potential negative influences on individual breeding pairs of grasshopper sparrows where activities and habitat overlap. On NFS land, however, these activities are expected to be minor because of the small amount of acreage involved and the conservation measures developed to minimize potential impacts. These conservation measures are similar across alternatives.

Action Alternatives: Alternatives B through G

As displayed in table 58, alternatives B through G provide for a similar amount of fuels treatment in mixed-shrubland, with a slight decrease in alternative E and greater decrease in alternative F. Because sagebrush is not a target species for fuels reduction on NFS land, potential influences on grasshopper sparrow and other sagebrush-associated species are expected to be similar to alternative A.

As displayed in table 58, alternatives B, D, and G provide for the same amount of livestock grazing as alternative A. There is a slight reduction in AUMs and area in alternative C, and a slight increase in AUMs in alternative D. The decrease in grazing area and stocking rates in alternative C may provide some secondary benefits to species such as the grasshopper sparrow, while the increase in alternative D may be associated with a higher degree of habitat impacts to the species. Alternatives E and F maintain the highest permitted forage allocation to livestock and are, therefore, assumed to have a potential for negative impacts to grasshopper sparrow habitat if the activities overlap. Overall, however, potential impacts are expected to be similar and, based on site-specific areas where conservation measures are available, to alleviate identified problems. The conservation measures are similar across all alternatives.

Cumulative Effects

Little to no management activity occurs in sagebrush on the Shoshone, except for grazing. Although sagebrush has a limited distribution across the Forest, livestock grazing effects have occurred where grazing activities occur within active allotments. Fuels management may occur in areas, which include small stands of sagebrush, but otherwise are dominated by other vegetation types. Management actions are conducted in sagebrush grasslands on the adjacent BLM lands where the objectives include opening up decadent stands improve the grass/forb understory, increase the age class diversity, improve forage conditions, and improve habitat. Overall, little influence or cumulative effects on sagebrush-associated species are expected on the Shoshone because of limited activities in this habitat type.

Determination of Effects and Rationale for Determination – Grasshopper Sparrow

All alternatives, including alternative A, **“may adversely impact individuals, but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide.”** The rationale for this determination follows:

- The primary threats to grasshopper sparrow populations associated with the Shoshone involve habitat conversions and activities on private lands.
- Some activities could overlap occupied grasshopper sparrow habitat and have negative influences on the species.
- The Shoshone Plan incorporated guidance provided to maintain and improve sagebrush habitat conditions.

Greater sage-grouse

Affected Environment

Sage-grouse (*Centrocercus urophasianus*) are categorized as G4/S4 species through the natural heritage program ranking. They are a candidate species for listing under the Endangered Species

Act and are a Forest Service Region 2 sensitive species. Historical populations, distribution, or abundance are unknown for sage-grouse on the Shoshone.

Sage-grouse are well distributed within the Great Basin and the Northern Rocky Mountain regions. Their range has contracted considerably in some areas from historic levels where sagebrush habitat has been lost. In Wyoming, sage-grouse are common because sagebrush habitat is still relatively intact when compared to other states (WGFD 2003). The WGFD tracks the number of males at leks each year. Within the Bighorn Basin, the number of males at leks has fluctuated (figure 17). No core habitat for sage grouse occurs on the Shoshone, but the Forest likely contains some late-summer brood-rearing habitat. Sage-grouse are known to occasionally occur on the Shoshone and are probably an occasional summer resident. There are currently no known population estimates or trends for the species on the Forest.

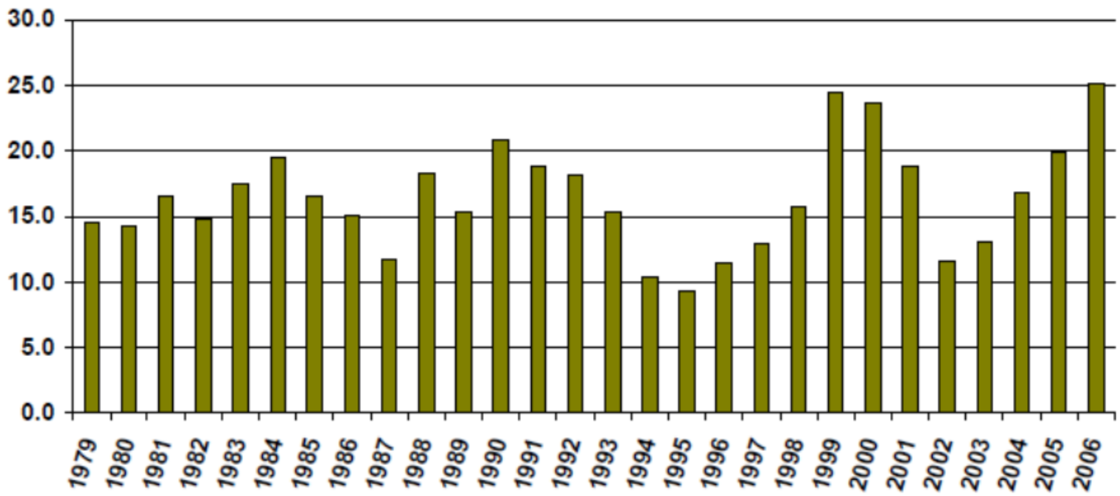


Figure 17. Average maximum number of males per active lek for greater sage-grouse in the Big Horn Basin Conservation Area, 1979 to 2006 (BBSGLWG 2007)

Habitat Distribution and Condition on the Shoshone

Sage-grouse are a sagebrush obligate species. Suitable habitat consists of plant communities dominated by sagebrush and have a diverse understory of native grasses and forbs (BBSGLWG 2007). Sage-grouse are area-sensitive and thus prefer large blocks of unfragmented habitat (Paige and Ritter 1999). Across the Shoshone there are approximately 38,784 acres of sagebrush, representing 2.0 percent of the Forest (U.S. Forest Service 2012b). This acreage includes all types of sagebrush. Mountain big sagebrush dominates the montane shrublands throughout the Absaroka Mountains. Arid low-elevation sagebrush occurs on the eastern margins of the Forest. The most extensive of these stands are found in the North and South Fork Shoshone River valleys. On the Washakie Ranger District mountain big sagebrush is mixed with bitterbrush and mountain snowberry. Additional sagebrush habitat likely occurs within some stands classified as grassland on the Shoshone.

In general, most of the sagebrush stands on the Shoshone are likely in a mature condition. This is largely due to fire suppression, especially at the lower elevations on the Forest. Fire suppression can cause increases in shrub cover and tree encroachment, but on the Shoshone the change is not large enough to be outside of the historic range of variability at the stand or landscape level (low confidence) (Meyers et al. 2006).

Roads on the Shoshone have likely fragmented some sagebrush stands. To what extent is currently unknown.

Overgrazing can also influence sagebrush ecosystems, though typically resulting in an increase of mature sagebrush due to the removal of understory herbaceous vegetation. Livestock may also increase the risk for the introduction of invasive plants.

Invasive plants are currently limited to localized concentrations and are primarily located along major travel corridors (roads and trails). Similarly, cheatgrass has yet to invade large or broad portions of the Shoshone. However, the threat of habitat loss remains high. Cheatgrass alters the fire regime and increases the probability for more frequent fires. This reduces the chance for sagebrush and native bunchgrasses to get re-established following a fire.

Risk Factors

Primary risk factors from forest management include: habitat fragmentation, prescribed fire, livestock grazing, and invasion by invasive plants.

Climate change has the potential to increase the risk of cheatgrass and could result in more frequent stand-replacement fires.

Habitat and Population Management Considerations

Retention of stands of mature sagebrush habitat at a watershed scale would provide for ensured habitat for populations of this species. Although to what level is unknown, it is assumed that within a range of what likely historically occurred is reasonable. This would also facilitate management toward ensuring sustainable and diverse conditions occur. If sagebrush was managed only for mature high canopy cover stands, the habitat is more at risk for losses due to wildfire, and does not provide the needed diversity of grasses/forbs. Mosaics created by prescribed burning may be most beneficial, though this could also be accomplished through other methods.

Paige and Ritter (1999) recommend small-scale, patchy prescribed burns for habitat diversity considerations, which should be conducted in the late spring or fall.

As mentioned previously, activities that have potential to expand cheatgrass or other invasive plants should be closely monitored to ensure further loss of habitat does not occur. Climate change may increase the spread of invasive weeds into sagebrush and alter fire regimes.

Roads can have negative effects on this species. Roads can reduce patch size, increase disturbance, and increase the risk for introduction of invasive plants. Additional road construction in large stands of sagebrush should be minimized.

Conservation Measures

A Candidate Conservation Agreement with Assurances is being prepared for the greater sage-grouse in Wyoming. When it is finalized the applicable conservation measures in the agreement will be incorporated into the revised forest plan. Until that time and for continued and improved management for sage-grouse and their habitat, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Birds in a Sagebrush Sea (Paige and Ritter 1999), Brewer’s Sparrow (*Spizella breweri*): A Technical Conservation Assessment (Holmes et al. 2005b), Sage Sparrow (*Amphispiza belli*): A Technical Conservation Assessment (Holmes et al. 2005a), and the Wyoming Greater Sage-Grouse

Conservation Plan (WGFD 2003) were reviewed to determine habitat needs. Since the Shoshone is not known to contain any leks and is outside of the core areas for sage-grouse, viability risk from forest management is likely low.

Conservation measures summarized include:

1. Prevent or reduce the risk for large stand-replacement fires in sagebrush habitat. Conduct prescribed burns that are small and patchy and maintain habitat diversity. Retain areas of large expanses of sagebrush habitat (minimize edge created).
2. In areas with cheatgrass and other invasive plants, avoid prescribed burns to reduce the risk of further spread.
3. Maintain native grasses and forbs through proper livestock grazing practices. Use rotational grazing systems to provide rest.
4. Consider resting burned areas from grazing to provide adequate regeneration of native vegetation.
5. Provide escape ramps at livestock watering facilities.
6. Maintain water abundance and associated vegetation at springs and seeps.
7. Prioritize and aggressively treat invasive weeds to prevent additional loss of sagebrush habitats.
8. Limit the number of new roads. Reclaim old roads that are not being used. Discourage road construction and other developments where it would reduce sagebrush habitat patch size.
9. Retain sagebrush habitat (no type conversions).
10. Re-establish sagebrush and native bunch grasses in habitat now dominated by invasive plants.
11. Provide a mosaic of open (5 percent) to moderate (25 percent) shrub canopy cover on the landscape.
12. Work collaboratively with the WGFD to ensure uniform and consistent application of Executive Order #2011-5 to maintain and enhance greater sage-grouse habitat and populations.

Monitoring Considerations

Sage-grouse populations are difficult to monitor outside of known lek sites. The Shoshone staff will continue to rely on WGFD lek observation data. On the Forest, habitat inventory and monitoring would be the best approach for this species. This could include monitoring prescribed fire treatments within sagebrush habitat.

Direct and Indirect Effects

Effects from Fuels Management and Livestock Grazing: Plan direction that could potentially influence the greater sage-grouse primarily involves fuels treatment activities, and livestock grazing. Differences in projected outputs by alternative for these activities are displayed in table 59.

Table 59. Activities and projected outputs that could potentially influence greater sage-grouse, by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Vegetation Treatment Acres Prescribed Fire (Total)	23,600	23,300	23,300	23,300	22,800	21,900	23,300
Grass	910	910	910	910	940	970	910
Sagebrush	2,730	2,700	2,720	2,710	2,600	2,420	2,700
Livestock Grazing							
Permitted AUMs (Cattle only)	55,500	55,500	31,000	55,500	57,890	61,100	55,500
Suitable Acres (Cattle only)	359,600	359,600	201,000	359,600	359,600	399,600	359,600

Alternative A: No action

As displayed in table 59, alternative A provides for a similar amount of fuels treatment in mixed-shrubland as alternatives B through G. These treatments primarily involve prescribed fire to reduce fuels hazards associated with mature, medium-density shrublands, including sagebrush. Because sagebrush is not a target species for fuels reduction on the planning area, potential impacts to occupied greater sage-grouse habitat from fuels reduction activities on the Shoshone are expected to be minor, but cannot be completely discounted.

Livestock grazing can have negative influences on greater sage-grouse if activities overlap occupied habitat. Impacts to riparian areas and understory forage plants are of particular concern because of their importance to breeding hens and new broods. As displayed in table 59, the permitted amount and area for cattle grazing does not differ between alternatives A, B, D and G. These activities are, therefore, predicted to have potential negative influences on the greater sage-grouse where activities and habitat overlap. On NFS land, however, these activities are expected to be minor because of the small amount of acreage involved and the conservation measures developed to minimize potential impacts. These conservation measures are similar across alternatives.

Action Alternatives: Alternatives B through G

As displayed in table 59, alternatives B through G provide for a similar amount of fuels treatment in mixed-shrubland, with a slight decrease in alternative E and greater decrease in alternative F. Because sagebrush is not a target species for fuels reduction on NFS land, potential influences on greater sage-grouse and other sagebrush-associated species are expected to be similar to alternative A.

As displayed in table 59, alternatives B, D, and G provide for the same amount of livestock grazing as alternative A. There are slight reductions in AUMs and area in alternative C, and a slight increase in AUMs in alternative D. The decrease in grazing area and stocking rates in alternative C may provide some secondary benefits to species such as the sage-grouse, while the increase in alternative D may be associated with a higher degree of habitat impacts to the species. Alternatives E and F maintain the highest permitted forage allocation to livestock and are, therefore, assumed to have a potential for negative impacts to occupied sage-grouse habitat if the activities overlap. Overall, however, potential impacts are expected to be similar and, based on site-specific areas where conservation measures are available, to alleviate identified problems. The conservation measures are similar across all alternatives.

Cumulative Effects

Little to no management activity occurs in sagebrush on the Shoshone, except for grazing. Although sagebrush has a limited distribution across the Forest, livestock grazing effects have occurred where grazing activities occur within active allotments. Fuels management may occur in areas, which include small stands of sagebrush but otherwise are dominated by other vegetation types. Management actions are conducted in sagebrush grasslands on the adjacent BLM lands where the objectives include opening up decadent stands to improve the grass/forb understory, to increase the age class diversity, to improve forage conditions, and habitat improvement. Overall, little influence or cumulative effects on sagebrush-associated species are expected on the Shoshone, because of limited activities in this habitat type.

Determination of Effects and Rationale for Determination – Greater Sage-grouse

All alternatives, including alternative A, **"may adversely impact individuals, but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide."** The rationale for this determination follows:

- No core habitat for greater sage grouse occurs on the Shoshone, but the Forest likely contains some late-summer brood-rearing habitat.
- The primary threats to sage-grouse populations involve habitat conversions and activities on private lands.
- Some activities could overlap occupied sage-grouse habitat and have negative influences on the species.
- The Shoshone adheres to the applicable conservation measures in the draft and/or final Greater Sage-Grouse Umbrella Candidate Conservation Agreement with Assurances for Wyoming and is taking action to maintain and improve habitat conditions.

Loggerhead shrike

Affected Environment

Loggerhead shrikes (*Lanius ludovicianus*) are considered a G4/S3 species by the State Natural Heritage ranking for Wyoming. Historical populations, distribution, or abundance are unknown for this species on the Shoshone. They are also ranked as level II priority species (monitoring) by Wyoming Partners in Flight for shrub-steppe habitat, and a Forest Service Region 2 sensitive species.

The loggerhead shrike is a widespread species in North America. It occurs across the Canadian prairies and into the United States, from central Washington to Virginia in the north, to the southern states and central plains (except for heavily forested higher mountains and higher portions of the desert) (Yosef 1996). It occupies a distinctive position in avian communities by preying on reptiles, mammals, and other birds, as well as invertebrates. Recent contractions in its range and declines in abundance have occurred in many areas of North America and in several different habitat types (Wiggins 2005). It is one of the few passerines whose population has declined continent-wide in recent decades (Yosef 1996). In Wyoming, it is found across the state, breeding in basin-prairie shrublands, sagebrush grasslands, mountain-foothills shrublands, pine-juniper woodlands, and woodland-chaparral (Nicholoff 2003).

They are an uncommon resident Forest-wide, and suitable breeding habitat appears to be rare on the Shoshone. There have been incidental observations on the Forest (WYNND 2010). However, none have been observed during recent surveys by the Rocky Mountain Bird Observatory from 2002 to 2009 (Hanni et al. 2009, Rehm-Lorber et al. 2010). There are currently no known population estimates or trends for the species on the Shoshone. At the State level, breeding bird surveys indicate a very slight declining trend (- 0.1), but the trend is not significant ($p = 0.97$) (WGFD 2010b). It is thought that population declines are due to habitat loss and conversion to cultivation and urbanization, loss of insect prey due to pesticide use, and pesticide contamination (especially on wintering grounds) (Nicholoff 2003).

Habitat Distribution and Condition on the Shoshone

In Wyoming, loggerhead shrikes are found in shrub-steppe, shrubland, and woodland habitats. They breed in basin-prairie shrublands, sagebrush grasslands, mountain-foothills shrublands, pine-juniper woodlands, and woodland-chaparral (Nicholoff 2003).

Loggerhead shrikes need relatively open habitat with scattered trees and shrubs for nesting and perch sites with low vegetation and bare ground for foraging (Nicholoff 2003). Shrikes also need barbed wire fences or thorny trees for impaling prey. Nesting habitat appears to be the most critical factor in habitat selection (Wiggins 2005). On the Shoshone, there are about 459,000 acres classified as grassland and 38,784 acres of sagebrush (USDA Forest Service 2012b).

The grassland cover type may be declining relative to sagebrush habitat. This may be due to fire suppression. However, the sagebrush cover type may not be above its historic range of variability (USDA Forest Service 2012a).

Livestock grazing in shrub-step habitats can influence loggerhead shrike habitat. It has been shown in short-grass prairie and shrub-steppe habitats, which are incidental on the Shoshone, that anything more than light grazing may degrade the habitat by eliminating grass and thereby reducing prey populations (Wiggins 2005). Livestock grazing may pose a significant threat to loggerhead shrike nesting habitat, as cattle often seriously damage thickets and small trees (Wiggins 2005). Also, conversion of shrub-steppe habitats to grasslands to benefit livestock grazing, decreases breeding habitat and increases fragmentation (Wiggins 2005). However, both rotational grazing systems and the later turn-out date of most livestock operations likely provides adequate areas of little influence from this effect. Fences associated with cattle allotments can provide needed hunting perches and barbed wire can provide needed locations for impaling prey.

Collisions with vehicles have been noted as a significant source of mortality and may be more severe in juvenile shrikes (Wiggins 2005). The loggerhead shrike foraging behavior along roadways, where perches are plentiful, and characteristically flying low, increases the chances of collisions with vehicles (Wiggins 2005). Most studies have focused on mortalities along highways. It is unknown to what extent forest roads may contribute to shrike mortality.

Risk Factors

Primary risk factors from forest management include: degradation and loss of nesting trees/shrubs, degradation of foraging habitat due to overgrazing by cattle, reductions in the prey base due to pesticides, and habitat fragmentation/degradation due to loss of shrub-steppe and sagebrush habitats. Off-forest risks include the loss of habitat due to agricultural conversion.

Habitat and Population Management Considerations

Retention of large blocks of grassland/sagebrush/shrub-steppe habitat at a watershed scale would provide habitat for populations of this species. It is assumed that the size and quantity of habitat blocks needed would be within a range of what historically occurred, and would be considered reasonable.

Prevent large-scale fires/prescribed burning in sagebrush habitat. Limit small-scale fires to non-breeding season. The guidelines developed for vegetation management in sage grouse habitat (WGFD 2003) would likely be adequate for this species.

Roads can have negative effects on these species. Roads can increase habitat fragmentation, and increase the risk of vehicle collisions. Additional road construction in large stands of sagebrush should be minimized.

Conservation Measures

To maintain and improve potential habitat for the loggerhead shrike on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Inclusion of these measures would continue to provide adequate habitat for this species and other shrub-steppe associated species, resulting in a low viability risk to this species.

Conservation measures summarized include:

1. Prevent or reduce the risk for large stand-replacement fires in sagebrush habitat. Conduct prescribed burns that are small and patchy and maintain habitat diversity. Retain areas of large expanses of sagebrush and shrub-steppe habitat.
2. To reduce the risk of further spread, prescribed burns should not occur in areas with cheatgrass and other invasive plants.
3. Maintain native grasses and forbs through proper grazing limitations. Use rotational grazing systems to provide rest and areas with reduced potential for cowbird parasitism. Provide for retention of about 50 percent of the current year’s growth of herbaceous vegetation for habitat in the following season.
4. Consider resting burned areas from grazing to provide adequate regeneration of native vegetation.
5. Prioritize and aggressively treat invasive weeds to prevent additional loss of sagebrush habitats.
6. Limit the number of new roads. Reclaim old roads that are not being used. Discourage road construction and other developments where it would reduce sagebrush habitat patch size.
7. Retain grassland and sagebrush habitats (no type conversions).
8. Re-establish sagebrush and native bunch grasses in habitat now dominated by invasive plants.
9. Provide a mosaic of open (5 percent) to moderate (25 percent) shrub canopy cover on the landscape.
10. Avoid or minimize insecticide use in shrubland habitats to maintain a food source for loggerhead shrikes (and other insectivores). Postpone all insecticide use until loggerhead shrikes and other insectivores have completed their breeding cycle.

Monitoring Considerations

Loggerhead shrikes can be monitored in conjunction with avian point count surveys. About 5 years of data collection would be needed to establish baseline trends. Habitat inventory and monitoring should also be considered in conjunction with population monitoring.

Direct and Indirect Effects

Effects from Fuels Management, and Livestock Grazing and Big Game: In occupied habitat, Plan direction that could potentially influence loggerhead shrikes primarily involves fuels treatment. Differences in projected outputs by alternative for these activities are displayed in table 60.

Table 60. Activities and projected outputs that could potentially influence loggerhead shrike, by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Vegetation Treatment Acres Prescribed Fire (Total)	23,600	23,300	23,300	23,300	22,800	21,900	23,300
Grass	910	910	910	910	940	970	910
Sagebrush	2,730	2,700	2,720	2,710	2,600	2,420	2,700
Livestock Grazing							
Permitted AUMs (Cattle only)	55,500	55,500	31,000	55,500	57,890	61,100	55,500
Suitable Acres (Cattle only)	359,600	359,600	201,000	359,600	359,600	399,600	359,600

Alternative A: No action

No direct or indirect effects on the loggerhead shrike are expected from alternative A because the species is not known to nest on the NFS portion of Shoshone. Suitable habitat for the loggerhead shrike is limited, with no breeding or local populations confirmed within the planning area.

Action Alternatives: Alternatives B through G

No direct or indirect effects on the loggerhead shrike are expected from implementation of any of the action alternatives because occurrence of this species is considered incidental to rare. Suitable habitat is for this species on NFS lands is limited, with no breeding or local populations confirmed within the planning area.

Cumulative Effects

No cumulative effects are expected because of lack of suitable nesting habitat.

Determination of Effects and Rationale for Determination – Loggerhead Shrike

All alternatives, including alternative A, are expected to have **No Impact** on the loggerhead shrike or its primary habitat. The rationale for this determination follows:

- The loggerhead shrike is considered incidental or extremely rare on Shoshone, with no breeding populations known to occur.

Northern harrier

Affected Environment

Northern harriers are (*Circus cyaneus*) considered a G5/S4B/S5N species by the State Natural Heritage ranking for Wyoming. There are two rankings for harriers in Wyoming for breeding and non-breeding birds (wintering in Wyoming). Historical populations, distribution or abundance are unknown for this species on the Shoshone.

Northern harriers are a holarctic species. In North America they breed in Alaska, through most of Canada, south to the Texas, Wisconsin, and the New England states (Macwhirter and Bildstein 1996). They winter throughout most of the conterminous United States, Mexico, and Central America. They breed throughout Wyoming in short-grass prairie and shrub-steppe and are considered a common species in the State (Slater and Rock 2005).

During surveys on the Shoshone from 2002 to 2008, the Rocky Mountain Bird Observatory detected three birds; one in 2006, two in 2007, and one in 2008 (Hanni et al. 2009). Trend data are not available for harriers on the Shoshone or in Wyoming. This is due to the low occurrence of harriers on survey routes.

Habitat Distribution and Condition on the Shoshone

In Wyoming, northern harriers are primarily found in short-grass prairie and shrub-steppe habitat. They appear to be area sensitive, thus preferring large unfragmented patches of habitat (Macwhirter and Bildstein 1996).

There are approximately 459,000 acres classified as grassland and 38,784 acres of sagebrush on the Shoshone (USDA Forest Service 2012b). Harriers are most likely to occur in the lower elevation shrub-steppe and grasslands.

The grassland cover type may be declining relative to sagebrush habitat. This may be due to fire suppression. However, the sagebrush cover type may not be above its historic range of variability (USDA Forest Service 2012a). Also, in some areas prescribed fire may be reducing the advancement of sagebrush and trees into grassland habitat.

Overgrazing in mixed and short-grass prairies is a major threat to harrier habitat. Most grazing causes the vegetation to become too short and open for harriers to utilize. However, both rotational grazing systems and the later turn-out date of most livestock operations likely provide adequate areas of little influence from this effect.

Risk Factors

The primary risk factors from forest management are livestock grazing and fire suppression. Other risk factors include cover type conversion to cropland and urban development. Both of these risk factors impact northern harrier habitat off of the Forest.

Habitat and Population Management Considerations

Retention of large blocks of grassland/sagebrush habitat at a watershed scale would provide for ensured habitat for populations of this species. Although to what level is unknown, it is assumed that within a range of what likely historically occurred is reasonable.

The use of prescribed fire and wildfire are important to reduce the impacts from shrub and tree encroachment into grasslands and to create a mosaic of habitats.

Conservation Measures

To maintain and improve potential habitat for northern harriers on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Inclusion of these measures would continue to provide adequate habitat for this species and other grassland associated species, resulting in a low viability risk to this species.

Conservation measures summarized include:

1. Allow for wildland fire use, where appropriate, to create a mosaic of habitats and reduce encroachment from shrubs and trees into grasslands.
2. Utilize prescribed fire to create a mosaic of habitats and to reduce tree and shrub encroachment.
3. In areas with cheatgrass and other invasive plants, avoid prescribed burns to reduce the risk of further spread.
4. Maintain native grasses and forbs through proper grazing limitations. Utilize rotational grazing systems.
5. Consider resting burned areas from grazing to provide adequate regeneration of native vegetation.
6. Prioritize and aggressively treat invasive weeds to prevent additional loss of grassland habitats.
7. Retain grassland and sagebrush habitats (no type conversions).
8. Re-establish native bunch grasses in habitat now dominated by invasive plants.

Monitoring Considerations

Of most importance for this species would be to attain distribution information for the Shoshone. This could be done utilizing roadside raptor surveys within suitable habitat. Two potential key areas to survey would be the arid grasslands in the South Fork Shoshone River drainage and Sunlight Basin.

Direct and Indirect Effects

Effects from Livestock Grazing and Big Game and Fire Management: Plan direction that could potentially influence the northern harrier primarily involves livestock grazing, and fire suppression. Differences in projected outputs by alternative for these activities are displayed in table 61.

Table 61. Activities and projected outputs that could potentially influence northern harrier, by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Vegetation Treatment Acres Prescribed Fire (Total)	23,600	23,300	23,300	23,300	22,800	21,900	23,300
Grass	910	910	910	910	940	970	910
Sagebrush	2,730	2,700	2,720	2,710	2,600	2,420	2,700
Wildfire Acres	185,200	182,900	184,100	183,700	175,000	161,000	182,900
Livestock Grazing							
Permitted AUMs (Cattle only)	55,500	55,500	31,000	55,500	57,890	61,100	55,500
Suitable Acres (Cattle only)	359,600	359,600	201,000	359,600	359,600	399,600	359,600

Alternative A: No action

As displayed in table 61, alternative A provides for a similar amount of fuels treatment in mixed-shrubland as alternatives B through G. These treatments primarily involve prescribed fire to reduce fuels hazards associated with mature, medium-density shrublands, including sagebrush. Because sagebrush is not a target species for fuels reduction on the planning area, potential impacts to northern harrier from fuels reduction activities on the Shoshone are expected to be minor but cannot be completely discounted.

Wildland fire use is not a planned output in any of the alternatives. However, it will be utilized as a tool to allow natural disturbances to occur as opportunities arise. It is estimated that all alternatives may allow from 161,400 to 185,200 acres of wildland fire use. Because sagebrush is not a target species for wildland fire use on the planning area, potential impacts to northern harrier from this activity on the Shoshone is expected to be minor, but cannot be completely discounted.

Cattle grazing on the Shoshone is likely to overlap potential habitat for the northern harrier. As displayed in table 61, the permitted amount and area for cattle grazing does not differ among alternatives A, B, D and G. These activities are, therefore, predicted to have potential negative influences on individual breeding pairs of northern harriers where activities and habitat overlap. On NFS land, however, these activities are expected to be minor because of the small amount of acreage involved and the conservation measures developed to minimize potential impacts. These conservation measures are similar across alternatives.

Action Alternatives: Alternatives B through G

As displayed in table 61, alternatives B through E and G provide for a similar amount of fuels treatment in mixed-shrubland, with a slight decrease in alternative E and greater decrease in alternative F. Because sagebrush is not a target species for fuels reduction of NFS land, potential influences on northern harrier and other sagebrush-associated species are expected to be similar to alternative A.

As displayed in table 61, alternatives B and D and G provide for the same amount of livestock grazing as alternative A. There are slight reductions in AUMs and area in alternative C, and a slight increase in AUMs in alternative D. The decrease in grazing area and stocking rates in alternative C may provide some secondary benefits to species such as the northern harrier, while the increase in alternative D may be associated with a higher degree of habitat impacts to the species. Alternatives E and F maintain the highest permitted forage allocation to livestock and are, therefore, assumed to have a potential for negative impacts to northern harrier habitat if the activities overlap. Overall, however, potential impacts are expected to be similar and, based on site-specific areas where conservation measures are available, to alleviate identified problems. The conservation measures are similar across all alternatives.

Cumulative Effects

Little to no management activity occurs in sagebrush on the Shoshone, except for grazing. Although sagebrush has a limited distribution across the Forest, livestock grazing effects have occurred where grazing activities occur within active allotments. Fuels management may occur in areas, which include small stands of sagebrush but otherwise are dominated by other vegetation types. Management actions are conducted in sagebrush grasslands on the adjacent BLM lands where the objectives include opening up decadent stands to improve the grass/forb understory, to increase the age class diversity, to improve forage conditions, and habitat improvement. Overall, little influence or cumulative effects on sagebrush-associated species is expected on the Shoshone, because of limited activities in this habitat type.

Determination of Effects and Rationale for Determination – Northern Harrier

All alternatives, including alternative A, **“may adversely impact individuals, but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide.”** The rationale for this determination follows:

- The primary threats to northern populations associated with the Shoshone involve habitat conversions and activities on private lands.
- Some activities could overlap occupied northern harrier habitat and have negative influences on the species.
- The Shoshone Plan incorporated guidance provided to maintain and improve sagebrush habitat conditions.

Short-eared owl

Affected Environment

Short-eared owls (*Asio flammeus*) are considered a G4/S3 species by the State Natural Heritage ranking for Wyoming. Historical populations, distribution, and abundance are unknown for this species on the Shoshone. They are ranked as level I priority species (conservation action) by Wyoming Partners in Flight for short-grass prairies and meadow habitats, a USFWS Bird of Conservation Concern, and a Forest Service Region 2 sensitive species.

The short-eared owl occurs on all continents except Australia and Antarctica. In North America, the species ranges from northern Alaska to northern Labrador, south to California, Utah, Colorado, Missouri, Illinois, Ohio, and Virginia (NatureServe 2011). In Wyoming, they are considered uncommon, but may breed almost anywhere statewide in low-elevation grasslands and marshy areas. Short-eared owl numbers can vary strongly from year-to-year with local breeding numbers increasing dramatically during periods of high rodent abundance (Wiggins 2004). They primarily eat rodents but also take other small mammals, birds, and insects (Wiggins 2006). Short-eared owls forage primarily by flying low, typically into wind, and dropping down onto prey, sometimes after a brief hover (Wiggins 2004). The population status of this species is difficult to assess because they are nomadic and prone to annual fluctuations in numbers (Wiggins 2004).

They are an uncommon resident Forest-wide, and suitable breeding habitat appears to be rare on the Shoshone. There have been no observations on the Forest, but a few in lower elevations just outside the Forest boundary (WYNND 2010). Also, there have been none observed during recent surveys by the Rocky Mountain Bird Observatory from 2002 to 2009 (Hanni et al. 2009, Rehm-Lorber et al. 2010). Trend data are not available for short-eared owls on the Shoshone or in Wyoming. This is due to the low occurrence of short-eared owls on survey routes.

Habitat Distribution and Condition on the Shoshone

Short-eared owls can be found scattered across Wyoming in open grassland, shrub-steppe, and marsh habitats, with an abundance of rodents (Nicholoff 2003). Short-eared owls require relatively large tracts of these habitat types for nesting and foraging. They appear to be particularly sensitive to habitat loss and fragmentation (Wiggins 2006). As ground nesters, they are susceptible to the increased predation pressure associated with fragmented habitats and near rural developments (Wiggins 2006). This is because habitat fragments contain a greater proportion of edge habitats that are favored by predators (Wiggins 2004).

There are about 459,000 acres classified as grassland, 13,981 acres of willow, and 38,784 acres of sagebrush on the Shoshone (USDA Forest Service 201b). Short-eared owls are most likely to occur in the lower elevation shrub-steppe, open riparian areas, and grasslands.

Overgrazing in mixed and short-grass prairies is a major threat to short-eared owl habitat. Most grazing causes the vegetation to become too short and open for owls to utilize for both nesting and foraging. Also, intensive grazing around wetlands can be detrimental to breeding sites (Nicholoff 2003). However, rotational grazing systems, the later turn-out date, and watershed protection of most livestock operations likely provide adequate areas of little influence from this effect.

Risk Factors

Habitat fragmentation is the primary risk factor to short-eared owls. Any forest management activities, such as livestock grazing or road development, which cause fragmentation, may affect short-eared owls. Other risk factors include fire suppression, cover type conversion to cropland and urban development. All of these risk factors impact short-eared owl habitat on and off of the Forest.

Habitat and Population Management Considerations

Retention of large blocks of grassland/wet meadow/sagebrush habitat at a watershed scale would provide habitat for populations of this species. It is assumed that the size and quantity of habitat blocks needed would be within a range of what historically occurred, and would be considered reasonable.

Livestock grazing can fragment short-eared owl habitat. Improving existing grassland/wetland quality by adjusting livestock grazing to achieve a balanced mix of short/medium/tall grass heights would help improve habitat if breeding is found on the Shoshone.

The use of prescribed fire and wildfire are important to reduce the impacts from shrub and tree encroachment into grasslands and to create a mosaic of habitats.

Roads can have negative effects on short-eared owls. Roads can increase habitat fragmentation. Additional road construction in large grasslands and large stands of sagebrush should be minimized.

Conservation Measures

To maintain and improve potential habitat for the short-eared owl on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Inclusion of these measures would continue to provide adequate habitat for this species and other short-grass prairie and grassland associated species resulting in a low viability risk to this species.

Conservation measures summarized include:

1. Allow for wildland fire use, where appropriate, to create a mosaic of habitats and reduce encroachment from shrubs and trees into grasslands.
2. Utilize prescribed fire to create a mosaic of habitats and to reduce tree and shrub encroachment.
3. In areas with cheatgrass and other invasive plants, avoid prescribed burns to reduce the risk of further spread.
4. Maintain wetlands and native grasses and forbs through proper grazing limitations. Utilize rotational grazing systems.
5. Rest burned areas from grazing to provide adequate regeneration of native vegetation.
6. Prioritize and aggressively treat invasive weeds to prevent additional loss of grassland/wetland habitats.
7. Limit the number of new roads. Reclaim old roads that are not being used. Discourage road construction and other developments where it would reduce habitat patch size.
8. Retain grassland, wetland, and sagebrush habitats (no type conversions).

Monitoring Considerations

The highest priority for this species would be to obtain distribution information on the Shoshone. This could be done utilizing roadside raptor surveys within suitable habitats.

Direct and Indirect Effects

Effects from Livestock Grazing and Big Game and Fire Management: Plan direction that could potentially influence the short-eared owl primarily involves livestock grazing and fire suppression. Differences in projected outputs by alternative for these activities are displayed in table 62.

Table 62. Activities and projected outputs that could potentially influence short-eared owl, by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Vegetation Treatment Acres Prescribed Fire (Total)	23,600	23,300	23,300	23,300	22,800	21,900	23,300
Grass	910	910	910	910	940	970	910
Sagebrush	2,730	2,700	2,720	2,710	2,600	2,420	2,700
Willow	110	110	110	110	110	100	110
Wildfire Acres	185,200	182,900	184,100	183,700	175,000	161,000	182,900
Livestock Grazing							
Permitted AUMs (Cattle only)	55,500	55,500	31,000	55,500	57,890	61,100	55,500
Suitable Acres (Cattle only)	359,600	359,600	201,000	359,600	359,600	399,600	359,600

Alternative A: No action

No direct or indirect effects on the short-eared owl are expected from alternative A because the species is not known to nest on the Shoshone. Suitable habitat for the short-eared owl is limited, with no breeding or local populations confirmed on Forest lands within the planning area.

Action Alternatives: Alternatives B through G

No direct or indirect effects on the short-eared owl are expected from implementation of any of the action alternatives because occurrence of this species is considered incidental to rare. Suitable habitat for this species is limited on the Shoshone, with no breeding or local populations confirmed on NFS lands within the planning area.

Cumulative Effects

No cumulative effects are expected because of lack of suitable nesting habitat.

Determination of Effects and Rationale for Determination – Short-eared Owl

All alternatives, including alternative A, are expected to have **No Impact** on the short-eared owl or its primary habitat. The rationale for this determination follows:

- The short-eared owl is considered incidental or extremely rare on Shoshone, with no breeding populations known to occur.

Riparian (lakes, streams, marshes) mammals

River otter

Affected Environment

The North American river otter (*Lontra canadensis*) is considered a G5/S3 species by the State Natural Heritage ranking for Wyoming. Historical populations, distribution or abundance are unknown for this species on the Shoshone.

Historically, river otters occupied most major drainages in Canada and the continental United States. Due to unregulated trapping, rivers otters were once extirpated from much of their range. Through recovery efforts, river otters have re-populated much of their former range. They are still absent in most of the western Great Plains and the southwestern United States (Boyle 2006). In Wyoming, they were extirpated from most of the state, except Yellowstone and Grand Teton National Parks. Currently, there are scattered populations in the western two-thirds of the state, including on the Shoshone.

No trend data are available for the Shoshone. In Wyoming, the population is reported to be increasing (Raesly 2001). Formal surveys have not been done on the Shoshone for this species. Past observations were primarily along the North Fork of the Shoshone River (WYNDD 2010).

Habitat Distribution and Condition on the Shoshone

In the intermountain west, river otters primarily occupy stream associated habitats. They prefer valley streams to mountain streams. On the Shoshone, valley streams are limited. The North Fork and South Forks of the Shoshone River likely provide the most suitable habitat.

Both of these watersheds are in good or excellent condition (USDA Forest Service 2008). Those in good condition reflect, to varying degrees, past and present activities. Most of the concern in these good condition watersheds is related to historic uses such as heavy grazing or roading associated with motorized recreation and timber harvest. These watersheds are generally on an improving trend due to recent and ongoing management actions. Continued recovery will occur naturally or through revised management.

Risk Factors

The primary risk factors from forest management are timber harvest and recreational activities. Other risks include water development, water pollution, and urbanization. None of these other risks have a major role on river otter populations on the Shoshone, but they have a larger role downstream from the Shoshone.

Natural risk factors would include flooding and drought, both of which could degrade habitat and reduce prey availability. Drought could affect river otters for a long period of time and over a large area.

Habitat and Population Management Considerations

Timber harvest can reduce riparian cover, increase stream siltation, and reduce woody debris. River otters in Region 2 may be especially vulnerable because of their linear habitat. Timber harvest should be carefully managed in these areas to maintain adequate habitat components.

Recreational activities present river otters with additional risks such as increased risk for mortality from roadkill, disturbance from domestic dogs, and incidental trapping (Boyle 2006).

Conservation Measures

To maintain and improve the river otter population and potential habitat on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Since this species is of low viability concern based on current habitat condition, it is recognized that inclusion of these measures would continue to provide adequate habitat for this species.

Conservation measures summarized include:

1. Manage dispersed camping and recreational uses so that degradation of riparian areas does not occur, and achieve improvements in existing degraded areas.
2. Maintain forested cover along edges of riparian areas where it naturally exists.
3. Locate roads and trails outside of riparian areas to prevent loss of habitat.
4. Re-vegetate decommissioned roads within riparian areas.
5. Use standard water quality conservation practices when conducting activities within riparian areas, including timber harvest or road and trail construction/reconstruction.

Monitoring Considerations

The most beneficial monitoring for river otters would be to improve information on known observations and distribution on the Shoshone. Surveys could be completed along stream reaches that provide potential habitat.

Direct and Indirect Effects

Effects from Water Management and Recreation Management: Plan direction that could potentially influence the river otter primarily involve water management activities (i.e., water diversions, deletions), and recreational activities. Differences in identified projected outputs by alternative for these activities are displayed in table 63.

Table 63. Activities and projected outputs that could potentially influence river otter by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Miles of open motorized roads and trails-Summer(total)	940	940	820	940	940	940	940
Special areas and designations	Five wilderness areas One wilderness study area	No new wilderness recommen-dation	Recommends 628,800 acres wilderness additions	Recommends 194,500 acres wilderness additions	No new wilderness recommen-dation	No new wilderness recommen-dation	No new wilderness recommen-dation
	One special interest area	Proposes 3 new special interest areas	Proposes 3 new special interest areas	Proposes 3 new special interest areas	Proposes 1 new special interest area (Kirwin)	Proposes no new special interest areas	Proposes 3 new special interest areas
	One special management unit One research natural area	Proposes 6 new research natural areas – Beartooth Butte, Lake Creek, Grizzly Creek, Sheep Mesa, Arrow Mountain, Roaring Fork	Proposes 8 new research natural areas - Beartooth Butte, Lake Creek, Pat O'Hara, Bald Ridge, Grizzly Creek, Sheep Mesa, Arrow Mountain, Roaring Fork	Proposes 8 new research natural areas - Beartooth Butte, Lake Creek, Pat O'Hara, Bald Ridge, Grizzly Creek, Sheep Mesa, Arrow Mountain, Roaring Fork	Proposes 3 new research natural areas - Sheep Mesa, Lake Creek, and Arrow Mountain	Proposes no new research natural areas	Proposes 8 new research natural areas - Beartooth Butte, Lake Creek, Pat O'Hara, Bald Ridge, Grizzly Creek, Sheep Mesa, Arrow Mountain, Roaring Fork
	One wild/scenic river	Protects 16 eligible wild/scenic river segments	Protects 16 eligible wild/scenic river segments	Protects 16 eligible wild/scenic river segments	Protects 16 eligible wild/scenic river segments	Protects 16 eligible wild/scenic river segments	Protects 16 eligible wild/scenic river segments

Alternative A: No action

As displayed in table 63, although differences among alternatives are difficult to evaluate in regard to potential influences on river otters, it is possible that alternative A provides as much potential habitat protection for the species as alternatives B, E, F, and G because it provides less indirect influences from motorized recreation that could potentially influence water quality. Alternative A does not identify any additional waterbodies for protection under special area designations such as Wild and Scenic River corridors that may better control some human-associated impacts. Overall, however, otters continue to expand and the effect from all alternatives is expected to be secondary to other factors such as drought and private water management activities.

Action Alternatives: Alternatives B through G

All action alternatives (B through F) are expected to allow the continued expansion of river otters into potential habitat on Shoshone. However, alternatives B, C, D and G allow for additional protective measures above baseline conditions that may indirectly benefit the river otter. Examples of these include better control of potential erosion from motorized vehicle use and more potential protection of riverine habitat from special area designations. Although continued expansion of river otters is also expected under alternatives E and F, these alternatives may require more site-specific mitigation measures, because they allow more active management.

Cumulative Effects

Habitat conditions in most of the smaller perennial streams on the Shoshone have continued to improve over time, but they still do not support populations of closely associated species such as beaver. Restoration and expansion of beaver would result in an increasing trend in potential river otter habitat due to the close association between these species.

Determination of Effects and Rationale for Determination – River Otter

All alternatives, including alternative A, **“may adversely impact individuals, but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide.”** The rationale for this determination follows:

- The North Fork and South Fork of the Shoshone River provide the best suitable habitat, which is in good or excellent condition
- The primary activities influencing river otters revolve around water management and natural factors such as drought.
- Water management activities are managed to reduce impacts on aquatic species; however, reduced water flows have direct and indirect influences on prey species and habitat conditions.

Water vole

Affected Environment

Water voles (*Microtus richardsoni*) have a heritage ranking of G5/S2 and are a Region 2 sensitive species. Sensitive status is largely based on perceived impacts from livestock grazing and other impacts focused in riparian areas. Historical populations, distribution or abundance are unknown for this species on the Shoshone.

Water voles only occur in the northwestern United States, and southern British Columbia and Alberta. Within Region 2, water voles are only known to occur on the Shoshone and Bighorn National Forests. On the Shoshone, they are known to occur in several of the major watersheds including: the Clarks Fork River, North Fork Shoshone River, South Fork Shoshone River, Greybull River, Upper Wind River, Popo Agie River, and the Sweetwater River watershed. Presence in the remaining watersheds on the Shoshone is suspected but not proven via capture or observation (Klaus and Beauvais 2004).

The Shoshone apparently supports a large number of water voles. This suggests a relatively high probability that they will persist here for a long time. Long-term viability of water voles on the Shoshone is further increased by the potential immigration of individuals from populations to the north in Montana, to the west in Yellowstone National Park, and to the south in the Bridger-

Teton National Forest (Klaus and Beauvais 2004). Therefore, water vole populations on the Shoshone appear to be secure.

No trend data are available for water voles on the Shoshone. One location in the Beartooth Mountains on the Shoshone has maintained stable female fecundity estimates and stable, possibly even increasing, abundance estimates for 30 years (Klaus and Beauvais 2004).

Habitat Distribution and Condition on the Shoshone

Water voles are closely associated with alpine and subalpine streams. They have been captured along stream courses from about 8,200 to 10,520 feet in elevation. They are typically found in linear colonies along spring fed or glacial streams with gravel bottoms with about a 5-degree slope (Klaus 2003).

Habitat for water voles could be considered abundant on the Shoshone. Based on currently known distribution and distribution modeling (Keinath et al. 2010), water voles have a medium to high probability of occurring in high-elevation riparian meadows on the Shoshone.

All of the watersheds mentioned earlier are in good or excellent condition, with the exception of a subwatershed in Crandall Creek (USDA Forest Service 2008). Lodgepole Creek was highly impacted by the 1988 Clover Mist Fire and a damaging thunderstorm and flash flood event in 1989. These events resulted in significant changes in upland and stream channel stability. Recovery of this subwatershed will take time. This subwatershed is likely at too low of elevation to support water voles.

Riparian habitat is mostly stable and existing protection measures should prevent the loss of any of this habitat type. The conditions of some riparian systems on the Shoshone are outside of their historic ranges of variability due to past impacts from tie hacking, grazing, and water diversions (USDA Forest Service 2009).

The Shoshone has been improving its management of riparian and wetland areas for the past planning period through improved livestock management efforts in coordination with grazing permittees. Historic levels of livestock grazing were very high in the early 1900s, and have been steadily reduced to bring stocking rates more in line with carrying capacity. Many of the sheep allotments on the Shoshone have been closed or converted to cattle.

Water voles have persisted on the Shoshone despite high historic levels of grazing that likely reduced vegetative cover along riparian areas, compacted soils, incised streams and eroded streambanks. These effects varied by stream reach. Reductions in both cattle and particularly sheep grazing from historical levels have likely improved riparian areas.

Risk Factors

The primary risk factor from forest management is livestock grazing in alpine and sub-alpine riparian areas.

Habitat and Population Management Considerations

Maintaining potential habitat for this species includes maintaining adequate amounts of woody vegetation (willow, aspen, etc.) along stream courses and maintaining well-developed overhanging streambanks with non-compacted soils where burrows can be constructed. High-elevation riparian management can be accomplished through proper livestock grazing management. Currently, a vast majority of wilderness on the Shoshone is not within active allotments.

Overgrazing of the streamside vegetation is the biggest concern. Prolonged and intense livestock grazing, even in the absence of grazing by native species, can eliminate water vole habitat by destroying streambanks, widening stream channels, lowering local water tables, eroding soil, and altering nutrient cycling (Klaus and Beauvais 2004).

Conservation Measures

To maintain and improve the water vole population and potential habitat on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Since this species appears to be wide-spread and most of its habitat is in wilderness, inclusion of these measures would continue to provide adequate habitat for this species.

Conservation measures summarized include:

1. Manage livestock grazing so that potential habitat is improved or maintained, particularly during drought years. Retention of vegetative cover at the stream edge would be the primary emphasis factor, as well as maintaining the ecological processes that provide for the long-term maintenance of these habitats.
2. Manage dispersed camping and recreational uses such that degradation of riparian areas does not occur, and achieve improvements in existing degraded areas.
3. Locate roads and trails outside of riparian areas to prevent loss of habitat.

Monitoring Considerations

The most beneficial monitoring item for water voles would be to monitor populations in known occupied habitat. Also, selected representative populations in grazed and un-grazed (by livestock) occupied habitat could be surveyed at 5-year intervals to determine continued persistence of voles for this next planning period.

Monitoring to determine compliance with and effectiveness of livestock management practices on riparian vegetation and physical stream characteristics would also be beneficial at the Forest-wide scale. Evaluations of the maintenance or improvement of habitat in representative sites Forest-wide would accomplish this need.

Direct and Indirect Effects

Effects from Livestock Grazing and Big Game and Summer Motorized Recreation Use: Plan direction that could potentially influence water voles primarily involves livestock grazing and summer motorized recreation. Differences in projected outputs by alternative for these activities are displayed in table 64.

Table 64. Activities and projected outputs that could potentially influence water vole, by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Livestock Grazing							
Permitted AUMs (Total)	55,900	55,900	31,400	55,900	58,300	61,500	55,900
Suitable Acres (Total)	375,400	375,400	216,800	375,400	375,400	415,400	375,400
Motorized Recreation-Summer (Acres available)	570,600	570,800	322,400	350,600	656,500	823,900	570,800

Alternative A: No action

Livestock grazing can have negative influences on water voles when activities overlap suitable habitat. Impacts to riparian areas and over story and understory forage plants are of particular concern because of their importance to water voles in meeting species requirements for cover and food. As displayed in table 64, the permitted amount and area for cattle grazing does not differ among alternatives A, B, D, and G. These activities are, therefore, predicted to have potential negative influences on the water voles where activities and habitat overlap. Livestock could continue to impact certain riparian habitats that this species needs.

As displayed in table 64, although differences among alternatives are difficult to evaluate in regard to potential influences on water voles, it is possible that alternative A provides as much potential habitat protection for the species as alternatives B, E, F, and G because it provides less indirect influences from motorized recreation that could potentially influence riparian streambanks and vegetation.

Action Alternatives: Alternatives B through G

In alternatives B through G, there will likely continue to be some problem areas, although there will be more tools (adaptive management strategies) available to fix these problems areas and prevent new ones from starting. Alternatives B, D, and G maintain the same amount of suitable acres and AUMs; as the current Forest Plan (alternative A). Alternative C reduces the total AUMs and would have the least impact on habitat conditions for the water vole. Alternative F increases AUMs substantially compared to all of the other alternatives and would have the potential for the greatest impact to riparian habitat. All alternatives are expected to allow the continued expansion of water voles into potential habitat on Shoshone; however, more focused management compliance would be needed under alternative F.

As displayed in table 64, alternative C offers fewer potential riparian habitat disturbances than the other alternatives from summer motorized recreation because of decreases in the amount of motorized use area. Alternative D offers the next fewest motorized acres, while alternative F offers the highest amount of motorized acreage. Alternatives B, E, and G offer a balance between the other action alternatives. Reductions in open motorized areas should decrease the potential for loss of habitat due to off road use.

Cumulative Effect

Cumulative effects over and above the direct and indirect effects mentioned above are minimal on the Shoshone due to the limited amount of private land within the Forest boundary. There are no known proposals for additional development of any of these lands. Lands adjacent to the Forest are primarily private or BLM. Private lands receive minimal pressure from urban development trends. These adjacent lands would likely continue to receive impacts from livestock grazing and water depletions that are ongoing. These activities should not impact habitat on the Forest, but may increase the value of the Forest’s riparian habitat. Individual species protections would be ensured through preparation of site-specific NEPA analysis and biological evaluations, with protection offered through Forest-wide standards and guidelines.

Determination of Effects and Rationale for Determination – Water Vole

All alternatives, including alternative A, **"may adversely impact individuals, but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide."** The rationale for this determination follows:

- There is uncertainty about some recreational uses, an expanded road network, and potential ground disturbances in riparian habitat.
- These activities would only occur on up to 34 percent of the forested acres and still leave larger areas in "intact" habitat conditions.

Riparian (lakes, streams, marshes) birds

Bald eagle

Affected Environment

The bald eagle (*Haliaeetus leucocephalus*) has a natural heritage ranking of G4/S3B/S5N. They have separate rankings in Wyoming for breeding birds and non-breeding birds (wintering in Wyoming). Bald eagles were delisted from the Endangered Species Act in 2007. Historical populations, distribution, or abundance are unknown on the Shoshone.

Bald eagles are found throughout the United States and Canada where suitable habitat exists. They winter in coastal areas, along major inland river systems and in the intermountain west, which includes Wyoming (Buehler 2000). Bald eagles are known to occur on the Shoshone, primarily as foraging birds.

Bald eagles nesting in northwestern Wyoming are part of a significant nesting population in the Rocky Mountains (WGFD 2010a, b). This population extends into Idaho and Montana. Bald eagles don't regularly nest on the Shoshone because nesting habitat is very limited. All active nests in recent years have been on adjacent BLM land (USDA Forest Service 2011). However, an active nest was located on the North Fork of the Shoshone in 2013. Eagles are known to forage along the North and South Forks of the Shoshone River.

No trend data are available that is specific to the Shoshone. Statewide population objective levels have been exceeded since 1987, and the State population continues to increase (WGFD 2010a, b). Within the Greater Yellowstone Ecosystem, carrying capacity for eagles may have been reached in Grand Teton National Park and along the Snake River in Wyoming.

Habitat Distribution and Condition on the Shoshone

Bald eagles typically nest in tall trees near large bodies of water. The majority of wintering bald eagles are found near open water where they feed on fish and waterfowl. When suitable conditions exist, particularly a lack of human disturbance, wintering bald eagles will forage in terrestrial habitats where they prey on small to medium-sized mammals (e.g., prairie dogs, jackrabbits); they also scavenge roadkill, winter mortalities of big game, and livestock (Travesky and Beauvais 2004).

Potential nesting habitat occurs primarily along the North and South Forks of the Shoshone River and possibly near other larger rivers and lakes on the Forest. Winter habitat would include these same areas, as well as, big game winter ranges and major roadways (scavenging road kill).

Risk Factors

The primary risk factors from forest management are recreational disturbance to nesting and winter roosting bald eagles. Other risk factors include contaminants, residential development and collisions with power lines.

Habitat and Population Management Considerations

Retaining large trees along major rivers and lakes would be the most important forest management emphasis for bald eagle habitat.

Reducing human disturbance around nest and winter roost sites is also important.

Conservation Measures

To provide management for this species to maintain or improve its potential distribution on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Given the lack of potential nesting habitat on the Forest, overall viability risk from forest management to bald eagles is low.

Conservation measures summarized include:

1. Known nest and winter roost sites will be protected per the National Bald Eagle Management Guidelines (USFWS 2007).

Monitoring Considerations

Continue to cooperate with the WGFD to monitor bald eagle nests.

Direct and Indirect Effects

Effects from Winter Motorized Use: The Shoshone primarily provides habitat for bald eagles during the non-breeding (winter) period. These eagles have migrated from their northern breeding grounds in search of food supplies such as fish, waterfowl, or carrion. Although numbers may vary depending upon winter severity and local food supplies, wintering eagles on the Shoshone primarily occur along major river corridors such as the North and South Forks of the Shoshone River, Greybull and Wind River. The primary activities that could potentially influence primary habitat or prey species for the bald eagle include motorized and non-motorized recreation, Differences in projected output for these activities by alternative are displayed below in table 65.

Table 65. Activities and projected outputs that could potentially influence bald eagles, by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Miles of open motorized roads and trails (Winter total)	670	690	230	680	690	970	690
Miles of snowmobile trails	280	280	160	280	280	370	280
Motorized Recreation-Winter(Acres available)	887,600	481,2000	103,000	323,800	526,400	825,200	592,400

Alternative A: No action

Disturbance from motorized and non-motorized recreation can be an impact on bald eagles in winter concentration areas. As displayed in table 65, alternative A could offer more high-use recreation areas than any of the action alternatives; however, this could be due to how the acres were calculated during the 1986 Forest Plan. Most likely, alternative F will have similar potential effects to bald eagles, depending upon the type, timing, and scope of the activity. Greater winter travel via snowmobiles could theoretically disturb eagles in winter concentration areas and/or while they are roosting or foraging.

Wildlife habitat management to improve big game winter range is projected to occur on 4,000 other big game species that may be an important winter food source for bald eagles in some localized areas. Benefits can be expected on a site-specific basis.

All alternatives offer the same amount of riparian habitat improvement over the life of the Plan. These activities may benefit prey species for the bald eagle if it occurs in areas where fish or waterfowl species will benefit from the actions.

Action Alternatives: Alternatives B through G

As displayed in table 65, the action alternatives differ in the amount of undisturbed habitat potentially available for the bald eagle. Of the action alternatives, alternative F offers the largest amount of acres available to winter motorized recreation. Alternatives C and D offer the least amount of acres available for motorized travel. Alternatives C and D, therefore, offer the highest probability of maintaining habitat options for bald eagles that depend on minimal human disturbance. Alternatives B, E and G offer a balance between the three other action alternatives, but also provide more undisturbed habitat and less potential disturbances than no action. Reductions in open motorized areas during winter should decrease the potential for displacement or disturbances to bald eagles during wintering periods.

Wildlife habitat management to improve big game winter range is projected to occur on 4,000 acres in all of the action alternatives during the life of the Plan. This projection includes bighorn sheep and other big game species that may be important food sources for bald eagles, particularly during the winter period. Benefits can be expected on a site-specific basis.

Cumulative Effects

Most of the winter eagle population is aggregated along specific river corridors that have been identified as bald eagle winter concentration areas. Use of other waterbodies by wintering bald eagles is also prohibited by the small amount of area that remains unfrozen or provides predictable food supplies during the winter periods.

Although minor disturbances to individual bald eagles on the Shoshone may occur, no cumulative effects have been identified and the population may be stabilizing to the available habitat and food supply.

Determination of Effects and Rationale for Determination – Bald Eagle

All alternatives, including alternative A, **“may adversely impact individuals, but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide.”** The rationale for this determination is as follows:

- Both winter and summer populations of bald eagles occur on or adjacent to the Shoshone National Forest. However, winter is the primary time of use in concentration areas around river drainages.
- All alternatives involve activities that may influence bald eagle or their primary prey species.
- Impacts are expected to be minimal and localized to individuals.

Harlequin duck

Affected Environment

While considered a G4 species globally (relatively common), Harlequin ducks (*Histrionicus histrionicus)* are considered an S1 species by the State Natural Heritage ranking for Wyoming. This is primarily due to its restricted range. Historical populations, distribution, or abundance are unknown for this species on the Shoshone.

Harlequin ducks are known primarily from the northwestern and northeastern portions of North America and southern Greenland. In its western range, populations may have declined, though breeding populations in the Rocky Mountain Region appeared stable during the 1990s (Robertson and Goudie 1999). Their distribution in Wyoming is restricted to the northwestern portion of the state. Harlequins are known to occur on the Shoshone and in the Greater Yellowstone Ecosystem, as recorded in recent WGFD surveys (WGFD 2003, 2008, 2009).

Based on surveys in 2002, the WGFD (2009) estimated that there are 70 breeding pairs in Wyoming. In 2007, these areas were resurveyed and the number of pairs observed was substantially lower (-67 percent) (WGFD 2009). On the Forest, The WGFD (2009) also found fewer pairs than during surveys done in 2002. It should be noted that 2007 was a low- water year, so breeding pairs may have departed early in response to those conditions.

Habitat Distribution and Condition on the Shoshone

Harlequin ducks use fast-moving stream systems for breeding habitat and winter along rocky coastlines. They typically nest on mid-stream islands (Wiggins 2005).

Based on past observations, Harlequins are known to occur along several rivers on the Shoshone including; N. Fork Shoshone River, S. Fork Shoshone River, Torrey Creek, Jakey's Fork, Crandall Creek, Hoodoo Creek, Clarks Fork, Lake Creek, Sunlight Creek, and Greybull River.

All of these watersheds are in good or excellent condition, with the exception of a subwatershed in Crandall Creek (USDA Forest Service 2008). Lodgepole Creek was highly impacted by the 1988 Clover Mist Fire and a damaging thunderstorm and flash flood event in 1989. This resulted in significant changes in upland and stream channel stability. Recovery of this subwatershed will take time.

Risk Factors

The primary risk factors from forest management are recreational activities (such as rafting and hiking) disturbing nesting birds and livestock grazing.

Habitat and Population Management Considerations

Within Region 2, their primary threats are disturbance to females at nest sites and degradation of water quality (Wiggins 2005). Harlequin females have abandoned nest sites after repeated human disturbance (Wiggins 2005).

Timber harvest and associated activities such as road building could create potential impacts to Harlequin duck habitat. This is primarily due to increased run-off and altered water flow (Wiggins 2005).

Livestock grazing may have an impact on Harlequin duck habitat. Impacts could include: reduction in streamside vegetation, increased run-off, and direct disturbance to nesting birds (Wiggins 2005).

Maintaining potential habitat for this species is necessary through proper riparian and aquatic habitat management that maintains adequate amounts of vegetative cover, with both herbaceous and woody types being important, along stream courses and in wetland areas. Any activities, including livestock grazing and timber harvest, should be carefully managed in these areas to maintain adequate cover components. Loss of vegetative cover directly relates to higher levels of predation and water quality issues.

Minimizing human disturbance during the nesting season along streams that contain potential habitat also is important.

Conservation Measures

In order to maintain and improve the Harlequin duck population and potential habitat on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Since this species is of viability concern, it is recognized that inclusion of these measures would continue to provide adequate habitat for this species.

Conservation measures summarized include:

1. Manage livestock grazing so that potential habitat is improved or maintained, particularly during drought years. Retention of vegetative cover at the stream edge would be the primary emphasis factor, as well as maintaining the ecological processes that provide for the long term maintenance of these habitats.
2. Manage dispersed camping and recreational uses so that degradation of riparian areas does not occur, and achieve improvements in existing degraded areas. Where known nesting of this species occurs, consider regulating recreational use during the nesting season to avoid disturbance.
3. Maintain forested cover along edges of riparian areas where it naturally exists.
4. Locate roads and trails outside of riparian areas to prevent loss of habitat and to reduce potential disturbance during nesting.
5. Re-vegetate decommissioned roads within riparian areas.
6. Use standard water quality conservation practices when conducting activities within riparian areas, including timber harvest or road and trail construction/reconstruction.

Monitoring Considerations

The most beneficial monitoring for Harlequin ducks will be to improve information on known observations and any potential breeding areas. The Forest should continue to coordinate with the WGFD for completion of Harlequin duck surveys. If breeding sites are found, an evaluation of the habitat being used may help provide further information for future monitoring, including human uses that may be disturbing any potential nest sites.

Direct and Indirect Effects

Effects from Livestock Grazing and Big Game, Recreation Management, Road Construction, and Special Area Designation: Management activities that may have effects to harlequin ducks include loss or degradation of habitat that eliminate or reduces cover and food supply and disturbance at the nest site or of nesting. Differences in projected outputs by alternative for these activities are displayed in table 66**.**

Alternative A: No action

As displayed in table 66, although differences among alternatives are difficult to evaluate in regard to potential influences on Harlequin ducks, it is possible that alternative A provides as much potential habitat protection for the species as alternative F, because it provides less indirect influences from livestock grazing that could potentially influence streambank habitat and water quality. Alternatives B through E and G all provide more potential habitat protection then alternative A, due to no increase or less amount of livestock grazing.

Construction of new roads as result of timber harvest that would remain open to public use is very minimal for all alternatives; estimated between 2 to 3 miles. Effects may be associated with these activities, but are expected to be minor because of best management practices in riparian habitat and the large amount of unroaded area that remains undeveloped.

Alternative A does not identify any additional waterbodies for protection under special area designations such as Wild and Scenic River corridors that may better control some human-associated impacts. Overall, however, Harlequin ducks continue to expand and the effect from all alternatives is expected to be secondary to other factors such as drought and private water management activities.

Action Alternatives: Alternatives B through G

All action alternatives (B through G) are expected to allow the continued expansion of Harlequin duck into potential habitat on Shoshone. However, alternatives B, C, D and G allow for additional protective measures above baseline conditions that may indirectly benefit the duck. Examples of these include better control of potential erosion from road construction due to vegetation management and more potential protection of riverine habitat from special area designations. Although continued expansion of Harlequin ducks is also expected under alternatives E and F, these alternatives may require more site-specific mitigation measures because they allow more active management.

Cumulative Effects

Cumulative effects over and above the direct and indirect effects mentioned above are minimal on the Shoshone due to the limited amount of private land within the Forest boundary. There are no known proposals for additional development of any of these lands. Lands adjacent to the Forest are primarily private and/or BLM. Private lands receive minimal pressure from urban development trends. These adjacent lands would likely continue to receive impacts from livestock grazing and water depletions that are ongoing. These activities should not impact habitat on the Shoshone, but may increase the value of riparian habitat on the Forest. Individual species protections would be ensured through preparation of site-specific NEPA analysis and biological evaluations, with protection offered through Forest-wide standards and guidelines.

Table 66. Activities and projected outputs that could potentially influence Harlequin duck, by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Livestock Grazing							
Permitted AUMs (Total)	55,900	55,900	31,400	55,900	58,300	61,500	55,900
Suitable Acres (Total)	375,400	375,400	216,800	375,400	374,700	415,400	375,400
Dispersed Recreation Management	Prohibits camping within 100 feet of lakes/ streams	Prohibits camping within 100 feet of streams and 200 feet of lakes	Same as alt. B	Same as alt. B	Same as alt. B	Same as alt. B	Prohibits camping within 100 feet of streams and 200 feet of lakes
Road Construction Miles-Timber	2	2	2	2	3	4	2
Special areas and designations	5 wilderness areas 1 wilderness study area	No new wilderness recommen-dation	Recommends 628,800 acres wilderness additions	Recommends 194,500 acres wilderness additions	No new wilderness recommen-dation	No new wilderness recommen-dation	No new wilderness recommen-dation
	1 special interest area	Proposes 3 new special interest areas	Proposes 3 new special interest areas	Proposes 3 new special interest areas	Proposes 1 new special interest area (Kirwin)	Proposes no new special interest areas	Proposes 3 new special interest areas
Special areas and designations (continued)	1 special management unit 1 research natural area	Proposes 6 new research natural areas – Beartooth Butte, Lake Creek, Grizzly Creek, Sheep Mesa, Arrow Mountain, Roaring Fork	Proposes 8 new research natural areas - Beartooth Butte, Lake Creek, Pat O'Hara, Bald Ridge, Grizzly Creek, Sheep Mesa, Arrow Mountain, Roaring Fork	Proposes 8 new research natural areas - Beartooth Butte, Lake Creek, Pat O'Hara, Bald Ridge, Grizzly Creek, Sheep Mesa, Arrow Mountain, Roaring Fork	Proposes 3 new research natural areas - Sheep Mesa, Lake Creek, and Arrow Mountain	Proposes no new research natural areas	Proposes 8 new research natural areas - Beartooth Butte, Lake Creek, Pat O'Hara, Bald Ridge, Grizzly Creek, Sheep Mesa, Arrow Mountain, Roaring Fork
	1 wild/scenic river	Protects 16 eligible wild/scenic river segments	Protects 16 eligible wild/scenic river segments	Protects 16 eligible wild/scenic river segments	Protects 16 eligible wild/scenic river segments	Protects 16 eligible wild/scenic river segments	Protects 16 eligible wild/scenic river segments

Determination of Effects and Rationale for Determination – Harlequin Duck

All alternatives, including alternative A, **“may adversely impact individuals, but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide.”** The rationale for this determination follows:

- Due to the uncertainty of some recreational uses and expanded road network and potential ground disturbances in riparian habitat.
- Streams used by Harlequin ducks are in good or excellent condition
- Water management activities are managed to reduce impacts on aquatic species; however, reduced water flows have direct and indirect influences on prey species and habitat conditions.

Trumpeter swan

Affected Environment

Trumpeter swans (*Cygnus buccinators*) are considered a G4/S2 species by the State Natural Heritage ranking for Wyoming. This is primarily due to its restricted range. Historical populations, distribution, or abundance are unknown for this species on the Shoshone.

Historically, trumpeter swans ranged across the northern United States, Canada, and Alaska. Their current distribution is sporadic, with populations in northwestern Canada and Alaska, the northern Rocky Mountains, and the Upper Midwest. The Tri-State Flock, which includes the Shoshone, is within the Rocky Mountain Population. The Shoshone is outside of the “Core” Tri-State Area, which includes Wyoming, Idaho, and Montana directly outside of Yellowstone National Park (USFWS 2010).

Trumpeter swans are surveyed annually within and outside of the Tri-State Core Area (WGFD 2010b). No breeding pairs have been observed on the Shoshone (WGFD 2010b). On the Shoshone, trumpeter swans are occasionally observed. They have primarily been seen in the Swamp Lake area.

Trend data are not available for the trumpeter swan population on the Shoshone, but trend data are available for the Tri-State Flock, which includes northwestern Wyoming. Counts of swans in the fall in northwestern Wyoming have increased steadily since about 1995 (figure 18).

Habitat Distribution and Condition on the Shoshone

Trumpeter swans breed primarily in shallow marshes, ponds and lakes (Slater 2006). Nests are usually in or surrounded by water. They often nest on beaver or muskrat houses.

Based on past observations, trumpeter swans are occasionally observed on the Shoshone with most observations around Swamp Lake. Swamp Lake and the adjacent wetlands probably provide the highest potential habitat on the Shoshone. Swamp Lake and the adjacent wetlands are currently managed as the Swamp Lake Botanical Area and will continue to be managed as such in the Forest Plan revision.

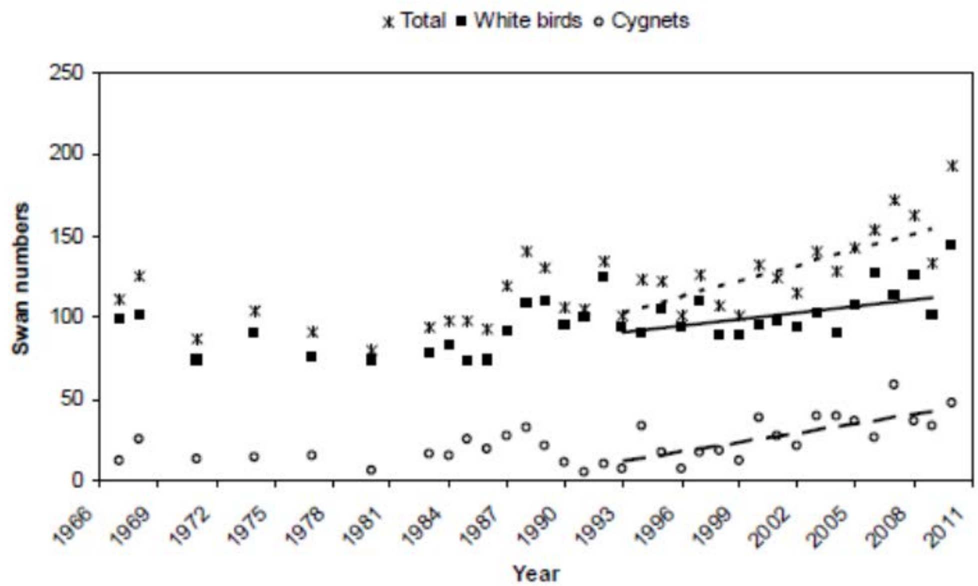


Figure 18. Counts of swans in Wyoming during the Fall Trumpeter Swan Survey, 1967–2010 (dotted, solid and dashed lines depict trends for total swans, white birds, and cygnets, respectively) (USFWS 2010)

Risk Factors

The primary risk factor from forest management is recreational activities disturbing nesting birds. Another primary risk factor is over-crowding of wintering birds. Trumpeter swans are not known to winter on the Shoshone.

Habitat and Population Management Considerations

Motorized and non-motorized recreation can reduce habitat availability and quality for trumpeter swans in breeding and non-breeding areas (Slater 2006). Therefore, minimizing human disturbance during the nesting season is important.

Breeding habitat is very limited on the Shoshone, as shallow wetlands are not a common feature on the landscape. The highest potential habitat on the Forest is at Swamp Lake, which is protected as the Swamp Lake Botanical Area.

Currently, there are no known breeding pairs on the Shoshone. Past use by trumpeters has primarily been individual birds and fall migrants. Since no known breeding pairs currently exist on the Forest, the risk to viability of the species is low.

Conservation Measures

To maintain and improve potential habitat for trumpeter swans on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Since this species is not of viability concern, these measures would continue to maintain and improve potential habitat for this species.

Conservation measures summarized include:

1. Coordinate with the WGFD to identify potential breeding wetlands and evaluate the potential for improving breeding habitat.
2. Maintain wetlands.

3. Locate roads and trails outside of riparian areas to prevent loss of habitat and to reduce potential disturbance during nesting.
4. Use standard water quality conservation practices when conducting activities within riparian areas, including timber harvest or road and trail construction/reconstruction.
5. Avoid disturbing trumpeter swan pairs during the breeding season.

Monitoring Considerations

The most beneficial monitoring for trumpeter swans would be to improve information on known observations and any potential breeding areas. The Shoshone staff should coordinate with the WGFD to complete annual swan surveys. If breeding sites are found, an evaluation of the habitat being used may help provide further information for future monitoring, including human uses that may be disturbing any potential nest sites.

Direct and Indirect Effects

Effects from Recreation Management: The primary risk factor from forest management is recreational activities disturbing nesting birds. Differences in projected outputs by alternative for these activities are displayed in table 67.

Table 67. Acres of management areas by alternative

MA	Description	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
3.1A	Swamp Lake SIA	581	581	581	581	581	581	581

Alternative A: No action

No direct or indirect effects on the trumpeter swan are expected from alternative A because the only known location this species has been observed is at Swamp Lake. Swamp Lake is designated a special interest area under the current Forest Plan and provides for management direction to prohibit road construction and limits recreational use of the area to day activities only.

Action Alternatives: Alternatives B through G

No direct or indirect effects on the trumpeter swan are expected from implementation of any of the action alternatives because occurrence of this species is considered incidental to rare and all of the alternatives maintain Swamp Lake as a special interest area, including alternative A

Cumulative Effects

No cumulative effects are expected because of lack of suitable nesting habitat.

Determination of Effects and Rationale for Determination – Trumpeter Swan

All alternatives, including alternative A, are expected to have **No Impact** on the trumpeter swan or its primary habitat. The rationale for this determination follows:

- The trumpeter swan is considered incidental or extremely rare on Shoshone, with no breeding populations known to occur.

Riparian (lakes, streams, marshes) amphibians

Boreal western toad, Columbia spotted frog, Northern leopard frog

Affected Environment

Boreal western toad (*Anaxyrus boreas boreas*), Columbia spotted frog (*Rana luteiventris*), and northern leopard frog (*Lithobates pipiens*) are grouped into one assessment as they all occupy similar habitat and are subject to the same threats. (Detailed descriptions for these species are contained in the biological evaluation.) The northern leopard frog has a natural heritage ranking of G5/S3; the Columbia spotted frog is ranked G4/S3; and the boreal western toad is ranked G4/S1. Historical populations, distribution, or abundance are unknown for any of these amphibian species that occur on the Shoshone.

Leopard frogs occur through much of North America, excluding the southeastern United States and the far northwestern areas of Alaska and Yukon Territories. They are found throughout most of Wyoming where suitable habitat exists. Various studies of northern leopard frog breeding habitats have been conducted in the Rocky Mountain region. In northern Colorado and in Wyoming, Corn and Livo (1989) found that northern leopard frogs bred and successfully hatched in a gravel pit, stock ponds, and beaver ponds. Hammerson (1999) noted that the northern leopard frogs bred in shallow, quiet areas of permanent bodies of water, in beaver ponds, and in seasonally flooded areas adjacent to or contiguous with permanent pools or streams in Colorado (in Smith and Keinath 2007).They are known to occur on the Shoshone based on past surveys. No trend data are available for the Shoshone, but it is suspected that the population is declining in Wyoming (Smith and Keinath 2007).

Spotted frogs only occur in northwestern North America from British Columbia to Utah. In Wyoming and in Region 2, they are known to occur on the Shoshone and Bighorn National Forests. Columbia spotted frogs inhabit a variety of vegetation communities, including coniferous or mixed forests, grasslands, and riparian areas of sage-juniper brush-lands. Elevation range for the species is reported up to 3,036 m (9,960 feet), with frogs ranging up to 2,890 m (9,482 feet) in the GYE (Reaser and Pilliod 2005). Dumas (1964) reported that relative humidity of 65 percent at 25 °C (77°F) is lethal to adult spotted frogs in approximately two hours; this would restrict spotted frogs to higher elevations or moist riparian zones in arid western landscapes. Because both breeding and over-wintering occur at aquatic sites, populations are located in the general vicinity of ponds, lakes, springs, and/or streams. The examination of movement distances suggests that breeding and wintering sites are generally less than 600 m (1,968 feet) apart although adults are capable of moving longer distances. There are only five known breeding sites on the Shoshone based on surveys from 1993 to 2002 (Patla and Keinath 2005). Known locations on the Shoshone are concentrated in the tributaries of the Upper Wind River and tributaries of the Clarks Fork of the Yellowstone.

The apparent rarity of spotted frogs on much of the Shoshone may relate either to the actual scarcity of this species on the southeastern edge of its range or to low survey effort (Patla and Keinath 2005). No trend data are available for the Shoshone, but trends are being developed for the Greater Yellowstone Ecosystem. While trends have not yet been quantitatively assessed for the Greater Yellowstone Ecosystem, initial assessments indicate that spotted frogs are not experiencing a widespread decline in the national parks of the Greater Yellowstone Ecosystem, based on the number of new breeding sites found each year and the general persistence of the species in previously identified occupied areas. However, some local declines of spotted frogs have been observed in the Greater Yellowstone Ecosystem (Patla and Keinath 2005).

Boreal western toads range over much of northwestern North America from the southern Yukon to Nevada. In Wyoming, they occur in the western and south-central mountain ranges. Boreal toads live in a wide range of habitats in western North America: wetlands, forests, woodlands, sagebrush, meadows, and floodplains in the mountains and valleys (Carpenter 1953, Campbell 1970, Black 1971, Stebbins 1985). Boreal toads require three main habitat components: (1) shallow wetlands for breeding, (2) terrestrial habitats with vegetative cover for foraging, and (3) burrows for winter hibernation (Loeffler 2001). There is no detailed information on the relative proportion of these habitat types required by boreal toads in Region 2. While they primarily use wetland habitats boreal toads may be observed in other habitats during dispersal to and from breeding sites. Although they have been observed in a wide range of elevations (from sea level to near or above tree line), boreal toads generally occur between 2,250 and 3,600 meters (7,500 and 12,000 feet) in Region 2 (Campbell 1970, Stebbins 1985, Livo and Yackley 1997, Hammerson 1999). This species is usually found in wetlands near ponds, lakes, reservoirs, rivers, and streams, and it is typically less common in densely forested areas (Campbell 1970, Hammerson 1999). On the Shoshone, they are found throughout the Forest. No trend data are available for the Shoshone. During amphibian surveys conducted on the Shoshone by the Wyoming Natural Diversity Database (WYNDD) in 2009, spotted frogs were found at 6 of 47 sites and boreal toads were found at 4 sites (and 2 additional unconfirmed boreal toad sites) (Keinath et al. 2009). No leopard frogs were found during surveys.

Within the Greater Yellowstone Ecosystem, declines have been reported in both Grand Teton and Yellowstone National Parks (Keinath and McGee 2005).

Declines in amphibian species can be characterized under two general patterns: those species that have been affected due to habitat alteration and those species for which no obvious causes of declines have been determined (Muths et al. 2003). The latter has been relatively recently associated with a pathogenic chytrid fungus. Boreal toad declines in the southern Rockies along with Wyoming toad declines in Wyoming have been attributed to chytrid fungal infections (Muths et al. 2003).

Habitat Distribution and Condition on the Shoshone

Amphibians are associated with riparian and wetland areas with perennial water, largely at the higher elevations where gradients are gentle in streams and more ponded habitats occur. Outside of the breeding season, boreal toads use a diversity of forested and non-forested habitat.

At the watershed scale, most are in good or excellent condition, with the exception of a subwatershed in Crandall Creek (USDA Forest Service 2008). Lodgepole Creek was highly impacted by the 1988 Clover Mist Fire and a damaging thunderstorm and flash flood event in 1989. This resulted in significant changes in upland and stream channel stability. Recovery of this subwatershed will take time.

Riparian habitat is mostly stable and existing protection measures should prevent the loss of any of this habitat type. The conditions of some riparian systems on the Shoshone are outside of their historic ranges of variability due to past impacts from tie hacking, grazing, and water diversions (USDA Forest Service 2009).

The Shoshone has been improving its management of riparian and wetland areas for the past planning period through improved livestock management efforts in coordination with grazing permittees. Historic levels of livestock grazing were very high in the early 1900s, and have been steadily reduced to bring stocking rates more in line with carrying capacity. Many of the sheep allotments on the Shoshone have been closed or converted to cattle.

Improvements in road locations and design are also likely to continue across the Shoshone, and this may also reduce recreation impacts to these sites.

Amphibians have persisted on the Shoshone despite high historic levels of grazing that likely reduced vegetative cover along riparian areas, compacted soils, incised streams, and eroded streambanks. These effects varied by stream reach. Reductions in both cattle and particularly sheep livestock grazing from historical levels have likely improved riparian areas.

Risk Factors

Primary risk factors from forest management include: livestock grazing, timber harvest, recreation activities and travel management within riparian areas. Other risk factors include predation (including from fish stocking) and disease.

Habitat and Population Management Considerations

Amphibian populations have declined worldwide and within Region 2. Maintaining potential habitat for these species is necessary through proper riparian and aquatic habitat management that maintains adequate amounts of vegetative cover, with both herbaceous and woody types being important, along stream courses and in wetland areas.

Any activities, including livestock grazing and logging, should be carefully managed in these areas to maintain adequate cover components, especially near known breeding sites. Loss of vegetative cover directly relates to higher levels of predation and other important physical habitat characteristics, including temperature regulation of ponds and stream courses and water quality issues. Information on amphibian responses to fire and fuels reduction is limited but can be far reaching. Generalizations are confounded by great taxonomic and ecological diversity among amphibians; as well as complex life histories. Furthermore, each life-history could be affected by fire differently (Pilliod et al. 2003). Effects of fire may be greatest for amphibians that are habitat specialists compared to species that occupy different types of habitat and tolerate a range of environmental conditions (Pilliod et al. 2003).

Amphibians may experience high levels of predation if vegetative cover is greatly reduced. Multiple sources of predation are known, including birds, reptiles, mammals, and fish. Predation by non-native trout is a concern.

The occurrence of amphibian disease and mortality events elsewhere in northwestern Wyoming suggests a high likelihood for spotted frog populations of the Shoshone to be affected eventually, if not currently, by the diseases *chytridiomycosis* and *ranavirus* (Patla and Keinath 2005).

Roads and undersized culverts have also been known to have an effect on distribution of amphibians by functioning as barriers or a large source of mortality.

Changes in water quality from chemical pollution (insecticides) and increased sedimentation have also been of concern in other areas. Stevens et al. (2006) found that almost all beaver ponds in their study supported breeding frogs and toads whereas unobstructed streams had essentially none. Their data suggested that to further amphibian conservation in boreal forests, beaver and their dam-building activity should be incorporated into forestry planning and management.

Climate change has the potential to reduce amphibian populations and habitat on the Shoshone. Amphibians have low adaptability potential and narrow environmental tolerance, which make them susceptible to climate change (Rice et al. 2012).

Conservation Measures

To provide management for these species to maintain and improve their potential distribution on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Since there is some viability risk to these species from forest management, it is recognized that inclusion of these measures would alleviate those risks and continue to provide adequate habitat for amphibians.

Conservation measures summarized include:

1. Manage livestock and ungulate grazing/browsing so that potential habitat is improved or maintained, particularly during drought years. Retention of vegetative cover at the wetland edge would be the primary emphasis factor, as well as maintaining the ecological processes that provide for the long-term maintenance of these habitats.
2. Maintain and improve known breeding sites.
3. Manage dispersed camping and recreational uses such that degradation of riparian areas does not occur and achieve improvements in existing degraded areas.
4. Provide forested cover along edges of riparian areas where it naturally exists to maintain temperature control of water.
5. Maintain water abundance and associated vegetation at springs and seeps.
6. Maintain existing beaver habitat and where appropriate, introduce beaver into historical habitat.
7. Coordinate with WGFD in assessing the impact of non-native trout on amphibian populations.
8. Do not allow for the application of insecticides or herbicides in aquatic habitats, or any other chemical that would threaten water quality or aquatic life, with the exception of pesticides used to restore native aquatic life (e.g., rotenone).
9. Locate roads and trails outside of riparian areas to prevent loss of habitat. Use standard water quality conservation practices when conducting activities within riparian areas, including timber harvest or road and trail construction/reconstruction.
10. Assess road crossings and prioritize which barriers need to be fixed.
11. Do not introduce non-native trout to lakes and rivers known to be of high value to amphibians.

Monitoring Considerations

The most likely beneficial monitoring for amphibians is to ascertain continued existence of populations in known occupied habitat. A continued effort to determine Forest-wide distribution is also needed.

Direct and Indirect Effects

Effects from Timber Management, Livestock Grazing and Big Game, Road Construction, Motorized and Non-motorized Recreation, and Fuels Management: Plan direction that could potentially influence the boreal toad primarily involves timber harvest, livestock grazing, road construction/ reconstruction, motorized/non-motorized recreation, and fuels treatment activities (wildland fire use only). Differences in projected outputs by alternative for these activities are displayed in table 68.

Table 68. Activities and projected outputs that could potentially influence the boreal toad, by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Suitable Timber base acres	86,300	127,000	122,100	124,500	179,700	251,200	127,000
Vegetation Treatment Acres Mechanical and Mechanical w/ Prescribed Fire (Total)	15,500	15,600	14,500	15,100	17,900	21,700	15,600
Spruce/fir	1,410	1,400	1,060	1,260	1,550	1,770	1,400
Aspen	620	630	530	620	640	660	630
Vegetation Treatment Acres Prescribed Fire(Total)	23,600	23,300	23,300	23,300	22,800	21,900	23,300
Spruce/fir	550	540	500	530	550	570	540
Aspen	920	910	900	910	880	820	910
Road Construction Miles-Timber	2	2	2	2	3	4	2
Wildfire Acres	185,200	182,900	184,100	183,700	175,000	161,400	182,900
Livestock Grazing							
Permitted AUMs (Total)	55,900	55,900	31,400	55,900	58,300	61,500	55,900
Suitable Acres (Total)	375,400	375,400	216,800	375,400	375,400	415,400	375,400
Motorized Recreation-Summer (Acres available)	570,000	570,200	321,800	350,000	655,900	823,300	529,000

Alternative A: No action

As displayed in table 68, there are several activities that could potentially influence habitat suitability for the boreal toad. Because wetlands and alpine systems are particularly vulnerable to human impacts and disturbances, it is probable that alternatives with more active management may offer more risk of impact to these sensitive habitats. Alternative A offers approximately the same amount of acres of active management area as alternatives B, C, D and G. Therefore, it is likely that alternative A has a static (maintains existing condition) potential of having negative impacts to the primary habitat components for the boreal toad. Alternatives E and F exceed alternative A in active management area and acres and may offer the highest risk of potential impacts.

The predicted timber harvest output in primary boreal toad habitat (spruce/fir) varies from 1,550 to 2,340 acres and is very minimal in all alternatives. Additional timber harvest in aspen varied from 1,430 to 1,540 acres of harvest during the life of the Plan (10 to 15 years). Although impacts could occur if timber sale activities occurred around a yet unknown population or breeding site, it is unlikely that this would occur due to continued survey requirements and conservation measures. Also, the overall amount of timber harvest associated with alternative A is very minimal, thereby reducing the risk that unknown populations could be impacted. Alternative A is, therefore, expected to have little, if any, influence on potential boreal toad habitat on the Shoshone.

Construction of new roads for timber harvest is very minimal and is estimated to be between 2 to 3 miles across all alternatives. The primary direct effect of roads on boreal toads involves the crushing of individuals from vehicle use. Roads can also create barriers to water flow and to the movement of toads across the landscape. Many indirect effects can also occur that influence riparian vegetation and water quality. Potential activities that could influence boreal toad populations and/or habitat include off-road vehicle use, trail construction and use, camping in riparian areas, and activities related to fisheries management such as in-stream channel work, poisoning, and stocking of fish in areas that historically did not support them (Loeffler et al. 2001). Alternative A (as does alternatives B and G) provides for motorized recreation opportunities as well as non-motorized recreation opportunities. Alternatives A and B would have fewer acres affected by motorized recreation then alternatives E and F, and more motorized recreation than alternatives C and D. This difference could potentially lessen impacts to high-elevation upland sites that could be considered potential habitat.

Cattle and sheep are grazed at higher elevations and can frequently overlap with potential boreal toad habitat. Potential direct effects from grazing can include trampling. Potential indirect effects can include reduced egg and tadpole survival from changes in water chemistry and/or riparian vegetation related to grazing. Alternative A and all action alternatives continue to allocate allotments to livestock grazing. Alternative A maintains the same permitted numbers and area as alternatives B, D, and G, with approximately 55,900 AUMs on 375,400 acres. Some historic domestic sheep allotments have been maintained as vacant because of conflicts with grizzly bears. Alternative A maintains these allotments as vacant.

Prescribed fire activities most likely do not overlap in elevation with boreal toad habitat on the Shoshone. However, wildland fire use will be utilized as a tool to allow natural disturbances to occur within high-elevation spruce/fir zones as opportunities arise. It is estimated that all alternatives may allow from 161,400 to 185,200 acres of wildland fire use. Depending upon fire severity and scale, these outputs could have negative or positive influences on the boreal toad. Primary influences of fire in boreal toad habitat involves the burning of small diameter (7 to 10 inches) ground fuels and slash piles that toads may use as refugia sites. Positive influences can occur if fire stimulates the growth of the shrub component in upland sites (Loeffler et al. 2001). Potential positive or negative influences cannot be predicted at this time because wildland fire use is not a planned output.

Action Alternatives: Alternatives B through G

As displayed in table 68, the projected timber harvest output in spruce/fir and aspen forest in alternatives B, C, D, E, F, and G varies from about 2,980 acres (alternative C) to 3,820 acres (alternative F). Overall, little effects difference exists among all of the alternatives because all of the outputs represent a minimal amount of the forest cover types involved, and potential impacts would only be possible around waterbodies. Construction of new roads as result of timber harvest that would remain open to public use is very minimal for all alternatives; estimated between 2 to 3 miles. Effects may be associated with these activities, but are expected to be minor because of best management practices in riparian habitat and the large amount of unroaded area that remains undeveloped. Alternative F also offers the greatest amount of projected timber output and greatest amount of area where this activity may occur. However, all alternatives influence less than 0.01 percent of the cover type and are expected to have no effect or minimal effects on boreal toad habitat.

Alternative B offers the same amount of disturbance from summer motorized use as alternative A. The effects from these two alternatives maintain suitable boreal toad habitat at the existing condition. Alternatives C, D, and G offer fewer potential disturbances than no action from summer motorized recreation because of the decreased amount of permitted motorized use area. Alternatives E and F offer the largest motorized acres, with alternative F offering the highest amount of acreage of the two alternatives. This difference could potentially allow greater impacts to high-elevation upland sites that could be considered potential habitat.

As displayed in table 68, alternative B maintains the same permitted numbers and area for livestock grazing as alternatives D and G, with approximately 55,900 AUMs on 375,400 acres and potential effects would be similar to alternative A. Alternative C reduces livestock numbers and allotment area to 31,400 AUMs and 216,800 acres. This alternative may reduce the amount of potential habitat influenced, but is not expected to have any measurable difference in regard to protection of habitat for the boreal toad. Alternatives E and F allow more livestock grazing than the other alternatives. Alternative E would increase amount of livestock use to 58,300 AUMs on 375,400 acres, and alternative F would increase livestock use and allotment area to 61,500 AUMs on 415,400 acres. Sheep allotments currently vacant could be filled under alternatives E and F. Alternative F would require more management attention to assure that livestock do not damage potential habitat for the boreal toad.

As with no action, it is estimated that wildland fire use may be used as a management tool on 161,400 to 185,200 acres in all action alternatives. The amount of area potentially used for wildland fire use is not dependent upon which alternative is selected, and no differences are expected.

Cumulative Effects

Cumulative effects over and above the direct and indirect effects mentioned above are minimal on the Shoshone due to the limited amount of private land within the Forest boundary. There are no known proposals for additional development of any of these lands. Lands adjacent to the Forest are primarily private and/or BLM. Private lands receive minimal pressure from urban development trends. These adjacent lands would likely continue to receive impacts from livestock grazing and water depletions that are ongoing. These activities should not impact habitat on the Forest, but may increase the value of riparian habitat on the Forest. Individual species protections would be ensured through preparation of site-specific NEPA analysis and biological evaluations, with protection offered through Forest-wide standards and guidelines.

Determination of Effects and Rationale for Determination – Boreal Toad, Columbia Spotted Frog, and Northern Leopard Frog

All alternatives, including alternative A, **“may adversely impact individuals, but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide.”** The rationale for this determination follows:

- There is uncertainty about some recreational uses, an expanded road network, and potential ground disturbances in riparian habitat.
- Riparian and wetland habitat used by boreal toads is in good or excellent condition
- All alternatives are associated with activities and outputs that may have potential influences on occupied habitat.
- Water management activities are managed to reduce impacts on aquatic species; however, reduced water flows have direct and indirect influences on prey species and habitat conditions.

Caves and mines mammals

Fringed myotis, Spotted bat, Townsend's big-eared bat

Affected Environment

Fringed myotis (*Myotis thysanodes pahasapensis*), spotted bat (*Euderma maculatum*), and Townsend's big-eared bat (*Corynorhinus townsendii*) were combined into one species viability assessment due to similar habitats and similar risks. Globally, all three species are G4. At the State level, fringed myotis and Townsend's big-eared bat are S2, and the spotted bat is S3. Historical populations, distribution, or abundance are unknown on the Shoshone. Also, no current trend data are available that is specific to the Shoshone or Wyoming for any of these bat species.

The fringed myotis ranges across the Pacific Northwest and central Rocky Mountains south to Mexico (Keinath 2004). Wyoming is within their current range. The WGFD surveyed for bats in northwestern Wyoming in 2009 and detected fringed myotis on the Shoshone based on acoustic calls and mist netting (WGFD 2010b).

Currently, the spotted bat is known to occur across large areas of western North America from southern British Columbia to Mexico (Luce and Keinath 2007). Its distribution in Wyoming is still unknown, but it is expected to occur statewide in suitable habitat (Hester and Grenier 2005). The WGFD surveyed for bats in northwestern Wyoming in 2009, and detected spotted bats at one location on the Shoshone based on acoustic calls (WGFD 2010b).

Townsend's big-eared bats are widely distributed in western North America. They occur from southern British Columbia south to Mexico and east to South Dakota and Kansas with disjunct populations in the eastern United States (Gruver and Keinath 2006). Townsend's are a year-round resident throughout most of Wyoming, but are primarily found in the north-central and southeastern parts of the state (Hester and Grenier 2005). The WGFD surveyed for bats in northwestern Wyoming in 2009, and detected Townsend's big-eared bats at multiple locations on the Shoshone based on acoustic calls (WGFD 2010b).

Habitat Distribution and Condition on the Shoshone

These three bats use a variety of habitats (table 69). Townsend's big-eared bats and fringed myotis use caves and abandoned mines for roosting and hibernacula, with spotted bats possibly using them for hibernacula.

Table 69. Habitat for fringed myotis, spotted bats, and Townsend's big-eared bats (Hester and Grenier 2005)

Species	Foraging	Summer Roost	Hibernacula
Fringed myotis	Dry conifer forest	Buildings, caves, rock crevices	Caves and mines
Spotted bat	Canyons, riparian, forest edge	Cliffs	Possibly caves and mines, may migrate south or to lower elevations
Townsend's big-eared bat	Forest edge, riparian	Caves, Mines, Buildings	Caves and mines

Forested foraging habitat is abundant on the Shoshone. There are about 309,442 acres of spruce/fir, 345,273 acres of Douglas-fir, 382,886 acres of lodgepole pine, 190,609 acres of whitebark pine, and 35,251 of limber pine on the Forest (USDA Forest Service 2012b). Shrubland foraging habitat is limited on the Shoshone. There are about 76,060 acres of willow, sagebrush, and aspen (USDA Forest Service 2012b). Some evidence suggests that lodgepole pine has become less abundant in the last century, while spruce/fir has increased (USDA Forest Service 2012a). Fire suppression reinforces this trend, but increases in wildfire and insect outbreaks may begin to reverse this trend.

Forest inventory data indicate that about 30 percent of the spruce/fir is mature (over 200 years old); about 22 percent of the lodgepole pine is mature (over 150 years old); about 16 percent of the Douglas-fir is mature (over 200 years old); about 23 percent of the whitebark pine is mature (over 200 years old); and about 28 percent of the limber pine is mature (over 200 years old) (USDA Forest Service 2009). Data on current aspen age classes are inconclusive.

In recent years, the Shoshone has experienced large wildfires and insect epidemics. About 115,000 acres have burned in the last 5 years and about 161,500 acres in the last 10 years (USDA Forest Service 2012a).

Over the past 11 years, widespread bark beetle epidemics have occurred on the Shoshone.

Insect outbreaks and wildfires are likely altering foraging habitat to some degree for these bats on the Shoshone. Climate change increases the potential for more and continued insect outbreaks and also increases the frequency of fires (Rice et al. 2012).

Caves and abandoned mines are rare on the Shoshone. Currently, there is very little human use of caves and abandoned mines on the Forest. Suitable cliff habitat for spotted bats is also a rare feature on the Shoshone. Based on distribution modeling, the highest probability of occurrence for spotted bats is the very northeastern edge of the Forest (Keinath et al. 2010).

Risk Factors

The primary risk factors from forest management are recreational use of caves and abandoned mines and vegetation treatments in shrubland and aspen habitat. A potential major risk factor associated with bats using caves and mines for hibernacula is white-nose syndrome. Habitat and Population Management Considerations

The most important forest management emphasis for the conservation of bats on the Shoshone is protection of caves and abandoned mines from human use. This will reduce the potential risk of spreading white-nose syndrome. Vegetation management projects should focus on restoration of aspen stands and reduction of conifer encroachment into the stands.

Conservation Measures

To provide management for these species and to maintain or improve their potential distribution on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Given the abundance of foraging habitat and recommended protection of caves and abandoned mines on the Shoshone, current viability risk from forest management to these bat species is low. If white-nose syndrome occurs in the region in the future, the viability risk will increase.

Conservation measures summarized includes:

1. Limit human disturbance, and where necessary, close caves and abandoned mines to human use that have documented bat populations.
2. When closing mines or caves, minimize disturbance and effects to microclimate, and provide access for bats.
3. Manage aspen, willow, and sagebrush cover types to reduce or halt the decline of acres due to conifer encroachment.

Monitoring Considerations

Important monitoring considerations for these bats would be to cooperate with the WGFD to continue to survey for bats and determine their distribution on the Shoshone. An inventory of known hibernacula and summer cave and abandoned mine roosting sites would be important.

Direct and Indirect Effects

Effects from Minerals Management, Fuels and Timber Management: Plan direction that could potentially influence the fringed myotis, spotted bat, and Townsend's big-eared bat include abandoned mine closures and, possibly, fuels treatment and timber management activities. Influences from fuels and timber treatments would be limited to the lower-elevation habitat types where the fringed myotis may potentially occur. Differences in projected outputs by alternative for these activities are displayed in table 70.

Table 70. Activities and projected outputs that could potentially influence the fringed myotis, spotted bat and Townsend's big-eared bat., by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Vegetation Treatment Acres Mechanical and Mechanical w/ Prescribed Fire (Total)	15,500	15,600	14,500	15,100	17,900	21,700	15,600
Douglas-fir	2,920	2,740	2,340	2,630	3,180	4,250	2,740
Lodgepole pine	5,290	5,330	5,640	5,360	7,060	9,210	5,330
Aspen	620	630	530	620	640	660	630
Vegetation Treatment Acres Prescribed Fire (Total)	23,600	23,300	23,300	23,300	22,800	21,900	23,300
Douglas-fir	4,950	4,870	4,840	4,870	4,750	4,590	4,870
Lodgepole pine	1,970	1,970	2,020	1,980	2,190	2,450	1,970
Aspen	920	910	900	910	880	820	910
Install Structures to Maintain Bat Habitat on Mine Closures	As opportunities arise	Same as alt. A	Same as alt. A	Same as alt. A	Same as alt. A	Same as alt. A	Same as alt. A

Alternative A: No action

Alternative A offers similar timber management treatments as alternatives B, C, D, and G in dry forest types that may support fringed myotis, spotted bat, and Townsend's big-eared bat. Because the fringed myotis is known to day roost in both conifer and aspen snags, potential impacts to the species could occur if the planned activities result in reductions in these components. This potential effect would be similar across most alternatives with the potential of the greatest effects in alternative F, as it proposes the most amount of vegetation treatment. Conversely, restoration activities that include thinning of small dense trees might benefit the foraging patterns of many bat species. Several Plan components also focus on snag management and retention, and although impacts will occur, they are anticipated to be minor.

Alternative A offers similar prescribed fire treatments as alternatives B through G in the dry forest types that offer potential habitat for the fringed myotis, spotted bat, and Townsend's big-eared bat. Impacts to potential roost sites or individual bats could occur in these locations if snags are fire-hardened, removed, or burned.

Alternative A provides the same wildlife management actions in regard to mine closures with bat gates as opportunities arise. Thus, all alternatives install the same quantity and quality of mine closure bat gates over the life of the Plan. This action could be quite beneficial to the fringed myotis spotted bat and Townsend's big-eared bat because they readily roost in abandoned mines.

Action Alternatives: Alternatives B through G

Alternatives B, C, D, and G are similar to alternative A; effects would be similar to those discussed above.

In general, alternatives E and F offer a higher risk of negative influences on some potential habitat components for the fringed myotis spotted bat and Townsend's big-eared bat, such as snags, because they both allocate a greater amount of area to active vegetation management scenarios. However, potential impacts are expected to be minimal because abandoned mines and cave habitat represent one of the most significant landscape features for this species and all alternatives include active wildlife management goals that target important underground roost sites for closure and protection. Plan components are also expected to reduce impacts to snags and other vegetation where active management occurs. Alternatives B through D and G offer timber management treatments in dry forest types similar to no action, therefore, the effects are similar to those in alternative A.

The protection of abandoned mines with bat gates could be the single-most important Plan output in regard to conservation of the fringed myotis because it frequently utilizes mines and caves for reproductive habitat. The fringed myotis, spotted bat, and Townsend's big-eared bat are also very sensitive to disturbances within these habitats. There is no difference among the alternatives in regard to implementation of wildlife management activities that may provide bat gates on abandoned mines used by bat species. The same potential benefits are associated with each action alternative.

Cumulative Effects

Cumulative effects are minimal on the Shoshone due to the limited amount of private land within the Forest boundary, and minimal, if any, development of NFS land anticipated in the future. There are no known proposals for additional development of any of these lands. Lands adjacent to the Forest are primarily private and/or BLM. Many cave resources occur adjacent to the Forest, some on private, and some on BLM. Recreational use of caves on the Shoshone is currently unknown, indicating a need for monitoring of these habitats, and implementation of protection measures, if necessary. Some of the caves adjacent to the Forest have received bat-friendly closure gates to mitigate human recreation impact. The most significant cumulative impact to rock outcrops and cave habitats and species on the Forest would continue to be from non-native species and/or recreation related disturbances. Both potential impacts may increase over time.

Determination of Effects and Rationale for Determination -- Fringed Myotis, Spotted Bat, and Townsend's Big-eared Bat

All alternatives, including alternative A, **"may adversely impact individuals, but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide."** The rationale for this determination follows:

- The single-most important habitat element for the fringed myotis spotted bat and Townsend's big-eared bat on Shoshone is most likely suitable mines and caves that provide reproductive habitat. Protection of these features is similarly associated with all alternatives.
- All potential impacts cannot be completely discounted, because some Plan activities may occasionally remove potential snag and tree roosts utilized by the species.
- Information on use of caves and mines by bats is limited on the Shoshone.

Cliff birds

American peregrine falcon

The American peregrine falcon (*Falco peregrinus anatum*) has a natural heritage ranking of G4/S2. Historical populations, distribution, or abundance are unknown on the Shoshone. The peregrine falcon was removed from the Endangered Species list in 1999.

Affected Environment

Peregrine falcons are known to breed worldwide. Historically, peregrine falcons bred throughout North America. They were extirpated from much of their range due primarily to DDT (dichlorodiphenyltrichloroethane). Through reintroduction and recovery efforts, peregrine falcons have re-populated much of their former range. They are found scattered throughout most of Wyoming, but breed primarily in the western half of the State (WGFD 2010a). Peregrines are considered a rare resident species in Wyoming. They are known to breed on the Shoshone.

The WGFD annually monitors peregrine eyries with the number of known eyries in the State steadily increasing since 1998 (WGFD 2010b). These data include eyries on the Shoshone. In 2009, more than 90 pairs of falcons nested in Wyoming. Trend data are also available for Yellowstone National Park, which is adjacent to the Shoshone. The number of nesting pairs has steadily increased in Yellowstone National Park since about 1990 (figure 19). No trend data are available that are specific to the Shoshone, but the trend is also likely increasing.

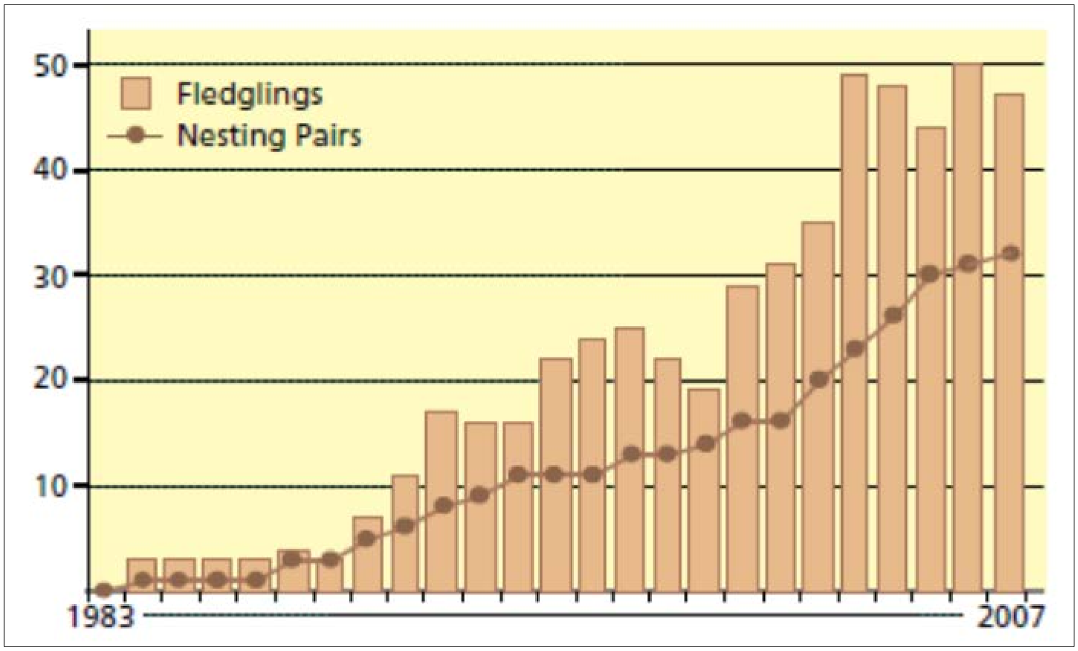


Figure 19. Total counted peregrine falcon nesting pairs and fledglings in Yellowstone National Park (YNP), 1984 to 2007 (YNP 2010)

Habitat Distribution and Condition on the Shoshone

Peregrines nest on cliffs which are often located near water and are usually close to habitat with abundant prey (WGFD 2010a). They forage in a variety of open habitats from open woodlands and forests to shrub-steppe, grasslands, marshes, and riparian habitats. Due to specific cliff nesting habitat requirements, nesting habitat for peregrine falcons is inherently limited on the Shoshone. The Clarks Fork of the Yellowstone River canyon likely provides some of the best habitat on the Forest based on past observations (WYNDD 2010).

Due to the typical inaccessibility to cliffs, forest management activities have had little effect on potential peregrine falcon nesting habitat. Of the various forest management activities, ice climbing could have the great potential of affecting suitable habitat for this species, but this needs to be further investigated.

Management Emphasis Species Consideration

Peregrine falcons will be retained as a Region 2 sensitive species on the Shoshone through forest plan revision.

Risk Factors

The primary risk factor from forest management would be recreational activities that disturb eyries. Other factors would include falconry.

Habitat and Population Management Considerations

Maintaining undisturbed habitat near eyries would be the most important forest management emphasis for peregrine falcon habitat. Human disturbance near eyries has been known to cause site abandonment (White et al. 2002).

Conservation Measures

In order to provide management for peregrine falcons and to maintain or improve its potential distribution on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Given the typical inaccessibility to peregrine falcon eyries on the Forest and by protecting known eyries, overall viability risk from forest management to peregrine falcons is low.

Conservation measures summarized include:

1. If an active eyrie is located, avoid project activities and human disturbance within 0.5 mile of the eyrie from February 1 to August 1.

Monitoring Considerations

Important monitoring considerations for peregrine falcons would be to continue to cooperate with the WGFD to continue the monitoring of known eyries to determine territory occupancy, nest success, and productivity.

Direct and Indirect Effects

Effects from Motorized and Non-motorized Recreation: Plan direction that could potentially influence the peregrine falcon primarily involves motorized and non-motorized recreation (i.e., rock climbing). Riparian management activities could potentially improve prey habitat for the falcon. Differences in projected outputs by alternative for these activities are displayed in table 71.

Table 71. Activities and projected outputs that could potentially influence the peregrine falcon, by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Motorized Recreation-Summer (Acres available)	570,000	570,300	321,800	350,000	655,900	823,300	529,000
Riparian and Watershed Improvements	No acres available	No acres available	No acres available	No acres available	No acres available	No acres available	No acres available

Alternative A: No action

Existing conditions have recovered the peregrine falcon to the point that it has been delisted from the Endangered Species list. Alternatives A, B, and G are expected to continue this trend because most nest sites are inaccessible to human impacts. However, it is possible that alternative A provides a higher risk of disturbance to individuals than alternatives C and D, because there is more “suitable opportunity” land for motorized travel. Both alternatives E and F increase the amount of motorized travel and human activity over alternative A, therefore they could potentially disturb peregrine falcons while they are nesting.

Rock and ice climbing activities also have the potential to disturb falcons if the activity occurs near nest sites. Although both rock and ice climbing are popular sports on the Shoshone, there is no evidence to suggest that they are currently influencing nest productivity or causing disturbances.

The amount of riparian improvement by alternatives is not known at this time. This activity may benefit prey species if it occurs in areas where falcons forage.

Action Alternatives: Alternatives B through G

Alternatives C and D are the only action alternatives that have the potential to reduce impacts from motorized travel in a similar manner, with most road access restricted to current routes and trails. Although travel impacts to individual falcons may still occur, it is likely that these travel management actions will reduce potential disturbances to nesting falcons. Both alternatives E and F increase the amount of motorized travel and human activity over the other alternatives, therefore, they could potentially disturb peregrine falcons the most while they are nesting.

Potential influences from rock and ice climbing are not expected to be different under the action alternatives. Site-specific management and protection of nest sites will occur.

Cumulative Effects

Cumulative effects are minimal on the Shoshone due to the limited amount of private land within the Forest boundary, and minimal if any development of NFS land anticipated in the future. There are no known proposals for additional development of any of these lands. Lands adjacent to the Forest are primarily private and/or BLM. Cliff resources, while limited, occur on lands adjacent to the Forest, some on private, and some on BLM. Recreational use of cliffs on the Shoshone is currently limited, indicating a need for monitoring of these habitats, and implementation of protection measures, if necessary.

Determination of Effects and Rationale for Determination – Peregrine Falcon

All alternatives, including alternative A, **“may adversely impact individuals, but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide.”** The rationale for this determination follows:

- Persistent populations of the peregrine falcon occur on the Shoshone, and the species has been declared recovered throughout the contiguous United States.
- Minimal influences from human disturbances are expected because of nest site inaccessibility.
- All potential impacts to individuals cannot be completely discounted because of some planned activities such as motorized travel, rock and ice climbing, and other recreational pursuits.

Management indicator species

Ruffed grouse

Affected Environment

Ruffed grouse (*Bonasa umbellus*) are considered a G5/S5 species by the State Natural Heritage ranking for Wyoming. Historical populations, distribution, or abundance are unknown for this species on the Shoshone.

Ruffed grouse range across the northern half of North America. They occur from central Alaska, through most of Canada, south to Utah, Wisconsin, and the Appalachian Mountains (Rusch et al. 2000). Ruffed grouse are a permanent resident in mountainous regions of the northwestern, north-central, and northeastern parts of the State.

No trend data are available that are specific to the Shoshone or Wyoming. WGFD does not track populations of this species, but they do periodically collect hunter harvest information. Based on recent WGFD harvest data (2010), ruffed grouse are consistently harvested in upland game management areas that encompass the Shoshone.

In Wyoming, ruffed grouse are found in aspen and aspen/conifer mixed stands. On the Shoshone, aspen is found in scattered stands across the Forest. There are about 23,300 acres of aspen on the Shoshone. Field observations indicate that most aspen is mature (USDA Forest Service 2009). Aspen occurs as a seral species and a climax species on the Shoshone (USDA Forest Service 2009). Climax stands occur below the lower limits of conifers, while seral stands grow among conifers. These seral stands are replaced by conifers over time without disturbance. Aspen is thought to be at the lower end or just below the historic range of variability (USDA Forest Service 2009).

The size of aspen stands has likely declined on the Shoshone. This is primarily due to fire suppression and livestock and wild ungulate grazing. White et al. (1999) documented that in an aspen stands that were in areas of known gray wolf use, may have benefited due to less browsing by elk on saplings.

Ruffed grouse were a management indicator species under the 1986 Forest Plan. They will be carried forward as a management indicator species in the Plan to represent aspen habitat.

Desired Condition

To maintain and improve potential habitat for ruffed grouse on the Shoshone, the following conservation measures were developed for incorporation into the Plan goals, objectives, standards, guidelines, and management approach. Inclusion of these measures would continue to provide adequate habitat for this species, as well as other aspen associated species, resulting in a low viability risk to ruffed grouse.

Conservation measures summarized include:

1. Allow for wildland fire use, where appropriate, to maintain aspen and to increase the size and age class diversity of aspen stands.
2. Utilize prescribed fire and/or mechanical treatments to regenerate aspen, reduce conifer and sagebrush encroachment, and to increase the size and age class diversity of aspen stands.

3. Consider resting burned and/or mechanically treated aspen stands from livestock grazing to provide for successful aspen regeneration.
4. When proposing treatments to regenerate aspen, treat the most acres of aspen possible at the same time to reduce the impacts from livestock grazing and wild ungulate (elk) browsing.
5. When treating small aspen stands, consider protecting them post-treatment with high fencing (Humphrey 2009). These stands are highly susceptible to overgrazing/browsing, especially by elk. Small aspen stands can be eliminated if the aspen suckers are not protected until they are above browsing height.
6. When proposing treatments to regenerate aspen, strive to achieve over 1,000 stems per acre, over 10 feet in height within 10 years post-treatment.

Direct and Indirect Effects

Effects from Timber Management, Fire and Fuels Management, Livestock Grazing, and Big Game: The primary risk factors from forest management are fire suppression and livestock grazing. A natural risk factor is wild ungulate grazing, primarily by elk. Maintaining and increasing the acreage of aspen on the Shoshone would be the most important forest management consideration. Increasing aspen age class diversity would also be an important aspect of aspen management. Protecting recently treated aspen stands from livestock grazing and wild ungulate browsing would be important to successfully regenerate aspen.

Alternative A provides for a similar amount of vegetation treatment in aspen as alternatives B, C, D, E, F, and G. These treatments primarily involve prescribed fire to reduce conifer encroachment in aspen stands and to improve stand health. Because vegetation treatment on aspen stands on the planning area is limited, potential impacts to ruffed grouse from these activities on the Shoshone are expected to have a positive impact to the species.

Wildland fire use is not a planned output in any of the alternatives. However, it would be utilized as a tool to allow natural disturbances to occur, as opportunities arise. The alternatives may allow from 161,400 to 185,200 acres of wildland fire use. Aspen is a target species for wildland fire use on the planning area, and potential impacts to ruffed grouse from this activity on the Shoshone is expected to be beneficial.

Livestock grazing on the Shoshone is likely to overlap potential habitat for the ruffed grouse. Permitted amount and area for cattle grazing does not differ among alternatives A, B, D and G. These activities are, therefore, predicted to have potential negative influences on individual breeding pairs of ruffed grouse where activities and habitat overlap. On NFS land, however, these activities are expected to be minor because of the small amount of acreage involved and the conservation measures developed to minimize potential impacts. These conservation measures are similar across alternatives. There is a reduction in AUMs and area in alternative C. The decrease in grazing area and stocking rates in alternative C may provide some secondary benefits to species such as the ruffed grouse. Alternatives E and F maintain the highest permitted forage allocation to livestock and, are therefore, assumed to have a potential for negative impacts to ruffed grouse habitat if the activities overlap. Overall, however, potential impacts are expected to be similar and based on site-specific areas where conservation measures are available to alleviate identified problems. The conservation measures in the Plan are similar across all alternatives.

Cumulative Effects

Although aspen has a limited distribution across the Shoshone, livestock grazing effects have occurred where grazing activities occur within active allotments. Fuels management may occur in areas, which include small stands of aspen, but otherwise are dominated by other vegetation types. Management actions are conducted in aspen stands on adjacent BLM lands where the objectives include opening up decadent stands to reduce conifer encroachment, improve the grass/forb understory, and to increase the age class diversity in aspen stands. Overall, little influence or cumulative effects on aspen-associated species are expected on the Shoshone, because of limited activities in this habitat type.

Brewer's sparrow

Affected Environment

Brewer's sparrow (*Spizella breweri breweri*) is categorized as a G5/S5 species through the natural heritage program ranking. They are also ranked as level I priority species (conservation action) by Wyoming Partners in Flight for shrub-steppe habitat, and are Forest Service Region 2 sensitive species.

Nests for this species are typically constructed in the bottom portion of live sagebrush plants, typically in the taller shrubs. Brewer's sparrows winter in the southwestern United States and north-central Mexico. They do not appear to have elevation limits in their breeding range.

Brewer's sparrows are well distributed within the Great Basin and other sagebrush habitats in northwestern North America. They breed throughout Wyoming (Rotenberry et al. 1999). They likely occur Forest-wide within suitable habitat based on recent surveys by the Rocky Mountain Bird Observatory from 2002 to 2008 (Hanni et al. 2009). From 2002 to 2009, the Rocky Mountain Bird Observatory detected 640 Brewer's sparrows (Hanni et al. 2009, Rehm-Lorber et al. 2010). There are currently no known population estimates or trends for the species on the Shoshone. At the State level, breeding bird surveys indicate a slight declining trend (- 0.7), but the trend is not significant ($p = 0.37$) (WGFD 2010b).

With fluctuations in natural ranges of habitat, it is difficult to determine whether populations of this species on the Shoshone are similar to historic levels. Regional declines reported in breeding bird survey results for most of the West indicate they are not (Paige and Ritter 1999), and significant acreages of sagebrush habitat have been lost throughout the West due to European settlement influences, such as conversion to agriculture, urban development, or losses due to cheatgrass invasion. These changes are likely having an effect on Brewer's sparrow populations, though these effects currently are not occurring to a significant extent on the Shoshone, as compared to surrounding lands.

Brewer's sparrows are dependent on sagebrush habitats, tending toward mature stands and larger stand sizes, which make them sensitive to habitat fragmentation (Paige and Ritter 1999). Food sources are primarily insects in the summer, with seeds of grasses and shrubs a secondary source. Across the Shoshone, there are approximately 38,800 acres of sagebrush, representing 2.0 percent of the Forest (USDA Forest Service 2012b). This acreage includes all types of sagebrush. Mountain big sagebrush dominates the montane shrublands throughout the Absaroka Mountains. Black sagebrush, Wyoming sagebrush and basin big sagebrush occur on the eastern margins of the Forest. The most extensive of these stands are found in the North and South Fork Shoshone River valleys and along the Beartooth front. On the Washakie Ranger District, mountain big sagebrush is mixed with bitterbrush and mountain snowberry. Additional sagebrush habitat likely occurs within some stands classified as grassland on the Shoshone.

In general, most of the sagebrush stands on the Shoshone are likely in a mature condition. This is largely due to fire suppression, especially at the lower elevations on the Shoshone. Fire suppression can cause increases in shrub cover and tree encroachment, but on the Shoshone the change is not large enough to be outside of the historic range of variability at the stand or landscape level (low confidence) (Meyers et al. 2006). There appears to be adequate habitat to support viable populations of this species on the Shoshone.

Roads on the Shoshone have likely fragmented some sagebrush stands. To what extent is currently unknown.

Livestock grazing can influence sagebrush ecosystems. High stocking rates typically result in an increase of mature sagebrush due to the removal of understory herbaceous vegetation. Trampling of nests is not thought to be of concern, as this sparrow nests in the canopy of sagebrush. Nest parasitism from cowbirds may have an impact, as cowbirds tend to follow livestock herds (Paige and Ritter 1999). However, both rotational grazing systems and the later turn-out date of most livestock operations likely provide adequate areas of little influence from this effect (Bock et al. 1993). Livestock may also increase the risk for the introduction of invasive plants.

Invasive plants are currently limited to localized concentrations and are primarily located along major travel corridors (roads and trails). Similarly, cheatgrass has yet to invade large or broad portions of the Shoshone. However, the threat of habitat loss remains high. Cheatgrass alters the fire regime and increases the probability for more frequent fires. This reduces the chance for sagebrush and native bunchgrasses to get re-established following a fire.

Retention of stands of mature sagebrush habitat at a watershed scale would provide for ensured habitat for populations of this species. Although to what level is unknown, it is assumed that within a range of what likely historically occurred is reasonable. This would also facilitate management toward ensuring sustainable and diverse habitat conditions. If sagebrush was managed only for mature high canopy cover stands, the habitat is more at risk for losses due to wildfire, and would not provide the needed diversity of grasses/forbs for other species. Mosaics created by prescribed burning may be most beneficial, though this could also be accomplished through other methods.

Paige and Ritter (1999) recommend small-scale, patchy prescribed burns for habitat diversity considerations, which should be conducted in the late spring or fall. The guidelines developed for vegetation management in sage grouse habitat (WGFD 2003) would likely be adequate for these species.

In a review of management indicator species for the Plan, Brewer’s sparrows were recommended to be maintained as a management indicator species in the Plan revision due to their habitat association and effective monitoring through point counts.

Desired Condition

For continued and improved management for the Brewer’s sparrow and its habitat, the following conservation measures were developed for incorporation into revised Plan goals, objectives, standards and guidelines. Inclusion of these measures would continue to provide adequate habitat for this species and other sagebrush-associated species resulting in a low viability risk to these species. Birds in a Sagebrush Sea (Paige and Ritter 1999), Brewer’s Sparrow (*Spizella* *breweri*): A Technical Conservation Assessment (Holmes et al. 2005b), Sage Sparrow (*Amphispiza belli*): A Technical Conservation Assessment (Holmes et al. 2005a), and the Wyoming Greater Sage-Grouse Conservation Plan (WGFD 2003) were reviewed to determine habitat needs.

Conservation measures summarized include:

1. Prevent or reduce the risk for large stand-replacement fires in sagebrush habitat. Conduct prescribed burns that are small and patchy and maintain habitat diversity. Retain areas of large expanses of sagebrush habitat (minimize edge created).
2. In areas with cheatgrass and other invasive plants, avoid prescribed burns to reduce the risk of further spread.
3. Maintain native grasses and forbs through proper grazing limitations. Use rotational grazing systems to provide rest and areas with reduced potential for cowbird parasitism. Provide for retention of about 50 percent of current year's growth of herbaceous vegetation for nesting cover in the following season.
4. Consider resting burned areas from grazing to provide adequate regeneration of native vegetation.
5. Prioritize and aggressively treat invasive weeds to prevent additional loss of sagebrush habitats.
6. Limit the number of new roads. Reclaim old roads that are not being used. Discourage road construction and other developments where it would reduce sagebrush habitat patch size.
7. Retain sagebrush habitat (no type conversions).
8. Re-establish sagebrush and native bunch grasses in habitat now dominated by invasive plants.
9. Provide a mosaic of open (5 percent) to moderate (25 percent) shrub canopy cover on the landscape.

Direct and Indirect Effects

Effects from Fire Management, Livestock Grazing, Big Game, and Invasive Plants: Primary risk factors from forest management include: habitat fragmentation, prescribed fire, livestock grazing, and invasive plants.

As mentioned previously, activities that have potential to expand cheatgrass or other invasive plants should be closely monitored to ensure further loss of habitat does not occur. Climate change has the potential to increase the spread of cheatgrass into sagebrush and alter fire regimes.

Roads can have negative effects on these species. Roads can reduce patch size, increase the potential for displacement by other species more adapted to roads and edge (horned larks), and increase the risk for introduction of invasive plants. Additional road construction in large stands of sagebrush should be minimized.

Alternative A: No action

As displayed in table 57, alternative A provides for a similar amount of fuels treatment in mixed-shrubland as alternatives B through G. These treatments primarily involve prescribed fire to reduce fuels hazards associated with mature, medium-density shrublands, including sagebrush. Because sagebrush is not a target species for fuels reduction on the planning area, potential impacts to Brewer's sparrows from fuels reduction activities on the Shoshone are expected to be minor, but cannot be completely discounted.

As displayed in table 57, the permitted amount and area for cattle grazing does not differ among alternatives A, B, D, and G. These activities are, therefore, predicted to have potential negative influences on individual breeding pairs of Brewer's sparrows where activities and habitat overlap. On NFS land, however, these activities are expected to be minor because of the small amount of acreage involved and the conservation measures developed to minimize potential impacts. These conservation measures are similar across alternatives.

Action Alternatives: Alternatives B through G

All alternatives provide for a similar amount of fuels treatment in mixed-shrubland, with a slight decrease in alternative E and greater decrease in alternative F. Because sagebrush is not a target species for fuels reduction of NFS land, potential influences on Brewer's sparrows and other sagebrush-associated species are expected to be similar to alternative A.

As displayed in table 57, alternatives B, D, and G provide for the same amount of livestock grazing as alternative A. There is a slight reduction in AUMs and area in alternative C, and a slight increase in AUMs in alternative D. The decrease in grazing area and stocking rates in alternative C may provide some secondary benefits to species such as the Brewer's sparrow, while the increase in alternative D may be associated with a higher degree of habitat impacts to the species. Alternatives E and F maintain the highest permitted forage allocation to livestock and are, therefore, assumed to have a potential for negative impacts to Brewer's sparrow habitat if the activities overlap. Overall, however, potential impacts are expected to be similar and based on site-specific areas where conservation measures are available to alleviate identified problems. The conservation measures are similar across all alternatives.

Cumulative Effects

There is little to no management activity that occurs in sagebrush on the Shoshone, except for grazing. Although sagebrush has a limited distribution across the Forest, livestock grazing effects have occurred where grazing activities occur within active allotments. Fuels management may occur in areas, which include small stands of sagebrush, but otherwise are dominated by other vegetation types. Management actions are conducted in sagebrush grasslands on the adjacent BLM lands where the objectives include opening up decadent stands to improve the grass/forb understory, to increase the age class diversity, and to improve forage conditions and habitat. Overall, little influence or cumulative effects on sagebrush-associated species is expected on the Shoshone, because of limited activities in this habitat type.

Red-breasted nuthatch

Affected Environment

Red-breasted nuthatches (*Sitta canadensis*) are a non-migratory, native avian species on the Shoshone. They are widespread in distribution in coniferous forests on the Shoshone and throughout Wyoming. They are associated with mature structural stages, primarily due to their association with soft snags for nesting cavities, and from both insects in bark and cone crops as forage. Hart and Hart (2001) found that old live aspen with heart rot was a significant component in cavity construction and indirectly benefits the nuthatch since it nests in constructed cavities. Norris and Martin (2008) suggest that nuthatches selected sites that maximized nesting and foraging opportunities, and during food pulses (mountain pine beetle outbreaks), nuthatches may select more foraging opportunities over higher densities of suitable nest trees.

This species would be most strongly associated with mature to older forest habitat structural stages (4A, 4B, 4C), and have been known to occur in the younger stages if snags are present. Currently, approximately 49 percent of the forested habitats are in structural stage 4, of which approximately 14 percent (174,000 acres) is in the 4C category. Nuthatches are not known to be sensitive to edge or fragmentation issues, including effects of roads or timber harvest. Keller and Anderson (1992) found similar results when comparing cut stands of trees (fragmented habitat) to unfragmented stands. While it was not clear from their 1992 data that red-breasted nuthatches were influenced by fragmentation, in previous study years they were more abundant in the uncut stands. Continued availability of their habitat (4C, snags, etc.) would be the issue of concern.

Since 2002, the Shoshone has undertaken avian point count monitoring to improve its information available on population trends for several species. The nuthatch is adequately detected through this survey protocol, and baseline trends indicate a stable population with estimated densities of approximately 206,500 (72 percent coefficient of variation) (Rehm-Lorber et al. 2010). However, populations are known to fluctuate in response to cone crops.

In a review of management indicator species for Plan revision, the red-breasted nuthatch was recommended to be a management indicator species due to their habitat association with snags in mature conifer forest stands.

Desired Condition

For continued and improved management for the red-breasted nuthatch and its habitat, the following conservation measures were developed for incorporation into the Forest Plan goals, objectives, standards and/or guidelines: maintain as recommended by current literature, the size, density and distribution of snags in habitat structural stage 4B (mature trees with 40 to 70 percent canopy closure) and 4C (mature trees with 70 to 100 percent canopy closure) when vegetation management practices are proposed.

Direct and Indirect Effects

Effects from Timber Management and Fire and Fuels Management: Anticipated activities (prescribed fire, commercial harvest, wildland fire use, and fuelwood cutting) that have the potential for removing mature coniferous habitat may have an impact on this species.

Alternatives A through G: No Action and Action Alternatives

The primary habitat factors associated with effects to red-breasted nuthatches would be both the availability and distribution of HSS 4C and old forest, and snags.

In summary of effects to habitat from management activities, alternatives A, B, C, D, and G would likely provide the greatest amount of this type of habitat (4C, old forest and snags) in the next planning period. Alternative E would follow, with alternative F having the least of any of the alternatives, but still an adequate amount of this type of habitat within the range of historic range of variation as designed by the snag guidelines adopted in the Plan. These effects are from the results of timber harvest, though the natural processes of insects and disease and fire would continue to be the largest source of influence on the availability of 4C and old forest stages and snags. Timber harvest would only occur on suited acres, which range from 8 percent of the total forested acres on the Shoshone in alternative A to approximately 20 percent in alternative F. Recent and past harvest activities have occurred on approximately 3 percent of the forested acres.

Snag removal occurs with firewood harvest. This effect typically only occurs within a few hundred feet along open roads. Where additional roads are constructed in support of harvest activities, there would be more of this type of habitat removed. Again, this would be most prevalent in alternatives E and F, with alternatives A through D and G all having the least amount of snag removal. However, it is also likely that due to the large expanses of habitat away from roads remaining, more than adequate snag abundance would be provided regardless of alternative, and desirable snag abundance levels would still be ensured in project areas, even following harvest. Timber modeling indicates that regardless of alternative, the forested acres would continue to mature with an abundance of mature structural stages. Wildfires and prescribed burns would create snags by killing live trees, and mosaic patterns typically leave green recruitment trees for future snags.

With regard to effects to Forest-wide populations, it could be assumed that populations would follow the trend of the habitat as discussed above, which would largely be driven by natural disturbance processes. However, as with any wildlife species, elements of climate would have a strong influence, affecting forage and prey available, and thereby, reproduction success. Red-breasted nuthatches are relatively unaffected by human disturbance. As with other passerines, active nests could be occasionally removed through timber and firewood harvesting. However, as only a few hundred acres of commercial harvest or firewood harvest are typically active in any given breeding season, this effect is thought to be minimal and undetectable to populations, particularly at the Forest-wide scale. The Plan will implement the measures required by the Migratory Bird Executive Order 13186 by providing appropriate management direction, monitoring, and consideration of rare species.

Anticipated activities (prescribed fire, commercial harvest, and wildland fire use) in all alternatives that may change habitat are all viewed as maintaining the habitat through time as desired by the Forest-wide strategy in the Plan. Diversity in age class structure may help prevent more widespread loss of habitat, and/or create resiliency to disturbance, even though habitat may actually be reduced in the short term through disturbance activities.

Cumulative Effects

In general, cumulative effects are assessed for the Shoshone and adjacent lands adjacent within 3 miles of its boundary. The period considered for this analysis is the anticipated life of the Plan, 10 to 15 years. Cumulative effects include the past, present, and reasonably foreseeable future actions, as mentioned in the summary of activities table (table 20). From this table, for the nuthatch, the past and present activities of vegetation management have been insignificant, as much of the landscape adjacent to the Shoshone is shrub/sagebrush habitat. The reasonably foreseeable future activities of subdivisions and vegetation treatments on adjacent lands are also insignificant.

The Shoshone would continue to be influenced by the natural disturbance processes, and only secondarily by timber harvest or prescribed burns. Alternatives E and F would have the most potential for timber harvest and fuelwood harvest, which can lower the number of snags in an area for this species. Logging activities and firewood harvest occur on private lands adjacent to the Shoshone, though this is typically limited by slope and road access, and occurs mostly in the southern part of the Forest.

Species of local concern

Rocky Mountain elk

Affected Environment

Historically, elk ranged across much of North America from western Canada south through most of the conterminous United States and into Mexico (RMEF 2009). Currently, elk still range across most of the western United States and Canada with isolated re-introduced populations in several eastern states. Rocky mountain elk (*Cervus canadensis*) occur across most of Wyoming where suitable habitat exists, including the Shoshone. Elk are considered a big game animal in Wyoming.

No trend data specific to the Shoshone are available, but data are available for elk herd units that encompass the Shoshone. Five herd units overlap the Shoshone including: Gooseberry, Cody, Clarks Fork, Wiggin's Fork, and South Wind River. For the most part, trends for these herd units have been relatively stable (USDA Forest Service 2012a) (figure 20). Population objectives have been at or above herd unit objectives. In a recent study completed on the Clarks Fork elk herd, Middleton (2012) found that pregnancy rates did differ by age class for the migratory versus non-migratory subpopulations of this elk herd, with non-migratory elk showing a higher pregnancy rate in the younger and older age classes. In addition, there has been a shift in calf production of the two subpopulations, with migratory elk producing fewer calves than non-migratory. Middleton's findings suggest that large carnivore recovery and drought, operating simultaneously, influenced the makeup of the migratory elk.

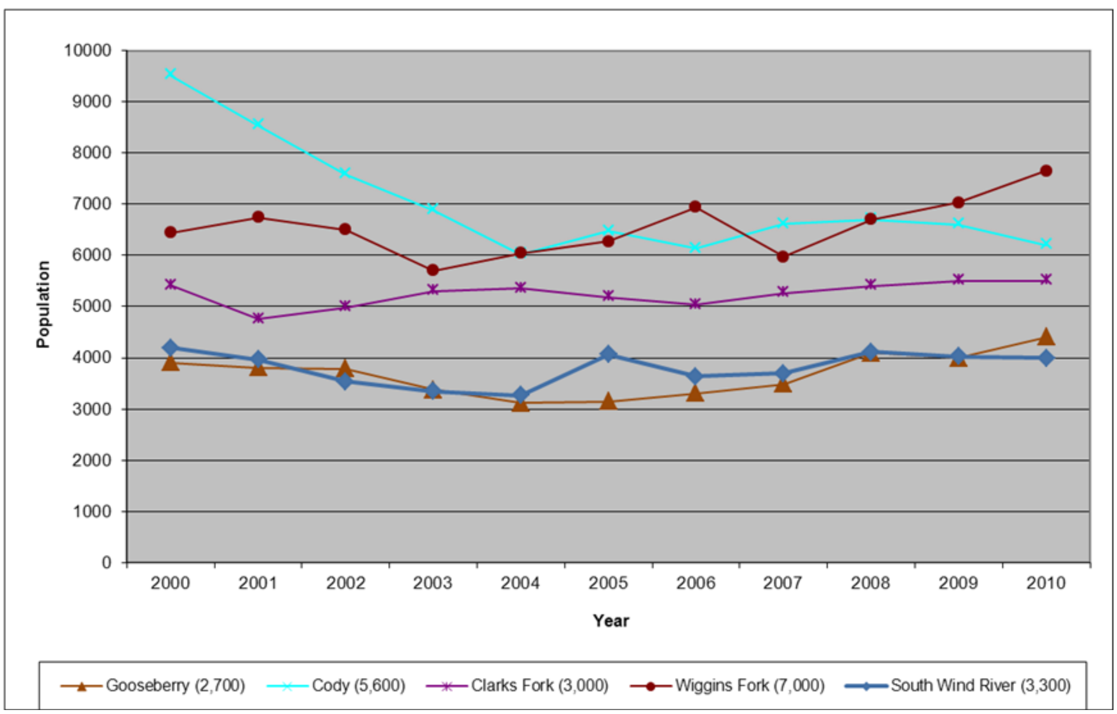


Figure 20. Population trends for elk herd units that encompass the Shoshone National Forest

Since elk are habitat generalists, virtually the entire Shoshone would be considered some type of seasonal range for elk, except for the most rugged portions of the Wind River Range. Elk calving and crucial winter ranges are the most important habitats on the Shoshone (see map 15).The Shoshone contains about 479,100 acres of calving areas and 896,000 acres of crucial winter range.

Security habitat is abundant on the Shoshone within the wilderness areas and the grizzly bear primary conservation area.

In recent years, the Shoshone has experienced large wildfires. About 115,000 acres have burned in the last 5 years, and about 161,500 acres in the last 10 years (USDA Forest Service 2012c). Wildfires create ideal foraging habitat for elk.

In February 2004, Wyoming lost its brucellosis class-free status when 31 reactor cattle were detected in a Sublette county herd (Wyoming Brucellosis Coordination Team [WBCT] 2005). Infection of these cattle likely originated from elk on the nearby elk feedground. Following this loss of class free status, increased surveillance of Wyoming cattle revealed a series of herds with the disease in the Greater Yellowstone Ecosystem ([GYE]; WBCT 2005).

To develop management strategies regarding brucellosis in the GYE of western Wyoming and regain brucellosis class-free status, the Wyoming Brucellosis Coordination Team identified the Brucellosis Management Action Plan (BMAP) process as their highest priority recommendation (WBCT 2005). BMAPs have already been finalized for several of elk herds including the Cody elk herd on the Shoshone.

The disease known as Brucellosis is caused by the bacteria *Brucella abortus* and is transmitted when a susceptible animal contacts and ingests bacteria following the abortion or stillbirth from an infected female. Exposure of a susceptible animal to the bacteria elicits an antibody immune response that can be detected (with varying degrees of accuracy) following one to several unique blood tests. When several or more animals are tested from a population within a given time period, this provides an index of exposure (but not infection) to the bacteria. This mathematical proportion of exposure (i.e., those animals that are antibody-positive divided by the sample population) is commonly referred to as “seroprevalence.”

Exposure of elk to brucellosis was first documented at the National Elk Refuge in 1933, and since then, has been documented in elk attending all 22 Wyoming state-operated winter feedgrounds on the adjacent Bridger-Teton National Forest, as well as winter free-ranging elk from western Wyoming, northeastern Idaho, and southern Montana. Seroprevalence of brucellosis in elk attending Wyoming winter feedgrounds averages about 25 percent and generally declines to levels less than 10 percent in winter free-ranging elk throughout the Greater Yellowstone Area. However, winter free-ranging elk habituating lands of the Shoshone National Forest in Wyoming, particularly those areas north of Lander and Dubois, have had seroprevalence levels as high as 22 percent.

It has long been recognized that elk of the Greater Yellowstone Area are a reservoir of brucellosis. Despite the use of winter feedgrounds, strain 19 vaccination, and several other best management practices, the threat of spillover from elk to domestic livestock has been realized and confirmed several times in the past decade. As elk herds of the Shoshone National Forest have continued to grow and utilize winter habitats in similarity to winter feedgrounds, it is likely that these elk will maintain elevated seroprevalence and also pose a threat to adjacent livestock operations. Most recently, this particular threat was realized following confirmed spillover of brucellosis from winter free-ranging elk of the Shoshone National Forest to adjacent livestock on private lands.

Whether from elk attending feedgrounds or winter free-ranging, elk-to-livestock transmission events have caused economic and logistical constraints for livestock producers and induced time-consuming policy changes at state and federal levels.

Desired Condition

Maintaining diverse and productive seasonal habitats would be the most important forest management emphasis for elk. In addition, limiting human access to elk calving and wintering areas would be important to reduce potential disturbance during these critical time periods. Providing sufficient security habitat outside of wilderness and the grizzly bear primary conservation area would be important.

The 1986 Forest Plan developed standards and guidelines to provide security for elk by maintaining a certain percentage of the forested habitat in hiding cover. However, later research recognized that hiding cover, which is defined as cover that would hide 90 percent of an adult elk at 200 feet (Lyon and Christensen 1992), did not incorporate the larger concern of the effect of road densities on elk distribution.

Elk security habitat is defined as “any area that will hold elk during periods of stress because of geography, topography, vegetation, or a combination of those features” (Lyon and Christensen 1992). Hillis et al. (1991) quantified elk security areas as nonlinear blocks of hiding cover 250 acres or more in size and 0.5 mile or more from any open road. They noted that elk vulnerability increases when security areas comprise less than 30 percent of an analysis unit.

For planning purposes, five geographic areas (WGFD elk herd units) were selected as the analysis units. The existing amounts of security habitat were assessed in these areas. Existing security areas were defined as those areas that met the habitat criteria (forested structural stages 1T, 2T, 3A, 3B, 3C, 4A, 4B and 4C with 250 or more acres), that were greater than 0.5 mile from any open road (Level 2 to 5) or motorized trail. Areas that were dropped out of the security analysis included 1T within fires less than 20 years old (recent burned young stand) and non-forested polygons. Table 72 displays the amount of existing and minimum security for each of the five elk herd units.

Table 72. Amount of existing and minimum security for the five elk herd units

Herd unit	Existing percentage of herd unit providing secure habitat	Minimum percentage of herd unit providing secure habitat
Clarks Fork	34	30
Cody	25	30
Gooseberry	31	30
South Wind River	44	30
Wiggins Fork	36	30

Potential elk security cover was also assessed to delineate areas that could meet security cover needs for elk in the future once timber stands that don’t currently provide cover (such as seedling/sapling stands) mature. For potential security, the same habitat parameters were used, although it was assumed that the Shoshone would not likely close a road long term if it were a

Level 3 to 5 due to investments (gravel, etc.), so areas within a 0.5-mile buffer of these types of roads could not be considered potential. Potential secure habitat is displayed in the environmental consequences section.

Elk were selected as a species of local concern due to the social interest in the species, and due to the species' habitat associations with forested canopy cover alterations and road densities. Security areas provide an analysis function for species with similar habitat associations, namely larger blocks of forested stands that have less human disturbance as they are greater than 0.5 mile from an open road. Examples of other emphasis species that may benefit from this type of habitat include grizzly bear, lynx, American marten, wolverine, goshawk, and boreal owl. As displayed above, some herd units are close to the minimum amount of security to meet the recommended level of 30 percent per analysis unit, largely due to a lack of forested cover from naturally occurring meadows and shrublands. Hillis et al. (1991) did not specify a minimum threshold of elk security for maintaining population abundance or to meet other specific management objectives. However, the interdisciplinary team recognized the need to maintain at least the existing amount of elk security for each elk herd unit and seek to improve during site-specific project implementation.

Elk security cover indirectly improves local economies because of the hunter opportunity generated by the quality habitat and resulting hunting experience. This becomes evident where general hunting season areas have been switched to limited entry, reducing both the number of hunters in the field and hunter success (WGFD 2004). The change in number of hunters has been especially evident in Hunt Area 52, Sunlight Basin.

Reductions in road densities to improve elk security cover need to be balanced with the public's desire to have motorized access for hunting and other recreation pursuits, including wildlife viewing, fishing, and scenic viewing. Adequate access is also necessary to achieve desired elk harvest levels. Closed roads and non-motorized trails are also main avenues of recreation access, providing larger disturbance potentials to wildlife from recreation as compared to areas where no trails or roads occur. Direct impacts from roads can include overexploitation, increased hunting pressure and increased roadkill (USDA Forest Service 2000). While changes in road density can improve elk security cover through seasonal closures during hunting seasons, the benefit of year-round secure habitat for other species is also important. However, based on radio locations of elk on the Starkey Experimental Forest and Range (The Starkey Project), M. M. Rowland (cited in Rowland et al. 2005) found no relations between the number of elk locations and habitat effectiveness based on open road densities. By contrast, the number of elk increased as the distance to roads increased. The main challenge to this type of habitat has been from the increased use of all-terrain vehicles as compared to conditions projected in the 1986 Forest Plan. Snowmobiles may also reduce the winter availability of secure areas, mainly for species other than elk.

Currently, no specific elk habitat monitoring occurs on the Shoshone, other than verification of application of standards and guidelines in projects. The 1986 Forest Plan directed habitat monitoring and treatment for big game winter range, which has not regularly occurred, though some project-specific treatments (e.g., prescribed burns) have occurred with monitoring for that purpose. The Shoshone provides a substantial amount of winter range, including crucial winter range and is primarily used by elk year-round. Issues with winter range primarily focus on human disturbance and stress, for which the 1986 Forest Plan contained management direction, as would the Plan.

Standardized Definitions for Seasonal Wildlife Ranges were developed in Wyoming among Federal and State agencies and the Wildlife Society, Wyoming Chapter, and adopted by these agencies in 2006. Big game winter range is where a population or portion of a population of animals uses the documented suitable habitat within this range annually, in substantial numbers only during the winter (variable, but commonly between December 1 and April 30).WGFD adopted the dates November 15 through April 30 for winter range closures in 2004. Timing restriction dates of December 1-April 30 were identified in the Revised LMP for all alternatives on big game crucial winter range.

Crucial range describes any particular seasonal range or habitat component (often winter or winter/yearlong range in Wyoming) but describes that component which has been documented as the determining factor in a population's ability to maintain itself at a certain level (theoretically at or above the WGFD population objective) over the long term. These definitions were used in this analysis.

It is the desire of the Shoshone staff to coordinate with the WGFD to improve security habitat on the Forest, to improve the ability to maintain elk herds within population objective and to provide improved hunter opportunity.

It is also the desire of the Shoshone to work cooperatively with the WGFD to reduce transmission risks of brucellosis between elk and cattle.

In order to provide management for elk and to maintain or improve its potential distribution on the Shoshone, the following conservation measures were developed for incorporation into Plan goals, objectives, standards, and guidelines. Since elk are habitat generalists and currently occur at or above management objectives, overall viability risk from forest management to elk is low.

Conservation measures summarized include:

- In cooperation with the WGFD, seasonally close motorized access to crucial elk winter range during critical time periods.
- Conduct management activities that disturb wintering elk outside of the critical time period except when the project is designed to maintain or improve crucial winter range conditions (i.e., prescribed fire).
- Conduct management activities that disturb calving elk outside of the critical time period except when the project is designed to maintain or improve elk calving area conditions (i.e., prescribed fire).
- When proposing treatments to regenerate aspen, treat the most acres of aspen possible at the same time to reduce the impacts from elk browsing.
- Utilize prescribed fire and mechanical treatments to maintain and improve elk seasonal ranges.
- Allow for wildland fire use, where appropriate, to maintain and improve elk seasonal ranges.
- Manage domestic livestock grazing on elk crucial winter ranges to provide sufficient forage for wintering elk within herd population objectives.
- Identify and maintain sufficient elk security habitat outside of the grizzly bear primary conservation area.

Direct and Indirect Effects

Effects from Timber Management, Fire Management and Road Use: The primary risk factor from forest management is human disturbance during critical time periods (calving and winter), fire suppression, and roads.

Roads can provide the mechanism to increase the harassment, poaching, collisions with vehicles and displacement of terrestrial vertebrates, including elk. Direct mortality of large mammals from motorized travel on forest roads is usually low, except for those with a home range straddling a road (USDA Forest Service 2000).

Disease risks include chronic wasting disease and brucellosis. Chronic wasting disease is currently not known to be prevalent in elk herds on the Shoshone.

Existing elk security areas were incorporated into different alternatives depending upon the amount of road and trail open to motorized use. For example, in alternative C, which has the most recommended wilderness and back country non-motorized, more secure habitat is proposed compared to the other alternatives. The same goes for potential secure habitat. This is habitat that would provide cover in the future due to seedling and sapling stands maturing into cover. Alternative C would once again provide more potential secure habitat due to less roads and trails open to motorized use. Table 73 displays the amount of secure and potential secure elk habitat by alternative for each of the elk herd units.

Table 73. Amount of secure and potential secure elk habitat for elk herd units, by alternative

Herd unit	Herd unit acres	Secure habitat				Potential secure habitat			
		Alt. C		Other Alts.		Alt. C		Other Alts.	
		Secure acres	Pct secure	Secure acres	Pct secure	Secure acres	Pct secure	Secure acres	Pct secure
Clarks Fork	544,541	184,959	34%	176,409	32%	238,495	44%	229,561	42%
Cody	824,184	206,449	25%	206,079	25%	357,414	43%	357,016	43%
Gooseberry	209,831	64,280	31%	64,227	31%	68,609	33%	68,555	33%
South Wind River	242,405	107,021	44%	92,403	38%	111,272	46%	95,647	39%
Wiggins Fork	617,069	219,371	36%	212,663	34%	244,649	40%	237,905	39%

Existing crucial winter range was also incorporated into management area (MA) prescriptions by alternative. This included managed big game crucial winter range (MA 5.4) For example, in alternative B, 55,000 acres of crucial winter range was designated MA 5.4, where under alternative F, all MA 5.4 acres were assigned to MA 5.1 instead. Even though the amount of crucial winter range varies by management area in each of the alternatives, the total amount of crucial winter range remains the same in all alternatives. Table 74 displays the crucial winter range by management area and alternative.

Table 74. Crucial winter range acres by alternative management areas

MA	MA Description	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
1.1	Wilderness	458,000	458,000	458,000	458,000	458,000	458,000	458,000
1.1A	Glacier Addition	6,100	6,100	6,100	6,100	6,100	6,100	6,100
1.2	Recommended Wilderness	0	0	265,500	61,500	0	0	0
1.2A	Recommended High Lakes Wilderness	0	0	1,320	0	0	0	0
1.2B	Recommended Dunoir Wilderness	0	0	6,790	6,790	0	0	0
1.3	Backcountry Non-Motorized	219,300	213,400	45,000	216,900	198,500	131,100	199,500
1.5A	Clarks Fork of Yellowstone Wild River	4,110	4,110	1,940	4,110	4,110	4,110	4,110
1.6A	High Lakes Wilderness Study Area	1,320	1,320	0	1,320	1,320	1,320	1,320
1.6B	Dunoir Special Management Unit	6,780	6,780	0	0	6,780	6,780	6,780
2.2A	Line Creek Research Natural Area	1,060	1,060	76	1,060	1,060	1,060	1,060
2.3	Potential Research Natural Area	57	11,450	2,330	12,700	0	0	12,190
3.1A	Swamp Lake Botanical Area	570	570	570	570	570	570	570
3.1B	Potential Little Popo Agie Moraine Geological Area	0	210	210	210	0	0	210
3.1C	Potential Sawtooth Peatbeds Geological Area	0	0	0	0	0	0	0
3.3A	Back Country Motorized	56,200	9,000	0	0	7,020	107,400	5,260
3.3B	Back Country Winter Motorized	0	4,590	0	0	4,870	0	24,800
3.3C	Back Country Summer Motorized	0	35,400	1,970	4,210	58,800	2,660	31,700
3.5	Back Country Recreation and Restoration	0	19,800	0	0	0	0	0
3.5A	Back Country Restoration Motorized							520
3.5B	Back Country Restoration Winter Motorized							1,710
3.5C	Back Country Restoration Summer Motorized							6,690
3.5D	Back Country Restoration Non-Motorized							10,200
4.2	Travel Corridor	67,600	59,000	48,300	59,000	60,600	60,700	58,400
4.3	Back Country Access Corridor	0	5,760	1,870	5,730	3,580	1,990	5,760
4.5A	Potential Kirwin Historical Area	49	49	49	49	49		1,670
5.1	Managed Forests and Rangelands	26,700	0	0	0	130	132,300	0
5.2	Public Water Supply	0	4,530	3,880	3,880	4,530	0	4,530
5.4	Managed Big Game Crucial Winter Range	45,600	55,000	52,100	54,000	79,900	0	55,000
8.2	Ski-based Resort	0	330	330	330	330	330	330

The biggest impact from the alternatives to elk crucial winter range is whether there are motorized use timing stipulations on crucial winter range. The degree of disturbance caused by winter recreationists (skiers, snowmobilers, helicopters) has mostly been reported in terms of flight distance or in some observed change in behavior manifested by animals. Based on elk heart rate data, Chabot (1991) showed that even when disturbances do not induce an overt behavioral response, the increased heart rates can result in relatively high energy expenditures, during the time of year when ungulates are struggling with weight loss. While no acreage figures were developed for each alternative, table 75 displays the timing restrictions proposed by alternative. Map 74 displays existing snowmobiles trails in relationship to crucial winter range.

Table 75. Winter motorized use on winter range

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Winter motorized use on big game winter range	Allowed on less than one third of crucial winter range	Allowed on just over 5% of crucial winter range	Prohibited on all winter range including crucial winter range.	Prohibited on all crucial winter range	Allowed on 10% of crucial winter range	Allowed on 40% of crucial winter range. No winter range timing restrictions.	Allowed on just under 10% of crucial winter range

Alternative C would provide the most disturbance-free winter habitat as it would restrict motorized use on all big game winter range, including crucial winter range. Alternative F would provide the least amount of disturbance free winter habitat as it proposes no timing restrictions in big game winter range. Alternatives D, B, G, E, and A would provide disturbance free habitat in a descending order from most to least, but all would provide more habitat then alternative F.

In addition to management prescription analysis, the likelihood of road construction or timber harvest in elk security areas was also assessed by alternative. Timber harvests are conducted to accomplish other resource objectives, in addition to providing commercial products. There are benefits from harvest activities in terms of forage production for elk and other wildlife, and general habitat diversity in terms of a variety of age classes created (structural stages). Timber harvests also remove a cover component of elk security habitat, and frequently roads are constructed to access timber stands, which are the two main variables in assessing elk security areas.

Alternative A would likely retain existing elk security areas in their current configuration for the next planning period. Small areas of existing elk security would likely be entered in alternatives B, C, D, and G. Larger areas of existing elk security would be entered in alternatives E and F. This is indicated by the amount of acres suited for timber production by alternative. The overlap of suited acres with security areas does not mean that harvest or road construction would necessarily occur. However, the likelihood of harvest and road construction activities increases with the number of acres of overlap given the higher objectives for timber harvest associated with those acres. Table 76 displays the acres of suitable timber by alternative.

Table 76. Acres of suitable timber, by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Suitable timber base acres	86,300	127,000	122,100	124,500	179,700	251,200	127,000

While elk security areas can theoretically be maintained by closing roads following uneven-aged harvest prescriptions, the risk of losing the integrity of the security area increases as more acres are harvested and more roads are built. People will continue to use roads and skid trails for access, whether by foot or horseback, depending upon the closure effectiveness. Studies on other forests have indicated a significant problem in achieving effective closures (Griffin 2004), and the Shoshone faces similar challenges. Road impacts can be offset by management of access prior to initiating timber harvest. Road closure in areas adjacent to planned harvest units can improve elk security prior to entering the adjacent area. In addition, if timber harvest treats larger areas (greater than 40-acre clearcuts), similar to natural disturbance processes in lodgepole pine, fewer roads would be needed, resulting in less impact on elk security.

It is also likely that some improvements to elk security would occur with Plan implementation. There may be additional user-created routes from motorized vehicles that may reduce the effectiveness of identified elk security, or potential elk security areas. It should be noted that user-created routes are not included in the model because they are not system roads or trails, and often locations are not specifically known.

It is assumed that security areas would be created within the geographic area through road closures to mitigate any additional user-created routes. However, this has yet to be tested at the project implementation scale, given known public resistance to road closures. It is feasible to rotate elk security areas on the landscape. In other words, as harvest or other vegetation management is conducted in one area, an adjacent area could have roads successfully closed to allow for elk and other species to use those areas. Similarly, as forested areas are either harvested or grow up, the forested cover aspect of security habitat can be rotated on the landscape. Travel management decisions would need to incorporate considerations for elk security, as would other vegetation management (e.g., prescribed fire) projects. The current projections for prescribed fire that have the potential for reducing forested canopy are relatively minor acres of forested habitat (approximately 1,450 acres per year).

Timber harvest and other vegetation management projects are also important for elk and other animals that rely on early seral stages for forage or other habitat needs. It is not desirable to retain mature forested canopies over the entire Shoshone to keep security areas, but rather a balanced need for a diversity of structural stages also needs to be considered (Toweill and Thomas 2002). The creation of additional forage in alternatives E and F would benefit summer range conditions; though the availability of the forage may be offset if roads are not effectively closed and elk do not use the areas. Also, summer forage quantity has not been a limiting factor for elk due to the natural interspersion of meadows on the landscape.

Effects from Livestock Grazing and Big Game: Livestock grazing would have no direct effects on elk security habitat. However, security habitat is most effective when it occurs adjacent to quality foraging habitat. Livestock grazing would remove forage that would be available to elk and other wildlife. Forage utilization standards and guidelines were developed with this in mind, and administration of these measures would largely address this issue. Currently, localized areas within individual allotments have problems with the cumulative use of rangeland vegetation by livestock and wildlife. Fences added to manage commercial livestock grazing can have a negative impact on big game species by catching them in the wire or restricting movement patterns due to the height of the wire. Alternatives E and F would have the greatest impact on forage on big game crucial winter range since both alternatives propose no forage utilization restrictions on commercial livestock on crucial winter range. Alternative C, which eliminates all commercial livestock grazing on crucial winter range, would benefit big game species the most. Alternatives A, B, D, and G all have the same effect since they propose forage utilization standards on crucial winter range.

Alternative C would provide the least potential transmission of brucellosis with domestic livestock. Alternative C would minimize disturbance to wintering elk, making it more likely they would remain on all Forest winter ranges, including crucial winter range. Without some type of timing restriction on elk crucial winter range, there is the potential of elk moving off the Forest to adjacent private property, increasing the opportunity for elk to intermingle with livestock. Alternative F would provide the greatest opportunity of transmission with domestic livestock because it proposes no timing restrictions on disturbing activities in elk crucial winter range, thereby providing the least amount of protection from disturbance during the critical winter months. Alternatives D, B, G, E, and A would provide disturbance-free habitat in a descending order from the most to least, but all would provide more protection from winter disturbance than alternative F. Under all alternatives, should brucellosis issues between elk and domestic livestock become more of a concern on National Forest System lands, recommendations in the Cody brucellosis management action plan developed by the Wyoming Governor's Brucellosis Coordination team and Wyoming Game and Fish Department will be utilized.

Effects from Recreation Management and Special Uses: Recreation activities would influence the effectiveness of elk security cover. In the absence of other large predators, human disturbance is the only major factor that displaces elk. The potential effect of humans is addressed in the discussion above on travel management. Where higher road densities occur, there is greater viewing and hunting pressure on elk, providing the disturbance that causes elk to seek secure habitat. Studies have shown that hunters, and presumably most recreationists, stay within 0.25 mile of open roads and trails (Lyon and Burcham 1998). Disturbance is largely a function of dispersed recreational use, as developed campgrounds are a localized source of disturbance. A surrogate for dispersed recreation would be the motorized recreation opportunities on the Shoshone, which largely follow trends in road development associated with timber harvest as described above, with similar effects by alternative.

With regard to effects on winter range, disturbance from recreation is typically of concern, as stress during this period can increase mortality. Most of the activity on winter range involves snowmobile use and collection of antler sheds. Similar to the 1986 Forest Plan, areas of identified winter range were mapped by the WGFD, and depending upon the alternative, would be closed or not to motor vehicle traffic as prescribed by the Forest-wide guideline (see crucial winter range timing restriction discussion above). There have been few vegetation management projects in winter range to improve forage conditions in the past several years. In addition, fences added to manage recreational developments can have a negative impact on big game species by catching them in the wire or restricting movement patterns due to the height of the wire. There would likely be no differences among alternatives with regard to treatments on big game winter range and the use of fences in developed recreational sites.

Special use activities such as recreation cabins, lodges, and other uses displace some wildlife, though these activities are not currently thought to be as significant as dispersed recreation.

Effects from Oil and Gas/Mineral and Energy Development: Oil, gas, and minerals development can impact wildlife primarily through alteration or destruction of habitat and through disturbance. In some circumstances, these activities may also create enhancement opportunities. The significance of the circumstances, these activities may also create enhancement opportunities. The significance of the impact depends on the amount, intensity, and duration of the disturbance, the specific locations and arrangements of the disturbance, and the ecological importance of the habitats affected. Small, isolated disturbances within non-limiting habitats are often a minor consequence within most ecosystems. However, larger-scale developments within habitats that are essential to survival or reproduction of wildlife (including migration corridors) become a more significant concern because such impacts cannot be relieved or absorbed by surrounding, unaltered habitats. Effects are mitigated through land reclamation and restrictions on timing, location, and types of disturbance as identified in documents such as *Recommendations for Development of Oil and Gas Resources within Important Wildlife Habitat* (WGFD 2010d). These recommendations are implemented through standard lease terms, and standards and guidelines in the revised Plan.

The projected development potential for mineral and oil and gas development on the Forest is low to very low under all alternatives. Because of this low potential, none of the alternatives are expected to have an adverse effect on wildlife.

Cumulative Effects

In general, cumulative effects are assessed for the Shoshone and the adjacent lands within 3 miles of the Forest boundary. The period considered for this analysis is the anticipated life of the Plan, 10 to 15 years. Cumulative effects include the past, present, and reasonably foreseeable future actions, as mentioned in the summary of activities table (table 20). From this table, for elk, the past and present activities of vegetation management and roads are the most significant, and the reasonably foreseeable future activities of subdivisions and increased recreation use (off-road vehicles, demographics) are most significant.

It is likely that wildfire would continue to influence the majority of cover and forage attribute conditions of elk security, regardless of alternative. It has been the increase of wildfire and recreation use that has led to the current lack of elk security. While some areas are less than the recommended 30 percent by elk herd unit due to these activities, some areas are naturally lower because of the amount of meadows versus forested areas.

Recreational use is likely to increase due to population factors surrounding the Shoshone, regardless of alternative. Use would continue to increase on the Forest and challenge us in managing the creation of additional roads and trails, and in the additional disturbance to wildlife. The Shoshone provides the majority of yearlong habitat in the cumulative effects area.

On lands adjacent to the Shoshone within 3 miles of the Forest boundary, private land is often viewed as refuge, as many land owners currently restrict hunter access either by charging high fees or through simple denial. Elk use of these areas is often highest during the late fall disturbance periods. The WGFD continues to work with land owners on this issue to gain access to achieve a better elk harvest. It is not known if improvements in elk security habitat on the Shoshone would alter or reverse the migratory behavior of elk to these areas during periods of stress, though it is possible over time (Thompson and Henderson 1998). This private refuge issue is important to the WGFD’s management of elk, as it makes it more difficult to stay at population objectives, especially when winters are mild and forage is sufficient to support large populations.

Finally, the development of timber resources on private land adjacent to the Shoshone is very minor and has little effect on elk security habitat. Any additional roads and loss of cover are somewhat mitigated by restricted access on private lands, and the effects of this use are fairly localized.

Losses of elk security areas would presumably lower the habitat available for the other wildlife species associated with this type of habitat.

It is not likely that the changes to elk security from the alternatives would have a measurable effect on elk populations in the next planning period. Elk populations respond more to changes in climate (e.g., drought), which influences availability and quality of forage in summer and winter. Loss of winter range is another issue for elk populations. However, under most climate conditions, hunter harvest is the most important factor influencing population abundance. Harvest can be directly affected by the location and extent of elk security areas on the Shoshone. If improvements in elk security occur, it is likely that the WGFD would be able to better manage elk populations with regard to objectives because of the increased effectiveness of hunter harvest. The Shoshone would likely try additional seasonal road closures to improve security habitat in areas.

Mule deer

Affected Environment

Mule deer (*Odocoileus hemionus*) are found in western North America from British Columbia south to Mexico and east to the western Great Plains. Mule deer occur throughout Wyoming where suitable habitat exists, including on the Shoshone. Mule deer are considered a big game animal in Wyoming.

No trend data specific to the Shoshone are available, but data are available for mule deer herd units that encompass the Shoshone. Five herd units overlap the Shoshone including: Upper Shoshone, Clarks Fork, Owl Creek/Meeteetse, Dubois, and South Wind River. For the most part, trends for these herd units have been relatively stable (USDA Forest Service 2010e) (figure 21). All herd units, except the Upper Shoshone, have been near or below population objectives. The Upper Shoshone herd unit has been at or above objective for the past several years. Habitat for mule deer in all these units has suffered from long-term drought effects, especially on winter range (see map 16).

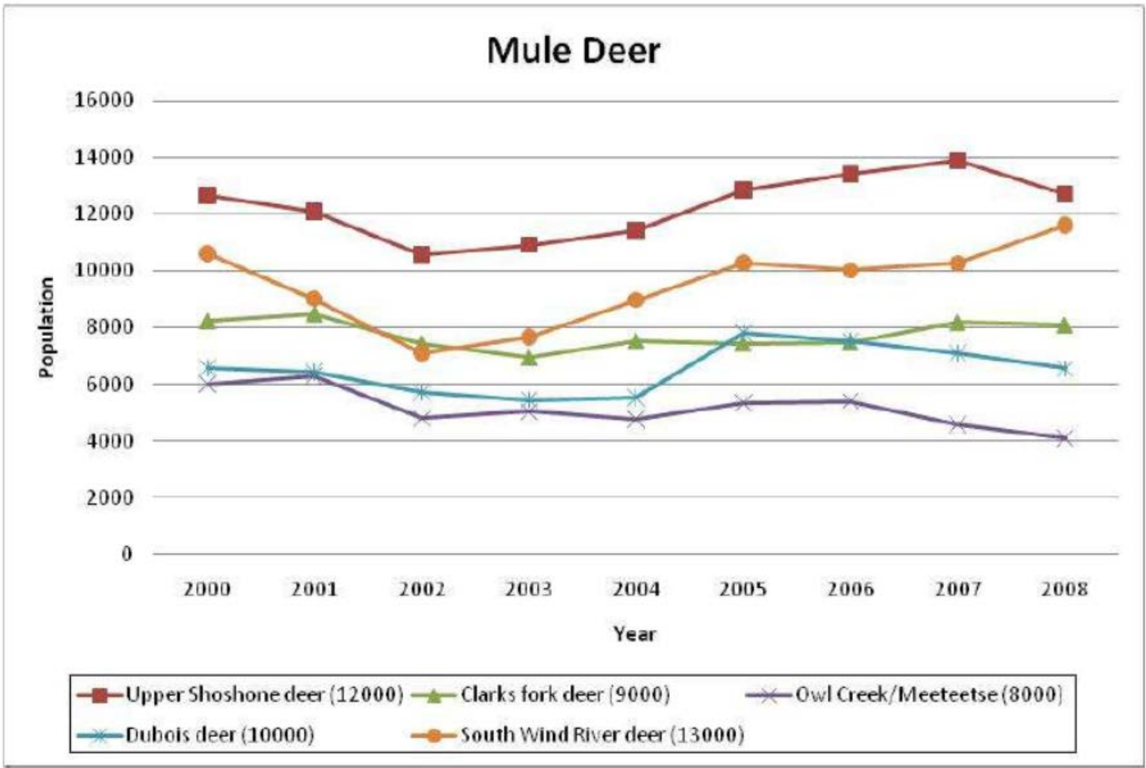


Figure 21. Population trends for mule deer herd units that encompass the Shoshone National Forest

Since mule deer are habitat generalists, virtually the entire Shoshone would be considered some type of seasonal range for mule deer, except for the most rugged portions of the Wind River Range. Mule deer crucial winter range is the most important habitat on the Shoshone (table 77).The Shoshone contains about 186,905 acres of crucial winter range. A vast majority of the crucial mule deer winter range occurs at lower elevations off the Shoshone.

In recent years, the Shoshone has experienced large wildfires. About 115,000 acres have burned in the last 5 years and about 161,500 acres in the last 10 years (USDA Forest Service 2012c). Wildfires create ideal foraging habitat for deer.

Desired Condition

Maintaining diverse and productive seasonal habitats especially those mixed mountain shrub habitats at mid-elevations that provide mule deer transition ranges between winter and summer ranges would be the most important forest management emphasis for mule deer.

Limiting human access to mule deer wintering areas also would be important to reduce potential disturbance during this critical time period.

To provide management for mule deer and to maintain or improve its potential distribution on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. Although several mule deer herd units are below management objective, incorporating conservation measures to maintain and improve habitat for mule deer on the Shoshone results in an overall low viability risk for mule deer.

Conservation measures summarized include:

1. If necessary, coordinate with the WGFD to seasonally close motorized access to crucial mule deer winter range during critical time periods.
2. Conduct management activities that disturb wintering mule deer outside of the critical time period except when the project is designed to maintain or improve crucial winter range conditions (i.e., prescribed fire).
3. Utilize prescribed fire and mechanical treatments to maintain and improve mule deer seasonal ranges.
4. Allow for wildland fire-use, where appropriate, to maintain and improve mule deer seasonal ranges.
5. Manage aspen for retention and expansion over current levels.

Direct and Indirect Effects

Effects from Timber Harvest: The primary risk factor from forest management is human disturbance during critical time periods (winter) and fire suppression.

Disease risks include chronic wasting disease, which is currently only known to occur in one hunt area that contains a small portion of the Shoshone.

Timber harvest and roads have minor effects to mule deer habitat, though any loss of habitat due to road construction would be negative, unless other roads are closed and revegetated to mitigate the loss. Clearcuts and harvest are considered beneficial for deer due to the increase in forage. Timber harvest in some winter ranges has been done to open canopies and increase forage quantity and quality, though this has been minimally practiced in the past. Harvest levels would be greatest in alternatives E and F, and remain largely the same as current levels in alternatives A and C, with moderate increases in harvest in alternatives B, D and G.

Effects from Fire Management: Prescribed burning would likely continue to be conducted to improve winter range conditions, though the levels conducted may not sufficiently regenerate enough ranges to meet the demand of wildlife use. An exception would be areas where sagebrush is a primary forage component, as fire can potentially reduce this shrub on the landscape for many years. However, the competing invasion of conifers into aspen stands may be a result of fire exclusion. Wildfire occurrence may account for significant changes in the next planning period, as the shrublands are regarded to be in a condition where they have missed fire cycles due to suppression, and could be more susceptible to catastrophic loss of larger acreages. There would be little difference among alternatives with regard to this potential.

Although crucial winter range (MA 5.4) would be managed regardless of alternative, it is most emphasized in alternatives E, B, G, D, C, and A, respectively, with F having the least amount, as shown in table 77.

Table 77. Management area 5.4 acres of crucial winter range, by alternative

Mgmt. area	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
5.4	45,600	55,000	52,100	54,000	79,900	0	55,000

Effects from Recreation: Human disturbance on big game winter range has been of increased concern, primarily due to the stress imposed on big game for activities such as antler hunting. Similar to the crucial winter range analysis discussed for elk, alternative C would provide the most disturbance-free winter habitat, as it would restrict motorized use on all big game winter range, including crucial winter range. Alternative F would provide the least amount of disturbance-free winter habitat, as it proposes no timing restrictions in big game winter range. Alternatives D, B, G, E, and A provide disturbance-free habitat in descending order from most to least, but all provide more habitat then alternative F.

Hiking and antler hunting would not be prohibited through the Plan at this time. This would not vary by alternative.

Effects from Livestock Grazing and Big Game: Potential conflicts with livestock grazing have been of concern in both summer and winter range areas, where combined use of forage can result in degraded habitat conditions. Revised Plan direction would address this, though instances of localized problem sites would likely continue in all alternatives for the next planning period. This issue is dealt with at the individual allotment scale, and includes shrub and grasslands on winter range, as well as willow and aspen cover types.

Effects from Oil and Gas/Mineral and Energy Development: The effects to mule deer are similar to those described for Rocky Mountain elk.

Cumulative Effects

In general, cumulative effects are assessed for the Shoshone and adjacent lands within 3 miles of its boundary, based on average deer/lion use patterns. The period considered for this analysis is the anticipated life of the Plan, 10 to 15 years. Cumulative effects include the past, present, and reasonably foreseeable future actions, as mentioned in the summary of activities table (table 20). For deer, the past and present activities of vegetation management and roads are the most significant, and the reasonably foreseeable future activities of subdivisions and increased recreation use (off-road vehicle, demographics) are most significant.

Winter range is in the zone with the most potential for increases in noxious weeds and non-natives (cheatgrass) due to the elevation and lack of forested canopy cover. While possibly limited amounts of winter range would be lost by this effect in the next planning period, the likelihood increases with time as has been demonstrated in other winter ranges in the State. Where roads, livestock grazing, recreational horse use, and wildlife use occur in these areas, those uses would be the most likely vectors. As weeds and other non-native species are expanding on private lands surrounding the Shoshone, this has the potential to increase risk on the Forest with similar effects. Any additional loss of winter range or other habitat on the Shoshone would translate into reduced carrying capacity on the Forest, eventually resulting in a downward trend or reduced population levels.

In addition, growth of housing developments in areas adjacent to the Shoshone may reduce carrying capacity of winter range. This may place a higher value on the availability and condition of winter range on the Shoshone.

Disease may continue to play an increased role in the abundance of mule deer herds, though currently this portion of Wyoming is thought to be minimally impacted by diseases such as chronic wasting disease. Displacement of mule deer by white-tailed deer may occur in localized areas, as white-tailed deer appear more able to persist with increased human occupation in lands adjacent to the Shoshone.

The subject of mule deer population declines is currently of research interest within the State and many western states and is typically related to a combination of many of the factors mentioned above.

Climate (drought and winter severity, annual forage production), hunting, and vehicle-related mortality would continue to be the primary factors associated in determining population levels and trends for both species. Forage quality on the Shoshone can also affect the condition of deer heading into winter ranges, with competition by livestock and increasing noxious weeds being a potential problem. Yearly coordination meetings would continue to be held with the WGFD to discuss habitat conditions and population objectives. There would not likely be a difference among alternatives overall with regard to deer habitat and populations in the foreseeable future.

Moose

Affected Environment

Moose (*Alces alces)* are a circumboreal species. In North America, they range throughout the boreal zone of Alaska and Canada, south to Colorado, Minnesota, and Maine. The subspecies *A. a. shirasi* occurs in the Intermountain West, including Wyoming (Baker 2008). Shiras Moose have a natural heritage ranking of G5/S5. They are considered a big game animal in Wyoming. Moose are known to occur on the Shoshone, but at low density probably due to limited habitat.

No trend data specific to the Shoshone are available. On the north end of the Shoshone within the Absaroka moose herd unit, population data collection is very difficult, if not impossible in the Absaroka Mountains (WGFD 2009a). On the south end of the Shoshone, the moose population in the Lander moose herd unit has been relatively stable in recent years, but below objective (WGFD 2009b). Similar to the Absaroka moose herd unit, no reliable population data exist for the Dubois moose herd unit, but it is suspected to be declining (WGFD 2009b).

Moose could be classified as riparian generalists because they utilize riparian habitat and adjacent forest. Winter moose habitat in northwestern Wyoming is dominated by riparian/deciduous shrub and lodgepole pine (Baker 2008). Where riparian habitats are less extensive, mature conifer forests that contain a high diversity of forage species become important (Baker 2008). In the summer, moose prefer lodgepole pine, spruce/fir, and riparian/deciduous shrub habitats.

Riparian shrub habitat is very limited on the Shoshone, especially along the Absaroka Front where most river valleys are V-shaped. Therefore, crucial winter range is also limited. About 82,000 acres of crucial winter range is found scattered across the Shoshone with the largest areas in the Upper Clarks Fork and Sunlight Basin (see map 17).

In recent years, the Shoshone has experienced large wildfires. About 115,000 acres have burned in the last 5 years, and about 161,500 acres in the last 10 years (USDA Forest Service 2012c). Wildfires that promote regeneration of upland and riparian shrubs would have a positive effect on moose, while wildfires in mature spruce/fir could have a negative effect. Also, the epidemic beetle kill in mature spruce/fir has likely reduced this important habitat type.

Desired Condition

Maintaining diverse and productive seasonal habitats would be the most important forest management emphasis for moose with emphasis on maintaining vigorous deciduous riparian vegetation.

Limiting human access to moose wintering areas also would be important to reduce potential disturbance during this critical time period.

In order to provide management for moose and to maintain or improve its potential distribution on the Shoshone, the following conservation measures were developed for incorporation into Plan goals, objectives, standards and guidelines. By incorporating these conservation measures to maintain and improve habitat for moose on the Shoshone, viability risk from forest management should remain low.

Conservation measures summarized include:

1. Where necessary, coordinate with the WGFD to seasonally close motorized access to crucial moose winter range during critical time periods.
2. Conduct management activities that disturb wintering moose outside of the critical time period, except when the project is designed to maintain or improve crucial winter range conditions (i.e., prescribed fire, reclamation of habitat).
3. Maintain sufficient mature conifer forest within moose winter range to provide thermal cover.
4. Utilize prescribed fire and mechanical treatments to maintain and improve moose seasonal ranges, especially riparian deciduous shrub habitat.
5. Manage aspen for retention and expansion over current levels.

Direct and Indirect Effects

Effects from Timber Harvest and Fire Management: The primary risk factors from forest management include timber harvest of mature conifer forest (spruce/fir) in moose winter range and human disturbance during critical time periods (winter).

Natural risk factors include stand-replacement wildfire in mature spruce/fir and epidemic beetle kill in mature spruce/fir.

Direct effects of management to winter habitat (mature spruce/fir) and willow (riparian) are primarily associated with timber harvest, though wildfire would continue to be the main disturbance agent for this resource. Moose often take advantage of burned areas to eat sprouting shrubs and trees. Alternatives E and F would likely have the highest levels of harvest for spruce/fir, although uneven-aged harvest (selection) prescriptions would likely retain habitat values in spruce/fir. Roads do not likely have a major effect on moose. The amount of willow proposed to be treated in each alternative does not vary and is so limited, not enough positive effect can be determined.

Effects from Livestock Grazing and Big Game: Livestock grazing would continue to be an effect on willow communities, with improvement over time through implementation of standards and guidelines. There would be little difference by alternative with regard to effects from livestock grazing. Areas where the combination of high use by livestock and moose negatively impact willow would be addressed through allotment planning and coordination efforts with the WGFD.

Effects from Oil and Gas/Mineral and Energy Development: The effects to moose are similar to those described for Rocky Mountain elk.

Effects from Recreation: Winter recreation may have an effect on moose, displacing them from some areas, such as riparian zones, where heavy snowmobile traffic or cross-country skiing may occur. Effects from snowmobiling are generally in localized areas rather than Forest-wide. Snowmobile use would be allowed to occur under all alternatives, but the amounts and types of use would vary according to any use of the 1.2 and 1.3 management prescriptions that limit snowmobile use, which would primarily be in alternative C.

Cumulative Effects

In general, cumulative effects are assessed for the Shoshone and adjacent lands within 3 miles of its boundary. The period considered for this analysis is the anticipated life of the Plan, 10 to 15 years. Cumulative effects include the past, present, and reasonably foreseeable future actions, as mentioned at the beginning of chapter 3 (table 20). From this table, for moose, the past and present activities of vegetation management (including livestock grazing) and roads are the most significant, and the reasonably foreseeable future activities of subdivisions and increased recreation use (off-road vehicles, demographics) are most significant.

Combined livestock and wildlife browsing of willows and aspen would likely continue to be an impact throughout the next planning period, regardless of alternative. Efforts in management would continue to address bringing the use levels within the carrying capacity of the resources.

Increases in noxious weeds, which affect riparian resources by decreasing native vegetation, would have a negative effect on moose habitat. Effects from lands adjacent to the Shoshone are minor, as moose spend the bulk of their time on the Forest.

Due to limited suitable habitat, moose populations would likely remain at current levels in absence of additional hunting or weather-related mortality.

Yellowstone Checkerspot

Affected Environment

The Gillette’s checkerspot (*Euphydryas gillettii*) has a natural heritage ranking of G3 and no State ranking. Historical populations, distribution, or abundance are unknown on the Shoshone. This butterfly is locally known as the Yellowstone checkerspot.

Gillette’s checkerspot has a very restricted range in North America. They are found in isolated populations in southeastern British Columbia, southwestern Alberta, Montana, eastern Idaho, and western Wyoming (Vaughan and Shepherd 2005). No trend data specific to the Shoshone or Wyoming are available. On the Shoshone, Gillette’s checkerspots are known from two areas in the Beartooth Mountains, two locations in the Fitzpatrick Wilderness, and one site on the Washakie Ranger District.

Gillette’s checkerspots are found in a variety of damp habitats in mountains including open, moist conifer forests; moist meadows; and streamsides (Vaughan and Shephard 2005). Larval host plants include twinberry honeysuckle (*Lonicera involucrata*), common snowberry (*Symphoricarpos albus*), and American alpinespeedwell (*Veronica wormskjoldii*).

Potential habitat for Gillette’s checkerspot is likely abundant on the Shoshone in high-elevation moist meadows in the Beartooth Plateau and Wind River Range.

In recent years, the Shoshone has experienced large wildfires. About 115,000 acres have burned in the last 5 years, and about 161,500 acres in the last 10 years (USDA Forest Service 2012c). Disturbance from wildfire is an important factor that contributes to Gillette's checkerspot habitat abundance (Debinski 1994, Williams 1995).

Desired Condition

Maintaining moist mountain meadows and an abundance of the larval host plants are important forest management emphases for Gillette's checkerspot.

For the known populations on the Shoshone, maintaining suitable habitat is these locations would be very important.

To provide management for Gillette's checkerspot and to maintain or improve its potential distribution on the Shoshone, the following conservation measures were developed for incorporation into forest plan goals, objectives, standards and guidelines. By developing conservation measures to maintain habitat, overall viability risk from forest management is low.

Conservation measures summarized include:

1. Manage livestock grazing so that potential habitat is improved or maintained, particularly during drought years.
2. Manage dispersed camping and recreational uses such that degradation of riparian areas does not occur, and achieve improvements in existing degraded areas.
3. Allow for wildland fire use, where appropriate, to create potential habitat for Gillette's checkerspot.

Direct and Indirect Effects

Effects from Livestock Grazing and Big Game, Road Construction, and Fire Management: The primary risk factors from forest management are livestock grazing and road construction, due to threats to the nectar or host plants, and fire suppression.

Plan revision activities that could potentially influence the checkerspot primarily involve livestock grazing. Differences in projected outputs by alternative for these activities are displayed in table 78.

Table 78. Activities that could potentially influence the checkerspot, by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Livestock Grazing							
Permitted AUMs (Total)	55,900	55,900	31,300	55,900	67,100	70,200	55,900
Suitable Acres (Total)	374,700	374,700	216,800	374,700	374,700	414,700	374,700
Motorized Recreation-Summer (Acres available)	570,600	570,800	322,400	350,600	656,500	823,900	570,800

Alternative A: No action

Livestock grazing can have negative influences on Gillette's checkerspots when activities overlap suitable habitat. Impacts to riparian areas and overstory and understory forage plants are of particular concern because of their importance to checkerspots in meeting species requirements for cover and food. As displayed in table 78, the permitted amount and area for cattle grazing does not differ among alternatives A, B, D, and G. These activities are, therefore, predicted to have potentially negative influences on this butterfly where activities and habitat overlap. Livestock could continue to impact certain riparian habitats that this species needs.

Although differences among alternatives are difficult to evaluate in regard to potential influences on Gillette's checkerspots, it is possible that alternative A provides as much potential habitat protection for the species as alternatives B, E, F, and G, because it provides less indirect influences from motorized recreation that could potentially influence riparian streambanks and vegetation.

Action Alternatives: Alternative B through G

In alternatives B through G, there would likely continue to be some problem areas, although there will be more tools (adaptive management strategies) available to fix these problems areas and prevent new ones from starting. Alternatives B, D, and G maintain the same amount of suitable acres and AUMs as the current Forest Plan (alternative A). Alternative C reduces the total AUMs and would have the least impact on habitat conditions for the butterfly. Alternative F increases AUMs substantially compared to all of the other alternatives and would have the potential for the greatest impact to riparian habitat. All alternatives are expected to allow the continued expansion of Gillette's checkerspots into potential habitat on the Shoshone; however, more focused management compliance would be needed under alternative F.

Alternative C offers fewer potential riparian habitat disturbances than the other alternatives from summer motorized recreation because of decreases in the amount of motorized use area. Alternative D offers the next fewest acres of motorized use, while alternative F offers the highest amount of acreage. Effects of alternatives B, E, and G fall between the other action alternatives. Reductions in areas open to motorized use should decrease the potential for loss of habitat.

Cumulative Effects

Cumulative effects over and above the direct and indirect effects mentioned above are minimal on the Shoshone due to the limited amount of private land within the Forest boundary. There are no known proposals for additional development of any of these lands. Lands adjacent to the Shoshone are primarily private and/or BLM. Private lands receive minimal pressure from urban development trends. These adjacent lands would likely continue to receive impacts from livestock grazing and water depletions that are ongoing. These activities should not impact habitat on the Shoshone, but may increase the value of riparian habitat. Individual species protections would be ensured through preparation of site-specific NEPA analysis with protection offered through Forest-wide standards and guidelines

Clark's Nutcracker

Affected Environment

The Clark's nutcracker (*Nucifraga Columbiana)* has a natural heritage ranking of G5 and no State ranking. Historical populations, distribution, or abundance are unknown on the Shoshone. This species is a permanent resident in the State; may be nomadic but not migratory in the typical sense.

Clark's nutcrackers are year-round residents from central British Columbia and west-central Alberta south through the mountain ranges and pine-covered ridges of the West to southern California, Arizona, and New Mexico (Montana Natural Heritage Program 2012).

Clark's nutcrackers in Wyoming typically occupy conifer forests dominated by whitebark pine at higher elevations and ponderosa pine and limber pine along with Douglas-firs at lower elevations, relying largely on seeds of these species for food. They are often seen above treeline in alpine meadows or flying among drainages (Montana Natural Heritage Program 2012).

The year-round diet consists primarily of fresh and stored pine seeds, but also includes insects and spiders, small animals (birds and mammals), and carrion (Tomback 1998). Conifer seeds (mostly ponderosa pine) made up 83 percent of the ingested food and occurred in the stomachs of all but nine of the 426 nutcrackers collected at low to moderate elevation in western Montana during 1946 to 1949. Nutcrackers ate Douglas-fir seeds only during the fall and winter of 1946 to 1947, when a bumper crop occurred (Montana Natural Heritage Program 2012).

Family groups and non-breeding Clark's nutcrackers occupy large home ranges in spring and summer, which are based on location of seed caches (Tomback 1998). Pine seeds can be transported up to 32.6 kilometers (19.5 miles) for caching in home ranges (Lorenz et al. 2011). Nutcrackers have a mutualistic relationship with whitebark pine, being the primary agent of dispersal for the pines, which in turn are a major source of food for the nutcrackers throughout the year (Tomback 1998). Caches contain typically 1 to 15 seeds; a single nutcracker may cache as many as 35,000 to 98,000 pine seeds in late summer and fall. A flock of about 20 nutcrackers at 2,610 meters (8,565 feet) in the Pioneer Mountains (SW Montana) in early September stored an average of 3.6 whitebark pine seeds per cache (n = 95 caches, range = 1 to 9 seeds) and covered each cache with earth or vegetation, effectively depositing the seeds at bill depth (Montana Natural Heritage Program 2012). Memory of caches is retained as long as 285 days; retrieval of caches sustains birds when cones are not available on trees. Breeding territories are much smaller than home ranges. One Montana breeding territory was 0.85 hectare (2.1 acres) in size (Montana Natural Heritage Program 2012). Raptors are the major predators of adults and juveniles. Clark's nutcrackers most likely occur throughout the Shoshone. During surveys conducted by the Rocky Mountain Bird Observatory from 2002 to 2009, Clark's nutcrackers were regularly observed in moderate densities. There is no population trend specific for the Shoshone.

Climate Change

One stressor common to all rare plant habitat groups that is beyond Forest Service control includes climate change. Potential climate change on the Shoshone has been described in Rice et al. (2012). Predicted climate shifts may result in changes in kind, amount, and distribution of precipitation, in turn, affecting rare plant habitat. Of particular concern is the effect on whitebark pine.

Desired Condition

Whitebark pine is an "obligate" mutualist of Clark's nutcracker, which means it is dependent on the bird for seed dispersal, whereas the nutcracker can survive without whitebark pine. In areas where numbers of living whitebark pine have diminished, nutcrackers may be infrequent visitors, thus, no longer providing seed dispersal "services" (Tomback 2005).

In an effort to restore and protect whitebark pine stands, management of whitebark pine in the Greater Yellowstone Ecosystem, including the Shoshone, would be guided by the Whitebark Pine Strategy for the Greater Yellowstone Area (Greater Yellowstone Coordinating Committee Whitebark Pine Subcommittee 2011). Loss of pines (whitebark, limber) to fire, disease, and bark beetle outbreaks could impact populations; management activities promoting the health of pines would benefit nutcrackers.

Direct and Indirect Effects

Effects from Timber Management and Fire Management: Loss of whitebark and limber pine to disease, insect outbreaks, and fire may lead to local and widespread population declines of Clark's nutcrackers.

Alternatives B through G would incorporate specific management direction into the Plan to protect, maintain, and restore whitebark and limber pine stands through identified goals and guidelines. Alternative A, while not addressing the need for whitebark and limber pine restoration, would still be able to include restoration efforts using best available science, but management direction would not contain the same focus as in alternatives B through G.

Fire may have beneficial effects to the restoration of whitebark pine by setting back successional stages by removing spruce and fir. All of the alternatives use fire as a tool to accomplish management goals and objectives. The alternatives have different management emphasis areas and as such, the use and emphasis of fire vary by alternative. The use of prescribed fire does not vary enough by alternative to make a difference in regard to effects on Clark's nutcracker.

Wildland fire use is not a planned output. However, it would be utilized as a tool to allow natural disturbances to occur within suitable Clark's nutcracker habitat as opportunities arise. It is estimated that all alternatives may allow from 161,400 to 185,200 acres of wildland fire use. Depending upon fire severity and scale, these outputs could have negative or positive influences on this species. Table 79 displays the potential use of fire by alternative.

Table 79. Potential use of wildland fire, by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Vegetation Treatment Acres Prescribed Fire (Total)							
Limber pine	1,740	1,720	1,720	1,720	1,660	1,540	1,720
Whitebark pine	340	340	300	340	330	310	340
Total	2,080	2,060	2,060	2,060	1,990	1,860	2,060
Wildfire Acres	185,200	182,900	184,100	183,700	175,000	161,400	182,900

All alternatives would have similar effects on the restoration of whitebark pine habitat.

Effects from timber harvest (potential for increased habitat loss from road construction), livestock grazing, motorized recreation (potential for user-created roads and increased dispersed recreation use from anticipated road construction), mineral or energy and oil or gas development, land use authorizations, and lands allocated to management area affect wildlife resources to some degree under all alternatives. Alternatives in the order of least impact to most are C, D, B, G, A, E, then F.

Cumulative Effects

Cumulative effects evaluate the potential impacts to wildlife resources from the proposed action when combined with past, present, and reasonable foreseeable actions. Cumulative effects over and above the direct and indirect effects mentioned above are minimal on the Shoshone due to the limited amount of private land within the Forest boundary. There are no known proposals for additional development of any of these lands. Lands adjacent to the Forest are primarily private or BLM and located at lower elevations. Private lands receive minimal pressure from urban development trends. These adjacent lands would likely continue to receive impacts from livestock grazing and water depletions that are ongoing. These activities should not impact Clark's nutcrackers habitat on the Forest.

The lands within the Shoshone boundary form the geographic scope for cumulative effects because this is the scope of the higher elevation forest types that make up the majority of Clark's nutcracker habitat when considering the areas where management activities are likely to occur on the forest. The temporal bound would be the life of the Plan, which is estimated to be 10 to 15 years.

In the subalpine / krumholtz zone, whitebark pine is predicted to retreat from lower-elevation ranges and either marginally exist at the highest elevations of the Shoshone or become extirpated (Rice et al. 2012). Further loss of whitebark pine habitat would have a negative effect on Clark's nutcracker.

Summary of Effects to Wildlife

All alternatives affect terrestrial wildlife resources to some degree. The greatest impacts from management activities are associated with timber harvest, roads and trails, and land use authorizations. Alternatives in the order of least impact to most are C, D, B, G, A, E, then F.

There is no difference among alternatives in the effects from management for riparian and wetland areas, scenic resources, wildlife habitat and old growth, soil and watershed, and heritage resources.

Alternatives that allow the least ground-disturbing activity and that discourage or make difficult human presence and activity, such as wilderness and inventoried roadless designations, will result in the least risk of disturbance to wildlife species. Alternatives in the order of least impact to most are C, D, B, G, A, E, then F.

Aquatic, Riparian and Fisheries Resources

Introduction

There are a variety of aquatic and riparian ecosystems on the Shoshone National Forest, including streams, rivers, ponds, reservoirs, wetlands, and riparian areas. These ecosystems support complex communities of vertebrate and invertebrate aquatic animals and an assortment of riparian and aquatic plants. Complex, species-rich communities of phytoplankton, zooplankton, macroinvertebrates, amphibians, and fish can be found in many of these habitats.

Forest management activities can affect the physical, chemical, and biological characteristics and functions of aquatic ecosystems, both positively and negatively over the short and long term. The challenge to resource managers is to implement multiple-use activities while conserving, protecting, and restoring aquatic biodiversity, watershed/stream health, and riparian/wetland conditions over the long term.

Historically, people have used aquatic ecosystems for many purposes including water development facilities for agricultural and municipal uses and water-dependent recreational uses. Human demand for water resources is increasing, and meeting these demands will be challenging for forest resource managers in the future.

Legal and Administrative Framework

Laws

Federal Water Pollution Control Act (Clean Water Act) was enacted to restore and maintain the chemical, biological, and physical integrity of the Nation’s waters. The Endangered Species Act requires Federal agencies to conserve threatened and endangered species. These acts, along with other land use laws, executive orders, and policies, guide management of aquatic resources on NFS lands. Other laws pertinent to watershed management of NFS lands can be found in Forest Service Manual (FSM) 2501.1.

Organic Administration Act of 1897 recognized watersheds as systems to be managed with care to sustain their hydrologic function and secure favorable conditions of water flow.

Federal Water Pollution Control Act, as amended, intends to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. There are five required elements:

- Compliance with state and other Federal pollution control rules.
- No degradation of instream water quality needed to support designated uses.
- Control of nonpoint source water pollution through conservation or best management practices (BMPs).
- Federal agency leadership in controlling nonpoint sources pollution from managed lands.
- Rigorous criteria for controlling discharge of pollutants into the Nation's waters.

Sustained Yield Forest Management Act of 1944 and the Multiple Use Sustained Yield Act of 1960 allow for the production of multiple quality goods and resources at sustained levels over time, including maintenance of water supplies.

Forest and Rangeland Renewable Resources Planning Act of 1974, as amended, requires an assessment of present and potential productivity of the land. This act contains many references to suitability and capability of specific land areas, to maintenance of land productivity, and the need to protect and, where appropriate, improve the quality of soil and water resources. The act specifies that substantial and permanent impairment of productivity must be avoided and has far-reaching implications for watershed management on national forests.

National Forest Management Act of 1976 prevents watershed condition from being irreversibly damaged and protects streams and wetlands from detrimental impacts. Land productivity must be preserved. Fish habitat must support a minimum number of reproductive individuals and be well distributed to allow interaction between populations.

Safe Drinking Water Act Amendments of 1996 provides states with more resources and authority to enact the Safe Drinking Water Act of 1977. This amendment directs the state to identify source areas for public water supplies that serve at least 25 people or 15 connections at least 60 days a year. The Wyoming Department of Environmental Quality is responsible for regulatory enforcement of this law.

Wilderness Act of 1964 provides direction for fish management including fish stocking in wilderness.

Executive Orders

Executive Order 11988 directs Federal agencies to provide leadership and take action on Federal lands to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains. Agencies are required to avoid the direct or indirect support of development on floodplains whenever there are reasonable alternatives and evaluate the potential effects of any proposed action on floodplains.

Executive Order 11990, as amended, requires Federal agencies exercising statutory authority and leadership over Federal lands to avoid to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands. Where practicable, direct or indirect support of new construction in wetlands must be avoided. Federal agencies are required to preserve and enhance the natural and beneficial values of wetlands.

Regulation and Policies

Regulations and policies have been passed in support of these laws and require the following:

- Protection of surface resources and productivity from all natural resource management activities (36 CFR 219).
- Limitations on land management activities to protect watershed condition. Forest Service Manual (FSM) 2500 and Forest Service Handbook (FSH) 2500 state policy and direction regarding watershed management.
- Watershed analysis as part of all planning activities (36 CFR 219, FSM 2500).

Regional Direction

Region 2 Species Conservation Assessments for Yellowstone Cutthroat Trout, Mountain Suckers and Lake Chubs. Describes current status and management direction for these sensitive fish species.

Other Agreements and Management Direction

Rangewide Status and Conservation Assessment for Yellowstone Cutthroat Trout, 2010. Provides current status and general management direction for Yellowstone cutthroat trout throughout its range. A Plan for the Management and Conservation of Yellowstone Cutthroat Trout in Wyoming (in draft). Wyoming Game and Fish Department Cheyenne, Wyoming. provides general management direction for Yellowstone cutthroat trout in Wyoming.

The memorandum of understanding (Supplement No. 1500-2007-1, August 1, 2007) between the Rocky Mountain Region and Intermountain Region of the Forest Service and the Wyoming Game and Fish Commission, through the WGFD, outlines the agencies' respective responsibilities in the management of fish and wildlife populations and their habitat. The Forest and the WGFD work in partnership to address habitat and population management issues for wildlife.

Policies and Guidelines for Fish and Wildlife Management in National Forest and Bureau of Land Management Wilderness, 2006. Provides guidance to State fish and wildlife agencies, Forest Service, and Bureau of Land Management personnel for managing fish and wildlife populations in wilderness in accordance with the Wilderness Act of 1964 (16 USC 1131-1136).

Memorandum of Understanding Between the Wyoming Game and Fish Commission and the USDA Forest Service on Fish, Wildlife, and Habitat Management within National Forest Wilderness in Wyoming, 2010. The memorandum of understanding serves as a framework for enhanced cooperation between Wyoming Game and Fish and the Forest Service Regions 2 and 4 in the management of fish, wildlife and habitat on Forest Service-administered wilderness areas in Wyoming.

Resource Protection Measures

Region 2 of the Forest Service has developed a Watershed Conservation Practices Handbook (FSH 2509.25), Forest Service National Best Management Practices Directives (collectively referred to as: Forest Service Regional and National BMP Directives), which provides direction for resource managers within the context of existing laws, regulations, and policies. The Forest Service Regional and National BMP Directives list standards and design criteria designed to protect, maintain, and enhance the integrity of soil, water and aquatic ecosystems and the biota that use them. Standards and design criteria are referenced under guidelines in the revised Plan. According to the Handbook, streams and watersheds that exhibit the following three conditions are at "potential" and in a dynamic equilibrium:

- **Integrity of stream flow** – expressed as minimum flood runoff and maximum base flows. Healthy watersheds have high rates of infiltration and minimum surface runoff. Most precipitation soaks into the soil, which reduces flooding, recharges groundwater, maintains riparian and wetland areas, and regulates stream flow.
- **Integrity of the fluvial (stream) system** – expressed as stable stream networks and channels and a balance between runoff and sediment yield. In healthy watersheds, the stream network is not expanding through gully erosion; streams are not aggrading or degrading; channel capacity is maintained over time; and streambanks are well vegetated.
- **Integrity of water quality and aquatic habitat** – good stream health supports productive, diverse, and stable populations of aquatic life and displays a natural range of habitat features (pool depth, substrate composition, and sequences of pools and riffles) for aquatic organisms.

Implementation and effectiveness monitoring of best management practices are typically carried out as an administrative review and do not involve quantitative water quality measurements. Implementation and effectiveness monitoring of Regional and National BMP Directives, the practices outlined in the Forest Service Regional and National BMP Directives and forest plan standards and guidelines can be carried out by a variety of personnel, including timber sale administrators, contract officer representatives, resource specialists, and line officers. Documentation of this monitoring might include field notes, memos, contract daily diaries, or the annual forest monitoring report. Systematic monitoring and adjustment of land management activities to protect soil and aquatic resources will ensure the highest possible level of best management practices implementation and effectiveness.

Methodology

For this integrated analysis, we incorporated historical habitat and population information, current survey and monitoring data, relevant research, reports and publications. We used this information to determine current stream and riparian habitat conditions, potential effects from future land management activities and their effects on the aquatic biota that use these habitats.

Spatial and Temporal Context for Effects Analysis

To determine effects, we analyzed potential short-term impacts and long-term benefits to riparian, stream and lake habitats and the aquatic biota that depend on them, addressing a variety of land management activities proposed in various alternatives over the planning period (15 years). We used information from the integrated Watershed Conservation Framework, which analyzes information at the 6th hydrologic unit code (HUC) level.

Affected Environment

See discussions under the water and soil section for descriptions of the Shoshone’s surface water, groundwater, water developments, riparian, and wetland areas that provide habitat for aquatic biota. Natural disturbances and human influences that affect aquatic resources are discussed. The physical, chemical, and biological integrity of Forest aquatic systems are assessed and key risks are identified.

Aquatic Habitats and Biota

The Shoshone supports a variety of biota in its aquatic and riparian ecosystems. The most common aquatic biota on the Forest can be broadly categorized as fishes, aquatic plants, aquatic insects, and the embryonic and larval stages of amphibians. Less obvious and even less understood are the phytoplankton, zooplankton, and microbes, which play a vital role in nutrient cycling and energy flow within the aquatic ecosystem. Amphibian species are discussed in more detail in the wildlife section.

Stream Habitats and Fisheries

The Shoshone currently has about 4,150 miles of perennial streams. About 1,420 miles of stream contain fish.

Diverse stream and riparian habitats are found throughout the Forest because of different geologic, soil and vegetative types, elevation, precipitation, and climatic changes. The central two-thirds of the Shoshone (from about the Clarks Fork River to the Wind River) are located in the Absaroka volcanics. The volcanics are generally characterized as young in geologic time, have poor water absorption characteristics and unconsolidated soils, and are highly erodible. As a result, tributary streams typically have high gradients, steep slopes, and large substrate with pocket pools providing the majority of the fish-holding habitat. Riparian zones are narrow and limited. The main stem valley streams are typically braided, unstable, and often migrate laterally due to significant bed load deposition. The floodplain and riparian zones are wide and dynamic. As a result, these main stem volcanic streams naturally carry substantial amounts of heavy fine sediments, bed load material, and woody debris during major runoff events. The main stem streams tend to be shallow and wide with low pool to riffle ratios, little in stream cover and streambank vegetation at base flows. This situation results in lower fish densities per linear mile of stream compared to other geologic-driven stream habitats on the Shoshone. Where suitable pool holding habitat does exist, fish densities are higher.

The northern and southern parts of the Shoshone are generally pre-Cambrian granitics. They are much less erodible than the volcanics. As a result, streams in these areas generally have more stable and well-defined channels with wide riparian and floodplain habitats, low gradients, more deep pools, well-established bank vegetation, and lower sediment loads than the volcanic streams. Additionally, these streams are narrower and deeper with higher pool to riffle ratios and have more suitable fish-holding habitat. The northern part of the Shoshone (generally north of the Clarks Fork River) is composed of hard granitics that are highly resistant to erosion, which results in very little instream fine sediment compared to the volcanics. Biological productivity is generally low since the hard granitics are erosion-resistant and nutrient-poor. The southern part of the Shoshone (generally south of the Wind River) is primarily composed of decomposed granitics that result in higher fine sediment in the form of sand with higher nutrient loading and biological productivity than the hard granitics.

Limited stream habitat is found in the North Platte River drainage on the Washakie District due to the small area encompassed in this headwater system on the Shoshone. It is located in the lower gradient, limestone geology type. These stream types are meandering, deep with wide riparian habitat, and typically have flood plains with significant willow habitat.

Overall, stream habitat conditions on the Shoshone are improving or remaining stable, and most are currently meeting desired conditions. Improving livestock grazing practices, improving road drainage, removing and replacing stream crossing barriers to fish passage, and implementing various stream habitat enhancement projects have all helped improve stream conditions, both on and adjacent to the Shoshone.

Historic native trout stream species include Yellowstone cutthroat trout and mountain whitefish. Subsequently, numerous game trout have been introduced into occupied and previously unoccupied stream habitats. They include Yellowstone and Snake River cutthroat, rainbow, rainbow-cutthroat hybrids, brook, brown, lake trout, and arctic grayling. Non-game stream fish species include longnose dace, white, longnose, common, and mountain suckers.

Lake Habitats and Fisheries

There are numerous lakes on the Shoshone with the majority located on the Beartooth Plateau, the Fitzpatrick Wilderness, the Popo Agie Wilderness, and adjacent areas. Currently, 311 lakes comprising about 9,074 acres support some type of fishery. Most of these lakes are found in the granitic geologic types. Granitics are not as erosive as the volcanics, tend to form rolling bench lands, and are less steep. The soil type is more porous and stores more surface water. The Absaroka volcanics have very few lakes and ponds because of steep slopes and high erosiveness, and the soil types do not absorb much surface water.

Historically, all of the high mountain lakes on the Shoshone were barren of fish because they were formed by uplifting and glacial activity. This process generally separated high mountain lakes and ponds from lowland streams, preventing upstream fish access and colonization. Many of the lakes that have suitable fish habitat have been subsequently stocked. Introduced lake game fish species include Yellowstone and Snake River cutthroat, rainbow, rainbow-cutthroat hybrids, brook trout, golden trout, lake trout, splake, and arctic grayling. Non-game lake species include white and longnose suckers. Other non-game fish include mountain suckers and lake chubs.

Of the 311 high mountain lakes with fish on the Shoshone, about 11 lakes are currently known to contain naturally reproducing conservation populations of Yellowstone cutthroat trout. Yellowstone cutthroat trout were originally planted since all the high mountain lakes on the Forest were presumed to be barren at the time of white settlement.

Forest-wide, some lakes are still barren with a portion of them having the potential to support a viable fishery. The WGFD staff believes all lakes within the Shoshone on the north zone with current fisheries potential have been stocked. On the south zone, the WGFD noted numerous lakes on the Shoshone with fisheries potential that have not been stocked, primarily within wilderness.

In stocked, previously fishless subalpine lakes, fish introductions have provided additional recreational opportunities and a diversity of fish species. Conversely, they have also affected the abundance, composition, and distribution of native amphibians and macroinvertebrates because of fish predation on various life stages and competition for available food sources.

Fisheries Habitat and Fish Species Management

The WGFD primarily manages fish populations, while the Forest Service primarily manages the habitat on the Shoshone. Both habitat and populations need to be managed in concert on and off the Shoshone to maintain productive, sustainable aquatic ecosystems. As a result, management of stream and lake habitats and fish populations is an ongoing cooperative effort between the WGFD and the Shoshone.

Outside of wilderness, fish stocking and population management are the primary responsibility of the WGFD in coordination with the Shoshone. In wilderness, fisheries management follows direction contained in the Wilderness Act and further defined in other agreements and memoranda of understanding with the Association of Fish and Wildlife Agencies and the WGFD.

Sensitive Fish Species

Yellowstone cutthroat trout – At the time of white settlement, the distribution of Yellowstone cutthroat trout included large areas of Montana, Idaho, and Wyoming. Rangewide, historical habitat for Yellowstone cutthroat trout was estimated to include about 17,720 miles of streams and 61 lakes (May et al. 2007, Gresswell 2009). In Wyoming, Yellowstone cutthroat trout historically occupied an estimated 6,710 stream miles.

Current distribution is estimated at about 7,530stream miles rangewide. As of 2006, Yellowstone cutthroat trout conservation populations occupied 7,200 miles of streams and 205 lakes (May et al. 2007). This represents 41 percent of the historical stream habitat. In Wyoming, Yellowstone cutthroat trout conservation populations (greater than75 percent pure) currently occupy 4,050 stream miles or 53 percent of the Yellowstone cutthroat trout’s current range.

Historically, Yellowstone cutthroat trout had an estimated 670 miles of stream habitat on the Shoshone (see map 18). Many streams were blocked from historical upstream migration due to natural barrier falls. Subsequent stocking of streams and downstream drift from upstream stocked lakes significantly increased stream fish distribution. This resulted in about 1,420 stream miles with fish currently on the Shoshone (WGFD Stream and Lake database 2011) and essentially doubled the historical miles of stream with fish on the Shoshone. From hybridization and competition with non-native fish species, Yellowstone cutthroat trout populations were significantly reduced to about 390 miles of stream for Yellowstone cutthroat trout conservation populations (greater than75 percent genetic purity) or about 59 percent of the historic, native stream miles on the Shoshone (May et al. 2007).

Yellowstone cutthroat trout are designated as a species of special concern by Montana, Idaho, Wyoming, Utah, and Nevada. The Forest Service classifies Yellowstone cutthroat trout as a sensitive species, and the BLM classifies Yellowstone cutthroat trout as a type-2 species, rangewide/globally imperiled. As a result, Yellowstone cutthroat trout are currently included on the Forest Service Region 2 sensitive fish species list.

Mountain suckers are found throughout much of western North America. It is widely distributed in some parts of its range and sparsely distributed in others. In Region 2, it occurs throughout Wyoming and in northwestern Colorado and western South Dakota. The species appears to be stable in some regions and declining in others (Mountain Sucker Conservation Assessment 2006). Currently, they are a sensitive fish species in Region 2. On the Shoshone, mountain suckers are common to abundant where suitable habitat is found (WGFD Stream and Lake Database 2011) primarily due to limited habitat alteration, development, and introduction of non-native species. In and around the Shoshone, mountain suckers are found in a variety of habitats including large rivers and streams at lower elevations and alpine lakes and streams in the mountains.

Lake chubs have a wide range and are found throughout much of Canada and the northern tier of the United States (Lake Chub Conservation Assessment 2006). The species is uncommon in the Great Plains. In Region 2, populations in South Dakota, Colorado, and Nebraska occur as small, isolated populations that have been declining steadily since European settlement. They are a sensitive fish species in Region 2. The species is currently widespread in Wyoming and is rated as secure (S5) by the Natural History Database. In Wyoming, they are typically found in cool, slow-moving back water foothill streams and in lakes. Where suitable habitat is available on the Shoshone, lake chubs are common to abundant (WDGF Stream and Lake Database 2011). This situation is primarily due to limited habitat alteration, development, and introduction of non-native species.

For more detailed information and management direction for these sensitive fish species see the Sensitive Fish Species Biological Evaluation located in the project record.

Aquatic Management Indicator Species

Stream game trout were selected as the management indicator species for aquatic habitat because they are well distributed throughout the Shoshone. In addition, good stream trout population information is available throughout the Shoshone for trend indices from working cooperatively collecting population information with the WGFD. Aquatic management indicator species include Yellowstone cutthroat trout, rainbow, their hybrids, brook and brown trout.

The primary risk factors from forest land management activities include improper timber harvest, livestock grazing, roads, and trails. Improper land management can increase stream sediment beyond natural levels. Streams can become wide and shallow with little instream cover. Undersized stream crossings can completely or partially block upstream fish passage. Catastrophic fires can significantly affect stream trout populations from increased sediment, removal of vegetative cover and greatly increase the potential for significant runoff events. Other natural risks include severe climatic events such as drought and floods outside the natural range of variability. Climate change has the potential to reduce summer flows in streams, increase spring runoff events, and increase summer water temperature in the long term (Rice et al. 2012). Increases in water temperature may also shift fish communities to favor non-native stream trout. Aquatic invasive species are also potential risk factors to stream trout and other fish populations.

Desired Condition

Stream and lake habitats and the aquatic biota that use them are conserved and managed within their natural range of variability. Streams are in dynamic equilibrium with their water and sediment supplies. Stream systems retain their ability to transport sediment, they neither aggrade nor degrade, and the floodplain is accessible when stream flows are above bankfull level. Lakes and their associated habitats are managed within their natural potential. These conditions provide for a range of habitats needed for aquatic biota over time. No new aquatic invasive species become established on the Shoshone. Sensitive fish species and their habitats are conserved and enhanced, thereby preventing listing under the Endangered Species Act.

Environmental Consequences

Nearly all activities carried out on the Shoshone and described in this analysis have the potential to affect aquatic and riparian resources in some manner, both positively and negatively, over the short and long term.

About half of the Shoshone is located in designated wilderness. The other half of the Shoshone is located in lands that are managed for various multiple-use resource objectives. One of the primary management strategies is to utilize management techniques that simulate natural processes. Periodic disturbance is an integral part of natural process on the landscape that is required for long-term sustainability of aquatic ecosystems (Kreutzweiser et al. 2012). These land management activities generally result in acceptable short-term impacts within forest plan standards and guidelines, Forest Service Regional and National BMP Directives, and other management direction for long-term benefits to riparian habitat and the biota that use them.

Creating riparian buffer protection zones and setbacks for long periods of time delays succession, reduces vegetative diversity and productivity, and increases the chances for large-scale fires outside the natural range of variability (Van de Water and North 2012). These researchers felt that the current “hands-off” management approach for riparian habitat management under the Northwest Forest Plan will continue on an altered trajectory of ecological processes and have undesirable long-term consequences (Messier et al. 2012).

Generally, land management actions have the most impacts immediately after the activity, with disturbance effects decreasing over time. Activities that alter the quantity, timing, and quality of water resources, permanently alter stream channel dynamics, or increase stream sediment significantly above natural levels over the long term have the greatest potential for adverse effects. Generally, the risk of adverse effects from land management activities increases the closer the disturbance is to riparian areas, streams, or wetlands. It also generally increases cumulatively the more activities there are in a drainage within a shorter timeframe. This aquatic and riparian resource analysis focuses on effects from anticipated management activities by alternative.

Direct and Indirect Effects

Streams, floodplains, riparian areas, lakes and ponds, and other aquatic habitats for various biota are closely related and interconnected. For each of the resource areas described below, the environmental consequences for aquatic resources including riparian and stream habitat and the biota that use them are compared by alternative, based on key indicators of disturbance for each type of activity. In general, alternatives that propose greater levels of disturbance activities for various resource uses in shorter periods of time within a drainage tend to pose greater risks to aquatic and riparian resources.

Effects from Timber Harvesting:

Aquatic resource habitat

Timber harvest can affect aquatic resources in a variety of ways over the short and long term, both positively and negatively. Harvest in riparian zones can reduce streamside vegetation and overhead cover, which can increase annual and daily stream temperature fluctuations somewhat and decrease the supply of large woody material available for recruitment to streams. Timber harvest can also increase stream sediment levels over the short term. Increased stream sediment also carries increased nutrients, which can increase biological productivity over the short term. Associated timber harvest equipment can damage or compact streambanks and riparian areas. With proper implementation, administration, and compliance, timber harvest can help simulate natural processes, set back succession, and provide a diversity of vegetative habitat types over the long term alone or in conjunction with prescribed fire, where appropriate.

Indirect effects of riparian and streamside timber harvest to aquatic ecosystems managed improperly could be changes in community composition and relative abundance of aquatic biota through excessive fine sediment covering interstitial spaces resulting in reduced or modified aquatic invertebrate communities and reductions in the abundance, distribution, and quality of fish spawning habitat.

In addition to timber harvest, associated roading can impact aquatic and riparian resources. Forest-wide standards and guidelines have been developed to minimize the impacts of timber harvest activities and associated roading on aquatic resources. In addition, the Forest Service Regional and National BMP Directives contain substantial design criteria and direction for timber harvest and associated roading to minimize short- and long-term impacts. Careful project planning, development of design criteria, and site-specific project implementation with proper implementation, administration, and compliance are critical. This strategy will ensure that vegetation management does not preclude achieving desired conditions for aquatic and riparian ecosystems or adversely affect viability of aquatic sensitive and management indicator species in the long term.

The risk of adverse consequences to riparian, streams, fish habitat, and the biota that use them may increase with higher timber harvest and associated roading levels. Potential for conflict with standards or guidelines could occur as land management activities begin to approach upper thresholds. Additionally, unplanned natural events such as large-scale fire, insects and disease, and/or flooding have the potential to increase cumulative effects.

Management indicator species, sensitive fish species, and aquatic invasive species effects

Generally, this analysis assumes that the amount of timber harvest increases the potential effects to aquatic resource effects proportionally. The actual risks and consequences are dependent on a variety of project-level factors, including the type of harvest and location relative to water resources and amount and type of roading, including stream crossings and types of crossings.

Effective implementation, administration, and compliance of watershed conservation practices and other project design criteria are critical to avoiding or minimizing impacts to aquatic resources and potentially affected streams under any alternative. Actual areas harvested and harvest type in any given year varies depending on alternative and budget levels. Site-specific effects to aquatic and riparian resources would occur as a result of a variety of factors including harvest levels and type, location of harvest relative to aquatic resources, amount of roads and type, the number and type of stream crossings, and the number and type of equipment used at the project level.

Based on the overall amounts of projected estimated harvest in the timber harvest section, alternatives F and E, respectively have the highest risk of effects to aquatic resources including riparian and fish habitat, stream management indicator species, fish sensitive species, and potential for aquatic invasive species establishment from timber harvesting and associated roading. Alternatives C and D, respectively would have the least amount of impacts because there is more wilderness and non-motorized emphasis with less roading. Alternatives B and G provide timber and roading similar to the existing forest plan levels, which would generally help minimize establishment of aquatic invasive species.

Effects from Roads and Trails Management:

Aquatic resource habitat

The Shoshone contains a variety of roads and trails with various levels of condition and maintenance. Roads range from paved highways maintained by the Federal Highway Administration and Wyoming Department of Transportation to system roads that range from gravel to two tracks. Many system roads were originally constructed to access suitable timber. There are many non-system and user-created routes and trails on the Shoshone. Roads and trails that are not disconnected from stream systems can be a chronic source of increased sediment (Winters et al. 2004). Some streams have adjacent roads or trails where significant erosion can deliver sediment directly into the stream. Excessive sediment can fill pools and change channel morphology, reducing habitat for fish, and plug the interstitial spaces of the streambed, suffocating fry and invertebrates and/or reducing habitat for invertebrates and spawning and rearing fish. Unlike many other disturbances that increase erosion, sedimentation from travelways tends to be chronic and to last as long as the travelways exist, which can create long-term impacts to aquatic habitat unless corrected. Roads, trails, and associated human travel also can cause reduction, disturbance, and interruption of riparian habitat. Accordingly, numerous fish and wildlife species associated with riparian areas can be adversely affected by excessive road-related sediment.

There are both economic and ecological consequences from increased sediment derived from roads and other sources. Sediment does not dissipate and is carried through the stream system where it may affect diversion structures, reservoirs, and water supplies. It can shorten the usable life of structures or result in higher maintenance costs. Since channels are interconnected, sediment delivered to ephemeral channels moves on to perennial channels during major runoff events.

Alteration of aquatic habitats for sensitive and management indicator fish species can include reductions in spawning gravels and hiding cover as substrates become more embedded. Pool volume can be reduced as sedimentation increases. During critical low-flow or overwintering periods, reduced pool depth can result in insufficient protection and survival for fish. Sediment deposition in spawning gravels reduces spawning success and the survival of emerging juvenile fish. Excessive fine sediment can adversely affect other aquatic biota including macroinvertebrates that fish use as a food source.

The proper implementation, administration and compliance with Forest Plan standards and guidelines, the Forest Service Regional and National BMP Directives, in conjunction with the appropriate project design criteria will minimize impacts from new or reconstructed roads. Bringing existing roads into compliance with improved protection measures is ongoing. The Shoshone has inventoried the existing road system and has been actively correcting road drainage and stream sediment problems over the planning period, as time and funding have become available.

Future road management should consider relocation or obliteration of existing roads out of riparian areas to reduce associated impacts. Impacts can be greatly reduced by proper road location and design. Where possible, travelways should be located away from stream channels, riparian areas, steep slopes, high-erosion-hazard areas and areas of high mass movement. Good design provides stable cut and fill slopes and adequate drainage that allows water to filter through vegetated buffers or sediment traps before entering the stream channel. Realignment of roads and other travelways so that they traverse riparian areas and streams at perpendicular rather than parallel angles would improve the quality of riparian and aquatic habitats by reducing chronic sediment sources. If relocation is not possible, seasonal restrictions could limit road damage and subsequent sedimentation. The Forest Service Regional and National BMP Directives, contain detailed guidance on roads and trails management from an aquatic resources perspective.

In the current plan, fish and other aquatic organism barriers at road crossings were not identified as an issue, and therefore, not addressed. Undersized stream crossings, especially culverts can restrict the channel, create downstream drops at the outlet, and flush out existing substrate within the culvert, resulting in complete or partial barriers to upstream aquatic and terrestrial organism passage. Undersized culverts also increase the chances of flood damage, maintenance or replacement costs. More recently, we have inventoried the entire forest for fish barriers at stream crossings on the entire Forest. We have developed an integrated priority list for crossing replacement. We use the Forest Service Regional and National BMP Directives and natural stream simulation principles to replace undersized crossings, which provide passage for aquatic and terrestrial organisms, reduce erosion, lessen the risk of damage from flooding, and provide a safe crossing for forest users.

Management indicator species, sensitive fish species and aquatic invasive species effects

The amount of road construction and stream crossings generally varies directly with the amount of suited land that has been allocated for timber harvest and allowable motorized use. Alternatives F and E, respectively would have the most road construction and motorized use of any of the alternatives considered, due to the larger amount of timber harvest activity and motorized use. These alternatives would have the most potential for adverse effects to aquatic resources, management indicator species, fish sensitive species and potential spread of aquatic invasive species. Alternatives C and D, respectively would have the least amount of expected road related impacts and spread of aquatic invasive species since there is more wilderness and non-motorized emphasis. Alternatives G and B provide a road and trail system similar to the existing forest plan levels and effects fall between the other alternatives.

Effects from Fires and Fuels management:

Aquatic resource habitat

Wildfire: Wildfire within the natural range of variability generally creates a mosaic of habitat types, sets back vegetative succession, and creates vegetative diversity in and around riparian areas. These processes also release sediments and nutrients into streams, which also increases biological productivity. Due primarily to past fire suppression policies, much of the forest and riparian areas are in a mature condition and susceptible to wildfire outside the natural range of variability. More recent fire management efforts have been undertaken to help correct these imbalances.

Wildfires significantly outside the natural range of variability can burn large landscapes very hot in some areas damaging soils and releasing significant amounts of sediment into streams, well above natural conditions. This can result in significant adverse effects to aquatic resources from erosion, excessive stream sedimentation, and extensive vegetative removal that can take a long period of time for recovery. Wildfire, prescribed fires, and their associated suppression activities can have the potential to impact aquatic and riparian resources. Fire suppression efforts can considerably increase erosion potential and delivery of sediment to streams from fire lines constructed by heavy equipment or by hand, if installed improperly.

The effects of prescribed fire can be considerably less severe than wildfires when managed properly. Because the location and severity of the fire are controlled to a greater degree, more ground cover remains and erosion potential is reduced. For example, sediment-trapping buffers can be left around stream channels to reduce the amount of sediment delivered to the stream. Entire watersheds are rarely burned by prescribed fires, and this reduces the effects of changes in water yield and peak flow. The use of prescribed fire can help reduce the risk of wildfire that would otherwise burn with increased severity and intensity, which can severely alter watersheds and riparian areas. Alteration of aquatic habitats for sensitive fish and management indicator species from excessive sedimentation resulting from wildfire includes reductions in spawning gravels and hiding cover as substrates become more embedded, reducing reproductive success. Pools can be filled with fine sediment and aquatic invertebrate production can be significantly decreased.

Prescribed Fire: Prescribed fire is primarily intended to improve wildlife habitat, reduce fuel loads, protect developments, and reduce the risk of severe wildfires. Many projects are completed in conjunction with mechanical fuels treatment prior to prescribed burning. These types of treatments generally simulate natural conditions, and have short-term minor impacts with positive long-term benefits for aquatic habitats and the biota that use them. Reductions in forested stands can also slightly increase stream flows that may be beneficial to aquatic resources. Fire suppression activities are typically conducted to minimize impacts to riparian areas by restricting the use of dozer lines and retardant in riparian areas. When retardant is allowed to reach water sources, aquatic biota may be impacted as a result from diminished water chemistry and quality. Potentially undesirable aquatic invasive species may also be transferred from one water source to another, from the use of the various types of fire suppression equipment that transport water and fine sediments where most aquatic invasive species are found.

Management indicator species, sensitive fish species and aquatic invasive species effects

Generally, the chances for wildfire are somewhat similar for all alternatives. It would be reduced somewhat with the alternatives that propose the most prescribed fire and timber harvest, but would also result in the most habitat disturbances (alternatives F and E, respectively). Alternatives C and D, respectively, propose the least amount of prescribed fire and timber harvest. Alternatives G, B, and A propose direction and management area allocations to help prevent catastrophic fires while helping to minimize short-term impacts to aquatic resources, management indicator species, and sensitive fish species, while helping to prevent the establishment of aquatic invasive species.

Effects from Livestock Grazing and Big Game:

Aquatic resources

Excessive ungulate grazing can have detrimental effects on aquatic resources, particularly in areas where livestock tend to concentrate, such as riparian areas for watering, feeding, and loafing. With proper grazing, management impacts to riparian areas can be compatible with maintaining desired conditions.

Historic livestock use has changed the vegetation composition and stream channels of some riparian areas. A loss of deep-rooted shrub and carex species has made streambanks in these sites more susceptible to grazing impacts and erosion. Improper livestock management and wild ungulate grazing can reduce streambank stability through vegetation removal, streambank trampling, and shearing. Livestock and other ungulates can compact soil or destabilize streambanks by direct hoof action, causing increased sediment, stream widening or down-cutting of stream channels, and often change riparian vegetation types, resulting in insufficient habitat for fish. Stream widening and sedimentation can reduce instream cover and habitat quality for fish though mechanisms similar to those described for vegetation removal through timber harvest or fire, but grazing impacts can be compounded by repeated annual livestock use of the same areas. Stream down-cutting often causes the water table to drop, which results in less riparian habitat and a vegetative type change. Down-cutting also leads to channel straightening and reduced stream sinuosity, which also reduces habitat for aquatic biota.

Alternatives A, B, C, D, and G maintain the same by number of allotments and animal unit months (AUMs); the same as the 1986 Forest Plan as amended allocation. Alternative C would reduce the total AUMs significantly, compared to alternative A; from 55,880 to 31,300 AUMs. Alternative E would increase AUMs substantially, compared to alternative A from 55,900 to 67,100 AUMs for the same number of allotments. Alternative F would significantly increase acreage to 348,900 acres. AUMs would also increase the most for all alternatives from 55,900 AUMs for current levels to 70,200 AUMs.

Livestock grazing under any of the alternatives has direct and indirect impacts on riparian and aquatic resources. Generally, as the livestock numbers and use increase, we will begin to reach the upper limits of acceptable use and potential for adverse aquatic resources cumulative effects, especially if additional allotments and use were added. Incorporation of and compliance with the revised Plan standards and guidelines would minimize the impacts on aquatic resources.

Drier periods may result in changes in livestock management, including reduced use and/or the livestock coming off the allotment early. Cool, wet spring and early summer weather may result in livestock coming on the allotment later in the season.

Management indicator species, sensitive fish species and aquatic invasive species effects

Alternatives B, A, C, D, and G maintain the same by number of allotments and AUMs; the same as the 1986 Forest Plan as amended allocation and would have similar effects. Alternative C would reduce the total AUMs significantly, compared to alternative A and would have the least impacts. Alternative E would increase AUMs substantially, compared to alternative A for the same number of allotments and have the potential for increased livestock impacts to aquatic resources. Alternative F would significantly increase the number of allotments and AUMs compared to current levels and have the most potential for aquatic resources impacts.

Effects from Recreation: Recreational use is estimated to increase overall during the planning period. The types of recreational uses would change under the various alternatives.

Summer Recreation: Most summer developed and dispersed recreation sites are located near streams, lakes, or valley bottoms. The potential influence of developed and dispersed recreation sites on aquatic resources varies across the Shoshone. Some sites are located in riparian habitats, and so corresponding influences would be anticipated there. Dispersed summer recreation sites are expected to have more negative impacts on aquatic resources, because they were not established with specific design criteria or standards and guidelines and, thus, do not provide the same level of resource protection as managed developed sites.

Recreation impacts to water resources on the Shoshone are generally related to streamside recreation use including roads and trails, camping, water-based recreation, and indirect potential effects from upland recreation activities. Motorized off-road non-winter recreation travel can cause riparian area degradation and adverse water quality impacts. Horse, bike, and foot traffic generally have less impact, but can cause localized effects, especially where trails parallel or cross streams. Lakes and streams, especially those with fish that attract anglers or provide good hunting opportunities in the area, can receive significant impacts from recreational livestock and foot traffic if not managed properly. Water-based recreation is increasing, and degradation can occur if proper facilities are not in place and use is not managed. Streamside areas are often chosen for dispersed campsites and recreational livestock use. Summer dispersed campsite use can damage riparian vegetation, cause soil compaction in riparian zones, erode streambanks, and cause increased nutrient loading and pathogen levels due to human waste contaminating streams and lakes. Often, the impacts tend to be localized; however, in areas that experience substantial recreational use, the cumulative impacts to aquatic and riparian ecosystems can be both observable and measurable. Protection of water quality, quantity, and riparian habitat near recreationally significant aquatic and riparian ecosystems is achieved through the implementation, administration, and compliance of Forest Plan standards and guidelines, Forest Service Regional and National BMP Directives, and project-level design criteria.

Recreational and commercial livestock can reduce water quality through bacterial input, nitrate pollution, and fine sediment from erosion if not managed properly.

The direct impacts to fish populations and fishing experiences are expected to be proportional to overall summer use increases. The WGFD primarily manages fish populations and can limit harvest through fishing regulations. Increased angling use can reach a point where a quality fishing experience can be impacted. Generally, the magnitude and extent of summer motorized recreation trends have a greater effect on aquatic resources than non-motorized recreation. Motorized recreational use has seen the largest increase in recreational uses during the planning period. Generally, increased recreation impacts on aquatic, riparian, and fish populations, including sensitive species, and aquatic management indicator species are assumed to be proportional to the acres available to summer motorized recreation.

Alternative F has the highest risk for potential adverse effects to aquatic resources from increased summer motorized recreation.

Fishing is an activity that occurs on the Shoshone. Access to streams, lakes, and reservoirs provides a variety of angling opportunities in locales that range from easily accessible developed sites to remote subalpine wilderness areas.

Fishing and associated equipment can contribute to the propagation and distribution of aquatic invasive species, which can damage aquatic biota and disrupt aquatic ecosystems.

Fishing pressure on the Shoshone is expected to increase under all of the revised Plan alternatives during the planning period. Except for stocked lakes and reservoirs and a few stream reaches with high fishing pressure, fishing is a “supply-limited” activity because there generally is more fishing pressure on easily accessible fisheries than the fish populations can support. The WGFD manages the majority of streams on the Shoshone under the “Wild” management concept; i.e., stocking does not augment fish populations. The WGFD has also placed special regulations on some streams to offset increased angling pressure.

Recreational fishing may adversely affect existing populations of Yellowstone cutthroat trout, and aquatic management indicator species on the Shoshone, because increased recreational fishing pressure generally results in increased harvest and incidental fishing mortality, although this can be addressed through fishing regulation changes and stocking strategies.

Non-motorized trails are popular among forest users and it is reasonable to expect increasing use on hiking and pack trails over the planning period. This increased use could result in the alteration and degradation of aquatic, riparian, and wetland resources without proper management. Trails can provide relatively easy access and opportunities for those who could introduce aquatic invasive species into aquatic environments.

Winter recreation: Generally, over-the-snow winter motorized recreational uses do not significantly impact aquatic resources because the streams and lakes and adjacent habitats are snow and/or ice covered. Some winter activities do have the potential to adversely affect aquatic and riparian resources if not managed properly. Non-motorized winter uses include cross-country skiing and snowshoeing. Motorized winter uses include snowmobiling and snow cat use for recreation and trail maintenance. Damage to vegetation and soil erosion can occur if snowpack is not adequate to protect these resources. Winter motorized activities can also compact the snow, forming barriers that may alter spring runoff patterns, which can result in soil erosion and gullies in certain situations.

Water contamination from human waste and petroleum products, such as motor oil and gasoline, can degrade water quality in waters adjacent to areas of concentrated use such as parking lots and snowmobile staging areas. The likelihood and magnitude of impacts from these activities depend on site-specific factors such as average slope, aspect, elevation, vegetation, weather conditions, available facilities, and amount of use. In very high-use, concentrated winter motorized use areas such as Yellowstone Park others have found adverse effects to water quality and aquatic biota. Because the Shoshone generally has much less use, site conditions vary, and these sites are relatively small in area and widely dispersed, it is reasonable to assume that cumulative impacts will be minimal at the Forest scale.

Developed winter recreation sites may adversely affect aquatic and riparian resources. Downhill ski areas include Sleeping Giant near Pahaska and the Red Lodge Race Camp on the Beartooth Plateau. Cross-country ski trails include the Park County Nordic Ski Association Trails at Pahaska, and Beaver and Willow Creek cross-country ski trails near Lander. They are permitted to operate on the Shoshone. Downhill ski area development can lead to increased runoff and erosion through timber clearing for lifts, runs, trails, and other facilities. Snowmelt runoff is increased, especially when cleared areas are compacted through grooming or where snow making has artificially increased the snow depth. Sleeping Giant uses water from the North Fork Shoshone River for making snow early in the ski season. The amount of water used is minimal and the intake is screened to prevent fish entrainment. As a result, this operation has no measurable effect on sensitive fish and aquatic management indicator species. Downhill ski areas and snow resorts also typically disturb soils throughout cleared areas. Erosion and sediment can result, especially from soils that are near streams, unstable, or highly erodible. In addition, these uses can also degrade wetlands and riparian areas by draining or filling them, or by altering their vegetation.

The Red Lodge Race Camp is located in high alpine above tree line. The operation is run in the late spring and early summer using existing snowpack. As a result, impacts to aquatic resources are minimal.

Currently, all alternatives would continue to permit the existing downhill and cross-country ski areas on the Shoshone. These are small enough that there are minimal impacts to aquatic resources from their use. Any future expansions would be designed to mitigate effects to aquatic resources with appropriate project design features.

Effects from Mineral and Energy Development:

Mining: The largest current activity associated with mining on the Shoshone, is limited to exploitation of mineral materials for road construction purposes or individual permits for landscaping use off-Forest. Gravel pits are generally located in areas with minimal impacts to aquatic resources. The development of mineral materials is not expected to be significant with any alternative.

Existing mining operations, for locatable minerals, in the Shoshone are typically small and limited in number and regulated by revised Plan standards and guidelines. Increases in mining activity are not anticipated for the future.

Mining effects could include land disturbances and processing activities that may affect surface and groundwater quality, water quantity, and timing of release. For this analysis, aquatic resource effects from mining are assumed to be proportional to the amount of land available for locatable minerals. Potential impacts to aquatic habitats and populations are expected to be minor for all alternatives, as there are no expected proposals for large mineral development operations because of minimal, if not non-existent, potential for development of these resources.

Alternatives A, B, E, F, and G have the same area available for locatable minerals exploration and have the greatest risk of adverse effects. Alternatives C and D have lower amounts of land available because recommended wilderness areas may eventually have minerals withdrawn from development. These alternatives would have lower risk of adverse effects from this activity than the other alternatives. Forest standards, guidelines, and project design features with proper implementation, administration, and compliance would minimize the effects to aquatic resources from mining activities, should they occur.

Oil and Gas Development: The possibility of oil and gas development in the planning period is predicted to be low or very low under all alternatives. Potential adverse effects would be from improper roading, land disturbance, effects to ground water and potential for spills. For oil and gas potential surface occupancy with stipulations, alternative A has the most acreage. Alternatives F, B, and E have less acreage in decreasing order. Alternatives C and D have less land available, and alternative G has the least acreage. If oil and gas development were to occur, Forest standards, guidelines, and project design features with proper implementation, administration, and compliance would minimize the effects to aquatic resources from oil and gas development.

Effects from Wilderness and RNA Allocation: Generally, wilderness and RNA allocations are beneficial to aquatic resources because there is significantly less land disturbance and development. And, these management areas allow for natural processes to occur. Existing fisheries population management is allowed to occur in these areas including management and conservation of Yellowstone cutthroat trout populations. These activities would benefit sensitive fish species and aquatic management indicator species. These areas would reduce the potential adverse effects of roading. They would reduce vehicular access, helping to reduce the threat of aquatic invasive species establishment. Alternatives C then D propose the most recommended wilderness, special interest areas, and research natural areas. Alternative F recommends no new wilderness, special interest areas, and research natural areas. Alternative E proposes the least amount of new areas. Alternative B recommends no new wilderness and proposes six new research natural areas. Alternative G recommends two new research natural areas in addition to those recommended in alternative B.

Cumulative Effects

This cumulative effects analysis is for the period of expected plan implementation (about 15 years), and is bounded by the 6th-level hydrologic unit code watershed boundaries.

Through the implementation of forest plan standards and- guidelines, the Forest Service Regional and National BMP Directives, and project design features, with proper implementation, administration, and compliance, the Shoshone delivers good, clean water of the proper quality and quantity to the Forest boundary. The cumulative effects table at the beginning of chapter 3 (table 20) includes the list of past, present, and reasonably foreseeable future activities that were considered with regard to cumulative effects to aquatic resources. There are no new anticipated water depletions proposed on the Shoshone. As a result, there should be no increases in this effect in the next planning period. Alternative C is expected to have the least impact to aquatic and riparian resources and alternative F would have the most effect on those resources. Effects are expected to be similar across the entire forest, over the life of the revised Plan, with regard to cumulative effects on aquatic and riparian resources.

Another effect would be the reconstruction of highways within the Forest boundary. There can be both short- and long-term effects from these types of activities. Currently, there is reconstruction planned for a portion of the Beartooth Highway on the Beartooth Plateau and the Louis Lake Road on the Washakie District during the planning period. Although there would be short-term disturbances, through implementation, administration, and compliance of Forest Plan standards and guidelines, the Forest Service Regional and National BMP Directives, Association of State Highway Transportation Officials guidelines, and specific project design features, there would be long-term benefits to aquatic resource habitat conditions and aquatic passage through improved road and stream crossing design techniques.

As further development and human use is anticipated adjacent to the Shoshone, there is potential for noxious weeds or other invasive plants and aquatic invasive species to become established on the Shoshone, primarily due to motorized equipment, boats, recreational equipment, livestock, and human use.

Future management of aquatic resources will depend upon integration and cooperation with other agencies and stakeholders. Most emphasis of forest management is on the maintenance, protection, or enhancement of habitats and the organisms that inhabit them including maintaining population viability. The Forest Service and the various cooperating agencies including the WGFD, USFWS, Trout Unlimited, BLM, Bureau of Reclamation, and Wyoming State Lands predicate the long-term maintenance and protection of Forest aquatic and riparian biodiversity from effective natural resource management.

Management of fish populations is primarily the role of State and other Federal agencies that rely on forest management of habitats to meet overall viability goals. A specific example of cooperative management among various agencies is protection and conservation of viable Yellowstone cutthroat trout populations.

Aquatic habitat protection and improvement projects should focus on the needs of native, sensitive, and management indicator species. Management decisions that affect these species should be made collaboratively by the appropriate State and Federal agencies and other stakeholders. Other threats to native and desired, non-native species viability, such as invasive species, habitat loss, and pathogens should also be managed collaboratively.

Looking past the forest boundary to consider how the Shoshone National Forest direct and indirect effects add cumulatively to downstream water quality and quantity, the most important consideration is that the headwaters of streams and rivers are located on the Shoshone. While the direct and indirect effects analysis shows that Shoshone activities affect downstream water, overall, the water quality leaving the forest is good, as documented by Conservation District water monitoring. About half of the Shoshone is located in designated wilderness. Impacts of agriculture, subdivisions, roads, and septic systems downstream of the national forest boundary are considered to be significantly more important contributors to water pollution and reductions in water quantity than all Shoshone activities combined.

Proper implementation, administration, and compliance with local, State, and water quality regulations, standards and guidelines, Forest Service Regional and National BMP Directives, and individual project design features will ensure that future management activities under any of the alternatives would continue to protect aquatic and riparian resources on the Shoshone in the long term and will not contribute to water quality degradation downstream of the Forest. Overall, it is anticipated that physical aquatic resource habitat conditions will be maintained or improved, due primarily to changes and/or continued improvements in management efforts, such as livestock grazing and timber harvesting practices, and improvements in the Shoshone transportation system. Barriers to upstream aquatic passage at stream crossings for organisms that use streams both on and off the Shoshone have been identified and corrected as funding and time becomes available. Biological effects on aquatic species such as drought, insects and disease, changing climate, and species competition are difficult to anticipate. Efforts will be made to research, understand, and plan future management activities considering these potential effects.

Fisheries Climate Change Effects

Rice et al. (2012) noted streamflows are a primary control for fish that are highly sensitive to climate change (Rieman and Isaac 2010 in Rice et al. 2012) as salmonid habitat availability can be limited by streamflow. Low flows can reduce habitat, forcing a migration to more suitable habitat (Gregory et al. 2009 in Rice et al. 2012). In addition to streamflow, stream temperature is another control that can limit salmonid habitat. Stream temperatures have been found to have a strong relationship with air temperatures (Webb and Noblis 2007; Kaushal et al. 2010 in Rice et al. 2012).

Cold-adapted fish species ranges are projected to generally shift upward in elevation due to downstream temperature increases, and to become increasingly fragmented and disjointed from larger streams that naturally hold source populations (Kelekher and Rahel 1996 in Rice et al. 2012). However, increased temperatures may improve habitat for native cutthroat trout at higher elevations, and isolated headwater streams may provide protection from non-native invasive trout (Cook et al. 2010 in Rice et al. 2012). The smaller tributaries and lower populations supported at higher elevations are projected to experience decreased genetic variability and probability of native trout survival (Cook et al. 2010 in Rice et al. 2012).

Potential consequences include shifted or reduced salmonid habitat and associated species, and reduced recreational fishing opportunities for native cold water fish if salmonid habitat is reduced or degraded. Also, the Shoshone may serve as a high-elevation refugium for salmonid populations (Rice et al. 2012).

Determination and Rationale

Sensitive Fish Species Determination:

All Plan revision alternatives, including alternative A, **"may adversely impact individuals (Yellowstone cutthroat trout, mountain suckers, and lake chubs), but would not likely result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability rangewide."** A summary for this determination follows. For a more detailed rationale, including management and conservation measures, see the Sensitive Fish Biological Evaluation located in the project record.

Yellowstone Cutthroat Trout

The primary reason for the significant reductions of Yellowstone cutthroat trout (*Oncorhynchus clarkia)* on the Shoshone is from past introductions of non-native trout that compete and/or hybridize with native Yellowstone cutthroat trout. WGFD currently manages for wild, genetically pure Yellowstone cutthroat trout wherever possible to minimize future impacts. Additionally, integrated and coordinated range-wide and geographic management unit Yellowstone cutthroat trout restoration projects, including both population and habitat components have been and will continue to be implemented during the planning period, helping to restore and conserve Yellowstone cutthroat trout populations on and adjacent to the Forest. Stream and riparian habitat currently is in good to excellent or improving condition overall on the Forest from improved grazing, roading, stream crossing, and stream habitat improvement projects. Proper implementation, administration, and compliance of Forest Service Regional and National BMP Directives, and other relevant measures including project design features will help maintain and improve aquatic habitat during the planning period.

Mountain Suckers

Stream and riparian habitat currently is in good to excellent or improving condition overall on the Shoshone from improved grazing, roading, stream crossing, and various habitat improvement projects. Mountain suckers (*Catostomus platyrhynchus*) are common to abundant on the Forest where suitable habitat exists. As a result, mountain suckers have issues in other parts of Region 2, but not on the Shoshone.

Lake Chubs

Stream, riparian, and lake habitat currently is in good to excellent or improving condition overall on the Shoshone from improved grazing, roading, stream crossing, and various habitat improvement projects. Lake chubs (*Couesius plumbeus*) are common to abundant on the Forest where suitable habitat exists. As a result, lake chubs have issues in other parts of Region 2, but not on the Shoshone.

Rare Plants

Introduction

The Forest Service has a legal requirement to maintain or improve habitat conditions for threatened, endangered, proposed or candidate species under the Endangered Species Act. Species covered under Endangered Species Act are those listed by the U.S. Department of Interior (USDI) USFWS. Sensitive plant species are developed and protected under the Regional Forester's Sensitive Species Program. The Shoshone National Forest is required to identify and mitigate potential effects to these species from Federal land-disturbing actions. To comply with the Endangered Species Act and the Sensitive Species Program, the forest botanist conducts inventories during project planning to locate and protect any threatened, endangered, proposed, candidate, Region 2 sensitive plant species, and forest plant species of local concern.

Legal and Administrative Framework

These acts, along with other land use laws, executive orders, and policies guide management of rare and sensitive plants on NFS lands. Other laws pertinent to management of NFS lands can be found in Forest Service Manual (FSM) 2600.

Laws

Endangered Species Act (ESA) of 1973 as amended creates an affirmative obligation "that all Federal departments and agencies shall seek to conserve endangered and threatened species of fish, wildlife, and plants." The act also requires Federal agencies to ensure that any authorized action funded or carried out by them does not jeopardize the continued existence of listed species or modify critical habitat.

Forest and Rangelands Renewable Resources Planning Act of 1974: Provides for maintenance of land productivity and the need to protect and improve the soil and water resources.

National Forest Management Act (NFMA) of 1976: "It is the policy of the Congress that all forested lands in the NFS shall be maintained in appropriate forest cover with species of trees, degree of stocking, rate of growth and conditions of stand designed to secure the maximum benefits of multiple use sustained yield. Plans developed shall provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet the overall multiple-use objectives, and within the multiple-use objective."

Executive Orders

Executive Order 11990 requires Federal agencies exercising statutory authority and leadership over Federal lands to avoid to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands. Where it is practicable, new construction in wetlands should be avoided. Federal agencies are required to preserve and enhance the natural and beneficial values of wetlands.

Regulation, Policies and Regional Direction

Regulations and policies have been passed in support of these laws and require the following:

- Forest Service Manual (FSM) 2600 and Forest Service Handbook (FSH) 2609 state policy and direction regarding wildlife, fish and sensitive plant program management.

- Forest Service Manual 2631.3. This manual outlines regional policy on the management of fens. Fen habitat accounts for 13 of the current 26 Region 2 sensitive plants on the Forest.

Resource Protection Measures

Threatened, endangered, proposed, or candidate species have special management requirements for all Forest Service management activities. The Endangered Species Act section 7 guidelines and recovery objectives have been followed where potential habitat of suspected threatened plant species may occur on the Forest.

For sensitive species, management efforts to ensure the diversity of rare plant communities or their habitat are already in place. The Forest Service management policy (FSH 2609.25, 1.25, 1988 and FSM 2670) ensures that for all the rare plant species, the following measures will be taken:

1. Biological evaluations will be written for all activities that may affect sensitive species and their habitat.
2. "Effects" of activities will be determined as similar to those for threatened, endangered, or proposed species.
3. Special management emphasis will be included in all management activities to ensure the viability of the sensitive species and to preclude trends toward endangerment that would result in the need for Federal listing. This Forest Service management policy will be employed at a species level in all alternatives to ensure its mandates are achieved and that sensitive species are conserved.

Management activities in fens are guided by Forest Service Handbook 2509.25, 2631.3, Region 2 Watershed Conservation Practices Handbook, and Forest Service National Best Management Practice Directives (collectively referred to as Forest Service regional and national BMP directives). The management measures and design criteria in the handbook include practices that are important parts of meeting desired conditions for soil, aquatic, and riparian resources. Field reviews of the application of best management practices provide information on effectiveness.

Sensitive species are assessed in a biological evaluation; information is summarized here.

All effects analyses describe the condition and effects to habitat in general on the Shoshone for purposes of assessing viability for rare plants. The main approach for species viability is to ensure that ecosystem components and processes remain functioning, and then to verify needed habitat components persist for rare species and species representative of others due to similar habitats.

Methodology

The rare plant species included in the analysis are those that are either listed under the Endangered Species Act, are on the Rocky Mountain Region (Region 2) Regional Forester's Sensitive Species list, or plant species of local concern. No threatened or endangered plant species are known to occur on the Shoshone. There is one candidate plant species on the Forest, whitebark pine. Because of its candidate status, it is listed as a Region 2 sensitive plant.

Distribution, habitat information, and population data for each species are available from the Wyoming Natural Diversity Database (WYNDD), the Rocky Mountain Herbarium, and Region 2 sensitive plant species conservation assessments and evaluations. Species Conservation

Assessments, evaluations, and rationale documents can be found in the Forest Plan project records and at the following website: http://www.fs.fed.us/r2/projects/scp/.

Forest plant lists were derived from extensive botanical work conducted by the Rocky Mountain Herbarium and by WYNDD since the last forest plan. This work has resulted in nearly 50,000 voucher specimens representing approximately 1,690 vascular plant taxa. Recently started inventory work on the non-vascular (bryophytes) of the Shoshone has to-date yielded approximately 200 taxa. Knowledge of fungi species on the Forest is limited. Information on Wyoming plants from the Rocky Mountain Herbarium is found at the following website http://www.rmh.uwyo.edu. WYNDD information on Wyoming rare plants is found at the following website: http://www.uwyo.edu/wyndd/.

Significant habitat for rare plants exists in the Swamp Lake Botanical Area, Line Creek Research Natural Area, and potential special interest areas and research natural areas. These special areas are an essential component for conserving rare plants on the Shoshone.

Spatial and Temporal Context for Effects Analysis

The primary spatial context used for Region 2 sensitive plant species and plant species of local concern is the area within the Shoshone National Forest boundary. This area represents the NFS lands where changes may occur to rare plants or habitats from activities implementing the various alternatives. Information from the University of Wyoming's WYNDD and Rocky Mountain Herbarium is used to analyze potential threats on the Forest. The timeframe of the analysis is 15 years or the life of the revised Forest Plan.

Incomplete and Unavailable Information

Distribution maps of Region 2 sensitive plant species and plant species of local concern are in many cases incomplete or are unknown. This information need will be emphasized prior to the next planning cycle. Knowledge of fungi and bryophytes on the Shoshone is limited. Systematic inventory of these classes of organisms is just beginning. Fen habitat inventory is lacking on most of the forest. The only area with extensive inventory is the Beartooth Mountains. Fen habitat is important because it contains 12 of the Forest's Region 2 sensitive plants.

Rare Plant Species

The Shoshone rare plant species include Region 2 sensitive plant species and species of local concern that occur, or could occur in the planning unit. Currently, 26 Region 2 sensitive and 23 species of local concern are documented on the Shoshone. Each of the Shoshone rare plant species was placed into one of seven appropriate habitat groups. The habitat groups include the following: fens/riparian, calcareous montane grasslands, calcareous rocky slopes and ridges, volcanic rocky slopes/montane shrublands, granitic montane grasslands, alpine, and subalpine/krumholtz forests. A brief discussion of the habitat groups follows.

Sensitive plant species that occur on the Shoshone are listed in table 80 with the associated habitat group; species of local concern that occur on the Shoshone are listed in table 81 with the associated habitat group. Most plant species of local concern are considered to be sensitive in Forest Service Region 1, Region 4, and/or the BLM within the Greater Yellowstone Ecosystem. Both lists evolve as knowledge of these species increases.

Table 80. Rocky Mountain Region sensitive plant species on the Shoshone National Forest (documented)

Common name(s)	Global/state ranking[17]	Habitat
Sphagnum moss *Sphagnum angustifolium*	G5/S1	Fens
Triangleglobe moonwort *Botrychium ascendens*	G2G3/S1	Riparian
A Roundleaf orchid *merorchis rotundifolia*	G5/S1	Fens
Lesser panicled sedge *Carex diandra*	G5/S2	Fens
Livid sedge *Carex livida*	G5/S2	Fens
Chamisso's bristlegrass *Eriophorum chamissonis*	G5/S2	Fens
Slender bristlegrass *Eriophorum gracile*	G5/S2	Fens
Hall's fescue *Festuca hallii*	G4/S2	Calcareous montane grasslands
Simple bog sedge *Kobresia simpliciuscula*	G5/S1	Fens
Wyoming tansymustard *Descurainia torulosa*	G5/S2	Volcanic rocky slopes and shrubland
English sundew *Drosera anglica*	G5/S2	Fens
Fremont's bladderpod *Lesquerella fremontii*	G2/S2	Calcareous rocky slopes and ridges
Kotzebue's grass of Parnassus *Parnassia kotzebuei*	G5/S2	Alpine
Absaroka Range beardtongue *Penstemon absarokensis*	G2/S2	Volcanic rocky slopes and montane shrubland
Greenland primrose *Primula egaliksensis*	G4/S1	Fens
Absaroka goldenweed *Pyrrocoma carthamoides* var. *subsquarrosa*	G4G5T2T3/S2	Calcareous montane grasslands
Tranquil goldenweed *Pyrrocoma clementis* var.*villosa*	G3G4/T2	Granitic montane grasslands

[17] Conservation status ranks estimate a species' risk of elimination. Status ranks are based on a 1 to 5 scale, with 1 denoting that a species is critically impaired and 5 denoting that a species is secure. Species status is assessed at three geographic scales: global (G), national (N), and state/province (S). The overall status of a species is denoted by its G-rank, while its condition in a particular country is denoted by its N-rank, and its condition in a particular state/province is denoted by its S-rank. State rank is assigned by Wyoming Natural Diversity Database (WYNDD) biologists and denotes a species probability of elimination in Wyoming. Subspecies, varieties, or any other designation below the level of a global ranked species, receives a T-rank that denotes their conservation status. A species may receive a B- or N-rank that refers to the conservation status of the breeding (B) or non-breeding (N) population in a particular nation or state/province. (NatureServe, February 2012, WYNDD February 2012).

Table 80. Rocky Mountain Region sensitive plant species on the Shoshone National Forest (documented)

Common name(s)	Global/state ranking[17]	Habitat
Entire-Leaf goldenweed *Pyrrocoma integrifolia*	G3?/S1	Granitic montane grasslands
Ice cold buttercup *Ranunculus gelidus* ssp. *grayi*	G5/S1	Alpine
Barratt's willow *Salix barrattiana*	G5/S1	Alpine
Sageleaf willow *Salix candida*	G5/S2	Fens
Myrtle leaf willow *Salix myrtillifolia*	G5/S1	Fens
Shoshone carrot *Shoshonea pulvinata*	G2G3/S2	Calcareous rocky slopes and ridges
North Fork Easter daisy T*ownsendia condensate* var. *anomola*	G4T2/S2	Volcanic rocky slopes and shrubland
Lesser bladderwort *Utricularia minor*	G5/S2	Fens
Whitebark pine *Pinus albicaulis*	G3G4/S3	Subalpine forests

The conservation status of a species or ecosystem is designated by a number from 1 to 5, preceded by a letter reflecting the appropriate geographic scale of the assessment (G = Global), N = National, and S = state/province). The numbers have the following meaning:

1 = critically imperiled

2 = imperiled

3 = vulnerable

4 = apparently secure

5 = secure.

For example, G1 would indicate that a species is critically imperiled across its entire range (i.e., globally). In this sense, the species as a whole is regarded as being at very high risk of extinction. A rank of S3 would indicate the species is vulnerable and at moderate risk within a particular state or province, even though it may be more secure elsewhere.

Table 81. Shoshone National Forest plant species of local concern (documented)

Common name(s)	Global/state ranking[18]	Habitat
N/A *Adoxa moschatellina*	G5/S2	Subalpine forests
Pink goat chicory *Agroseris lackschewitzii*	G4/S3	Fens/riparian
Sweet-flowered rock jasmine *Androsace chamaejasme* var. *carinata*	G5T4/S1S2	Calcareous rocky slopes and ridges
Least moonwort *Botrychium simplex*	G5/S2	Riparian
N/A *Carex idahoa*	G2G3	Riparian
Enander's sedge *Carex lenticularis* var. *dolia*	G5T3/S1	Alpine
Bristly stalked sedge *Carex leptalea*	G5/S3	Riparian
Black and purple sedge *Carex luzulina* var. *atropurpurea*	G5T3/S2	Fens/ Riparian
Evert's waferparsnip *Cymopterus evertii*	G2G3/S2S3	Calcareous rocky slopes and ridges
Woolly fleabane *Erigeron lanatus*	G3G4/S1	Alpine
Arctic cottongrass *Eriophorum gracile*	G5/S2	Alpine
Northern fescue *Festuca viviparoidea*	G4G5/SNR	Alpine
Hall's rush *Juncus hallii*	G4G5/S3	Riparian
Siberian bog sedge *Kobresia sibirica*	G5/S1	Alpine
Island purslane *Koenigia islandica*	G4/S1	Alpine
Shortflower monkey flower *Mimulus washingtonensis*	G4/S2	Riparian
Stalkpod locoweed *Oxytropis podocarpa*	G4/S2	Alpine

[18] Conservation status ranks estimate a species risk of elimination. Status ranks are based on a 1 to 5 scale, 1 denoting a species is critically impaired and 5 denoting a species is secure. Species status is assessed at three geographic scales: global (G), national (N), and state/province (S). The overall status of a species is denoted by its G-rank, while its condition in a particular country is denoted by its N-rank, and its condition in a particular state/province is denoted by its S-rank. State rank is assigned by WYNDD biologists and denotes a species probability of elimination in Wyoming. Subspecies, varieties, or any other designation below the level of a global ranked species, receives a T-rank that denotes their conservation status. A species may receive a B- or N-rank that refers to the conservation status of the breeding (B) or non-breeding (N) population in a particular nation or state/province. (NatureServe, February 2012, WYNDD February 2012).

Table 81. Shoshone National Forest plant species of local concern (documented)

Common name(s)	Global/state ranking[18]	Habitat
Icegrass *Phipsia algida*	G5/S1	Alpine
Alpine poppy *Papaver radicatum* ssp. *kluanense*	G5T3T4/S2	Alpine
Smoothstem parrya *Parrya nudicaulis*	G5/S2	Alpine
N/A *Potentilla nivea* var. *pentaphylla*	G5/S2	Alpine
Weber's saw-wort *Saussurea weberi*	G2G3/S2	Alpine
Alpine meadow rue *Thalictrum alpinum*	G5/S2	Alpine

Affected Environment

Habitat Groups

A brief description of the seven habitat groups follows.

Fens and riparian

Fens are a type of wetland that occupies only a small percentage of the landscape, but represents an important element of biological diversity. Because of their water-holding capability and unique characteristics, fens provide very stable habitats and often support several globally rare plant and invertebrate species and unique species assemblages. In the Rocky Mountain Region, fens are usually groundwater driven and are dominated by wetland plants. Fens are generally characterized by their stable presence on the landscape for thousands of years and associated plant and animal communities that may be relics from historic glaciation periods. Because the rate of accumulation of peat in fens is so slow and the species associated with fens are so unique, these ecosystems are difficult to reclaim and are essentially irreplaceable.

Thirteen sensitive and 7 plants of local concern on the Shoshone are restricted to fen and other riparian habitats. Fen habitats can be further characterized by different plant communities and species, different substrates, different pH and different abiotic processes. In numerous cases, sensitive plant species co-occur at known fen sites and the stressors and ecological processes that influence their habitats apply to all of them. Riparian vegetation across the Forest is also diverse and ecologically complex. Trianglelobe moonwort appears to be most associated with tall willow habitat in the Absaroka Range. Fen and riparian habitat can be found across the Shoshone. Potential and existing research natural areas and special interest areas offering protection of outstanding examples of this habitat include: Line Creek Research Natural Area, Swamp Lake Botanical Area; potential Sawtooth Peatbeds Geological Area, and Little Popo Agie Moraine Geological Areas; and potential Lake Creek and Beartooth Butte Research Natural Areas.

Calcareous montane grasslands

Two sensitive plants occur in calcareous montane grasslands. Dominated by Idaho fescue, these grasslands are found at the north end of the Shoshone on soils derived from limestone geologic formations. This includes areas on Bald Ridge, Rattlesnake Mountain, and Logan Mountain.

Potential research natural areas offering protection of outstanding examples of this habitat include: Arrow Mountain, Pat O'Hara, and Bald Ridge.

Calcareous rocky slopes and ridges

Two sensitive and two plant species of local concern occur in calcareous rocky slopes and ridges. This habitat is found on soils derived from limestone geologic formations. On the north end of the Shoshone this includes areas on Bald Ridge, Rattlesnake Mountain, and Logan Mountain. On the south end of the Forest, this habitat is found on sedimentary geologic formations along the flanks of the Wind River mountain range. Potential research natural areas offering protection of outstanding examples of this habitat include: Arrow Mountain, Pat O'Hara, and Bald Ridge. Of these three research natural areas, only the potential Bald Ridge Research Natural Area provides protection for the largest known population of *Shoshonea*, a species endemic to the northeast portion of the Greater Yellowstone Area.

Volcanic rocky slopes and montane shrublands

Three sensitive plants occur in volcanic rocky slopes and montane grasslands. This habitat is found on soils derived from the various formations in the Absaroka volcanics. This habitat occupies large areas of the central portion of the Shoshone. Potential research natural areas offering protection of outstanding examples of this habitat include Grizzly Creek and Sheep Mesa.

Granitic montane grasslands

Two plants are associated with granitic montane grasslands. The habitat for this species is found in granitic uplands of the Wind River Range. The potential Roaring Fork Research Natural Area offers protection of an outstanding example of this habitat.

Alpine

Three Region 2 sensitive plants and 13 species of local concern occur in alpine grasslands. This habitat is found at elevations generally greater than 9,800 feet. This habitat exists on almost a quarter of the Shoshone and, with a few exceptions (Beartooth, Phelps, and Carter Mountains), is mostly wilderness. Line Creek Research Natural Area and the potential Sheep Mesa, Beartooth Butte, Roaring Fork, Arrow Mountain, and Pat O'Hara Research Natural Areas offer protection of outstanding examples of this habitat.

Subalpine and krumholtz forests

Subalpine forests occur generally above 8,500 feet in elevation across the Shoshone. One candidate Region 2 sensitive plant (whitebark pine) and one species of local concern occur in subalpine forests and krumholtz habitat. Whitebark pine is a common five-needle pine in the Greater Yellowstone Area. Within subalpine forests, whitebark pine gradually becomes more common with increasing elevation. It is not as common on calcareous substrates. Krumholtz forests are found at upper tree line in harsh wind-blown environments. *Adoxa moschatellina* is found on lower-elevation subalpine forests with calcareous substrates.

Whitebark pine is threatened by bark beetle infestations, white pine blister rust, altered fire regimes, and climate change across its range. The whitebark pine strategy for the Greater Yellowstone Area (GYCC 2011) provides guidance to land managers for managing whitebark pine across the Greater Yellowstone Ecosystem. Line Creek Research Natural Area and the potential Sheep Mesa, Beartooth Butte, Roaring Fork, Arrow Mountain, Lake Creek, and Pat O'Hara Research Natural Areas offer protection of outstanding examples of this habitat.

Climate Change

One stressor common to all rare plant habitat groups that is beyond Forest Service control is climate change. Potential climate change on the Shoshone has been described in Rice et al. (2012). Predicted climate shifts may result in changes in kind, amount, and distribution of precipitation, in turn affecting rare plant habitat. Of particular concern is the effect on whitebark pine, alpine, lower-elevation grassland and shrubland, and riparian and fen habitats. In the subalpine/krumholtz zone, whitebark pine is predicted to retreat from lower-elevation ranges and either marginally exist at the highest elevations of the Forest or be extirpated. Alpine vegetation is predicted to decrease in extent and increase in fragmentation, resulting in refugia alpine habitat. Lower-elevation grassland and shrubland habitat will become drier and habitat will shift upward in elevation. This will create the potential for cheatgrass and other noxious weed spread on the landscape. Wetland (fen and riparian) habitat may be reduced in extent or lost (Rice et al. 2012). Climate change has the greatest potential of affecting the 26 sensitive and 23 plant species of local concern due to the predicted effects on rare plant habitat.

Environmental Consequences

The known threats and/or stressors that have the potential to negatively affect the plant species were reviewed for each of the seven plant habitats. Potential adverse effects were considered based upon the likelihood and intensity to which the various alternatives may affect the threats or stressors.

Potential threats are defined as activities (Forest Service or otherwise) or natural conditions that currently or potentially have negative effects on the diversity of rare plant communities or their habitat. Threats can be divided into the following three types: direct (e.g., livestock grazing—trampling; herbivory; and recreational activities—off-road vehicle, over-snow travel, hiking, and associated trampling), alteration of ecological factors (e.g., fire exclusion, insects, and disease), and habitat reduction (e.g., oil and gas exploration and road construction and reconstruction). These are discussed where appropriate by the seven habitat groups.

Fens and riparian

Several management activities and risks may affect rare plants in this habitat. They include management actions that alter hydrologic regimes; alterations to riparian plant community succession through vegetation manipulation; changes to natural disturbance regimes such as flooding; management activities that affect water quality, such as road construction, reconstruction and maintenance activities that result in runoff; livestock use; sedimentation from timber harvest activities; invasive plants and their control; off-road vehicle use around wet margins; and recreational use.

The Forest Service Regional and National BMP Directives provide a high level of protection for rare plants in fens and other riparian habitat. Those protections are in effect for all the alternatives. The most substantial risk to this habitat that has not been mitigated by these protections is the risk of a wildfire burning a large area and affecting either the hydrologic regime or nutrient inputs into these habitats.

Calcareous montane grasslands

Several management activities and risks may have effects on rare plants in this habitat. These include disturbance associated with recreational use, trail construction, road maintenance, and maintenance of administrative sites. Livestock grazing levels and water developments may affect plant numbers. Invasion of exotic plant species may affect some sites.

Calcareous rocky slopes and ridges

Several management activities may affect rare plants in this habitat. These include disturbance associated with recreational use, trail construction, maintenance of roads, and maintenance and use of administrative sites. Probably the most substantial risk to the plants in this habitat is the risk of a wildfire or prescribed fire burning a large area and precipitating the invasion of exotic plant species, particularly cheatgrass, which may affect rare plant survival. Chemical control of invasive plants also may have a negative effect.

Volcanic rocky slopes and montane shrublands

Several management activities and risks may affect rare plants in this habitat. These include disturbance associated with recreational use, trail construction, maintenance of roads, and maintenance of administrative sites. Invasion of exotic plant species, particularly cheatgrass, may affect plant survival after wild and prescribed fire. Spotted knapweed and Dalmatian toadflax spread may threaten habitat and chemical control efforts also may have a negative effect.

Granitic montane grasslands

Several management activities and risks may affect rare plants in this habitat. These include disturbance associated with recreational use, trail construction, livestock grazing, maintenance of roads, and maintenance of administrative sites.

Alpine

Several management activities and risks may affect rare plants in this habitat. These include disturbance associated with recreational use, trail construction, off-road vehicle use, livestock grazing, and maintenance of roads.

Subalpine and krumhotlz forests

Effects on this habitat include timber harvest, wildfire, prescribed fire, road and trail construction, and other activities that could directly impact populations through vegetation and/or ground disturbance. However, some of these actions may have overall beneficial effects for whitebark pine.

Direct and Indirect Effects

At the scale of the entire Shoshone National Forest, it is important to realize the difficulties associated with assessing the impacts of broad forest plan direction to 26 Region 2 sensitive plants and 23 plant species of local concern. Plant species may be rare due to evolutionary history, basic population ecology, historic or current human activities, or more likely, a complex combination of these factors. Human activities may or may not be responsible for the current distribution and abundance of the rare plant species. However, an important assumption in this analysis is that certain management actions may contribute or detract from the availability or quality of habitats that support rare plant species.

For each of the resource areas described below, the environmental consequences for rare plant habitat are discussed and then compared by alternative, based on key indicators of disturbance for each type of activity. In general, alternatives proposing greater levels of disturbance activities increase the potential for impacts to rare plant populations. The exception is whitebark pine where disturbance processes can be a beneficial effect and may aid in restoring this species.

Effects from Timber Harvesting: Mechanical activities include vegetation management treatments, whether for restoration or to meet timber production objectives. Activities such as logging can have impacts to plants and plant habitat through canopy removal, soil disturbance and erosion, and stream sedimentation. In addition, mechanical activities for vegetation treatment may require road building. Roads can increase access to and fragment habitat, thus providing an avenue for invasive plant species. They can be placed on ridge tops, in riparian areas, or through rocky slopes, which are important habitats for a number of species. Reconstruction and maintenance of existing roads can directly or indirectly affect plant populations by introducing competitive weeds and altering availability of light, nutrients, and moisture.

Most of timber harvesting activity on the Forest is in subalpine forests. As discussed above in fire, restoring historical fire regimes and restoring conditions toward historic range of variability that provide a range of seral stages may benefit some Region 2 sensitive plant species, particularly whitebark pine, in the long term.

Alternatives that include more timber harvest activity have more potential to negatively affect rare plant habitat. Acres of timber harvest range from 6,030 acres in alternative C where the potential impact is lowest to 12,200 acres in alternative F where the potential impact is highest. Alternatives A, B, D, and G are at the lower end of the range established by alternatives C and F. Though timber harvest can negatively affect rare plant habitat, the acres of timber harvest activity is small compared to total Forest acres and any negative effects would be addressed by applying design criteria for maintaining rare plant habitat.

Alternatives A, B, D, E, F, and G would have similar beneficial effects in restoring whitebark pine habitat. Alternative C would have the least beneficial effect.

Effects from Roads and Trails Management: Roads or trail use, maintenance, and construction can contribute to the spread of noxious weeds, and increase areas to soil disturbance that may affect rare plant habitat.

Habitat areas of particular concern include calcareous rocky slopes and ridges and calcareous montane grasslands. Existing NFS roads pass through habitat of Fremont's bladder pod, Shoshone carrot, Hall's fescue, and Absaroka goldenweed. Increased use and subsequent maintenance may affect habitat.

Alternatives with more miles of road and trail construction have more potential to negatively affect rare plant habitat. Miles for motorized roads and trails are projected to increase in all action alternatives except alternative C, where miles decrease. The greatest increase would be in alternative F where road miles increase by 4 miles and motorized trail miles increase by 60 miles. Non-motorized trail miles are projected to remain constant across all alternatives. Though new construction, reconstruction, and maintenance activities associated with roads and trails can negatively affect rare plant habitat, the acres of land impacted by these activities would be small compared to total Forest acres, and any negative effects would be addressed by applying design criteria for maintaining rare plant habitat.

Effects from Disturbance Processes (fires/fuels management and insect/disease mortality): Timing of burns is an important factor to some rare plants. For example, the use of prescribed fire in the spring has potential impacts to some rare plants. In general, these plants are not adapted to fire at this time of year and spring burning can interfere with flowering, fruiting, and other physiological impacts; and could affect life history patterns with pollinators. However, those risks have to be weighed against the trade-offs in the event that prescribed burning could not take place at another time of year and, therefore, a higher risk occurs that an uncharacteristically intense wildfire occurs. In general, most plant species would benefit by restoring more historical fire regimes. For those rare plants that thrive in open areas created by fires, using fire to help restore a more natural fire regime could benefit those species in the long term. There are also impacts to plants associated with wildfire suppression activities, such as fire line construction and other mechanical activities, reforestation following fire, and the increased potential for the spread of noxious weeds.

Wild and prescribed fires can pose risks to rare plants in fen and riparian habitats, particularly when the fires are uncharacteristic. Rare plants at Swamp Lake Botanical Area and the potential Peatbeds Geological Area are particularity susceptible.

Prescribed and wildfire impacts to the calcareous montane grasslands, rocky slopes and ridges, and volcanic rocky slopes and montane shrublands habitats can and has led to the spread of cheatgrass and Dalmatian toadflax. Rare plant competition with invasive species may lead to population declines. Increased chemical control methods may also impact rare plants in these habitats.

Fire may have beneficial effects in restoring whitebark pine by removing spruce and fir and setting back successional stages.

All of the alternatives use fire as a tool to accomplish management goals and objectives. The alternatives have different management emphasis areas and as such, the use and emphasis of fire vary by alternative.

White pine blister rust is having an impact on whitebark pine. This disease is affecting large acreages of whitebark pine, and in conjunction with bark beetle epidemics, is killing large numbers of trees. This combined impact is accelerating the reduction of whitebark pine in some areas. Restoration activities for whitebark pine are included in all alternatives, but it will be many years until the scope and effectiveness reach the point where the trend can be reversed.

Alternatives that include more hazardous fuels reduction activity have more potential to negatively affect rare plant habitat. Acres of hazardous fuels reduction activity range from 35,000 acres in alternative C, where the potential impact is lowest, to 41,200 acres in alternative F, where the potential impact is highest. Alternatives A, B, and D are at the lower end of the range established by alternatives C and F. Though hazardous fuels reduction activity timber harvest can negatively affect rare plant habitat, the acres of timber harvest reduction activity is small compared to total forest acres and any negative effects would be addressed by applying design criteria for maintaining rare plant habitat.

All alternatives would have similar effects on the restoration of whitebark pine habitat.

Effects from Livestock Grazing and Big Game: Direct livestock or big game grazing effects are from herbivory and trampling. Indirect effects become detrimental to rare plants when grazing exceeds capacity and results in habitat decline from loss of ground cover, lowered ecological condition, or introduction of invasive species.

Fens and riparian habitat are resilient but can be altered by grazing beyond capacity. Trampling and introduction of invasive species such as Canada thistle are concerns in some fens containing rare plants. The Sawtooth Peatbeds potential special interest area is particularly susceptible to trampling. Exposed vegetation on peat is easily displaced and results in erosion of an irreplaceable resource.

Herbivory does not directly affect rare plants in the volcanic montane shrub habitat. Both sensitive species in this habitat are forbs that occupy rocky sites. Indirect effects become detrimental when grazing exceeds capacity and results in habitat decline from loss of ground cover, lowered ecological condition, or introduction of invasive species.

Several active grazing allotments contain calcareous montane grasslands habitat. Hall's fescue may decrease with heavy grazing pressure (Anderson 2006). Potential over utilization around water developments may affect habitat. Effects of grazing on Hall's fescue have not yet been studied on the Shoshone.

In alpine habitats, hoof action causing trampling and displacement of thin alpine soils potentially may have a negative effect on rare plant habitat. Increased animal unit months (AUMs) may lead to more incidental use of alpine habitat.

In considering the alternatives, alternatives E and F have more emphasis on active grazing management than the others, while alternative C has the least. Alternatives A, B, D, and G are similar in AUMs. In general, it is assumed that the greater number of AUMs, the greater the potential of impact on rare plant habitat.

Alternatives that include more commercial livestock grazing have more potential to negatively affect rare plant habitat. Commercial livestock grazing AUMs range from 31,309 AUMs in alternative C, where the potential impact is lowest, to 70,212 AUMs in alternative F, where the potential impact is highest, followed by alternative E with 67,057 AUMs. Alternatives A, B, D, and G would be the existing level of 55,881 AUMs.

Though livestock grazing can negatively affect rare plant habitat, negative effects may be addressed by applying design criteria for maintaining rare plant habitat.

Effects from Recreation: Recreational impacts can include trampling, both by hikers and off-road vehicle use. Road building and the development of campgrounds and other facilities used by recreationists also contribute to plant impacts, as these developments make more areas accessible and concentrate use. Dispersed camping and recreation have similar impacts, which are more difficult to monitor. Other recreational impacts include off-road vehicle use, which can also disturb soil, affecting both habitat and potential habitat. Roads and trails for recreational use can contribute to the spread of noxious weeds, and increase the accessibility of areas to disturbance. Recreational livestock use as well as native ungulates may have impacts relating to trampling and herbivory. Snow compaction by heavy snowmobile use has been shown to have negative effects on fen habitat.

Fens/riparian, calcareous montane grasslands, calcareous rocky slopes and ridges, volcanic rocky slopes/montane shrublands, granitic montane grasslands, alpine, and subalpine/krumholtz forests habitats to some degree have the potential to be effected by concentrated areas of recreational activities.

In general, it is assumed that the greater the motorized recreation use, the greater the potential impact on rare plant habitat. In considering the alternatives, alternatives E and F have more emphasis on summer motorized recreation, and alternatives C and D have the least use associated with motorized recreation. Alternative A, B and G fall in between the extremes.

Alternatives A and F have more emphasis on winter motorized recreation, and alternatives C, and D have the least use associated with motorized recreation. Alternative B, E and G falls in between the extremes.

Effects from Noxious and Invasive Species: Introduced invasive plant species can displace rare species through competitive displacement. Indirect impacts include herbicide spraying and mechanical ground disturbance to control noxious weeds once they gain a foothold. Competition from invasive non-native species and noxious weeds can result in the loss of habitat, loss of pollinators, and decreased rare plant species viability. Roads, trails, livestock, and canopy reduction can provide ideal pathways for introducing non-native species. Indirectly, herbicide spraying can destroy populations of native pollinators by contaminating nesting materials and pollen resources, further decreasing the viability and reproductive success of rare species.

Fens/riparian, calcareous montane grasslands, calcareous rocky slopes and ridges, volcanic rocky slopes/montane shrublands, and granitic montane grasslands rare plant habitats are most susceptible to noxious week invasion. Many vectors for potential spread may be linked to increased disturbance, which may come from fire, timber harvesting, recreation, wildlife, livestock, mineral development, and road and trail corridors.

Alternatives E and F, with their emphasis on active management, would be expected to have the greatest impacts on weeds, and at the other end of the spectrum, alternatives C and D would be expected to have the least impacts. Alternatives A, B, and G fall between those two extremes.

Effects from Mineral and Energy Development: Mining directly adjacent to wetlands, or within streams or flood plains that are connected to wetlands, can reduce water availability or flow, sedimentation, and/or pollution.

In considering the various alternatives, reasonably foreseen mining activities are low to very low and similar across alternatives. Consequently, effects to rare plant resources would be the same across alternatives.

Effects from Oil and Gas Development: Road construction and pad site disturbance associated with oil and gas development have the potential to remove rare plants and their habitat.

In considering the various alternatives, reasonably foreseen mining activities are low to very low and similar across alternatives. Consequently, effects to rare plant resources would be the same across alternatives.

Effects from Wilderness Recommendation for Designation: Wilderness designations generally increase the level of protection to rare plants and their habitat. Where trail construction, recreational livestock, and authorized special use permits may directly affect rare plants and their habitat, research natural areas in wilderness offer more protection options for rare plant habitat. The exception is for whitebark pine—wilderness limits beneficial management options for planting, thinning, and prescribed fire.

In considering the alternatives, alternatives C and D include the most recommended wilderness designation, which may lead to greater protection of rare plant habitat. Alternatives A, B, E, F, and G would not recommend increasing designated wilderness, which may lead to less potential protection for rare plant habitat. The opposite is true in the case of whitebark pine habitat restoration.

Effects from Research Natural Areas and Special Interest Area Allocation: Research natural area and special interest area designations generally increase the level of protection to rare plants and their habitat. The exception in special designation is in wilderness where trail construction, recreational livestock, and authorized special use permits may directly affect rare plants and their habitat. In research natural areas and special interest areas those activities may be limited, depending on their effect to rare plant habitat and other plant communities.

Rare plant habitat in calcareous montane grasslands, rocky slopes, and ridges would be most affected by alternatives A, B, E, and F. These alternatives do not include Bald Ridge and Pat O'Hara potential research natural areas. These two research natural areas are central to two of the three largest populations of *Shoshonea* in the world; all three are on the Shoshone. Alternatives that do not recognize Bald Ridge and Pat O'Hara research natural areas may increase the risk of eventual listing of some rare plants. These areas and the other potential research natural area / special interest areas are an essential and complementary component to conservation of rare plants on the Forest, the Greater Yellowstone Area, nationally, and globally.

In considering the alternatives, alternatives C, D and G place more emphasis on special area designation, which leads to greater protection of rare plant habitat. Alternatives A, E, and F would involve less designated areas and subsequently less protection for rare plant habitat. Alternative B does not include Pat O'Hara and Bald Ridge research natural areas and would not protect needed rare plant habitat for calcareous montane grasslands, rocky slopes, and ridges.

Determination and Rationale

The overall determination for most species in this plan is **"May adversely impact individuals but not likely to result in a loss of viability in the planning area nor cause a trend toward federal listing."** For whitebark pine, the determination is the same, but some management elements would have a **"Beneficial impact"** for the species across its range.

Fens/riparian habitat-related sensitive species

Implementation of any of the alternatives for this project, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing** for any of the sensitive plant species known to occur or likely to occur on Shoshone National Forest as described above. These species include: sphagnum moss, triangleglobe moonwort, roundleaf orchid, lesser panicled sedge, livid sedge, Chamisso's bristlegrass, slender bristlegrass, simple bog sedge, English sundew, Greenland primrose, sageleaf willow, myrtle leaf willow, and lesser bladderwort.

This determination is based on the recognition of known occurrences and/or suitable habitat for all the sensitive plant species within the Shoshone, and the possibility that these species could occur in future project areas and be affected by the actions associated with those projects. It also takes into account that site-specific pre-disturbance plant surveys will be implemented on areas that contain potential habitat for these species, and if any sensitive plant species are found, avoidance measures will be implemented unless the management action could improve habitat conditions for sensitive plant species without adversely affecting the viability of the affected sensitive plant species populations.

Calcareous rocky slopes and ridges habitat-related sensitive species

Implementation of any of the alternatives for this project, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listin**g for any of the sensitive plant species known to occur or likely to occur on Shoshone National Forest as described above. These species include: Shoshone carrot and Fremont's bladderpod.

This determination is based on the recognition of known occurrences and/or suitable habitat for all the sensitive plant species within the Shoshone, and the possibility that these species could occur in future project areas and be affected by the actions associated with those projects. It also takes into account that site-specific pre-disturbance plant surveys will be implemented in areas that contain potential habitat for these species. If any sensitive plant species are found, avoidance measures will be implemented unless the management action could improve habitat conditions for sensitive plant species without adversely affecting the viability of the affected sensitive plant species populations.

Calcareous montane grasslands habitat-related sensitive species

Implementation of any of the alternatives for this project, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing** for any of the sensitive plant species known to occur or likely to occur on Shoshone National Forest as described above. These species include: Hall's fescue and Absaroka goldenweed.

This determination is based on the recognition of known occurrences and/or suitable habitat for all the sensitive plant species within the Shoshone, and the possibility that these species could occur in future project areas and be affected by the actions associated with those projects. It also takes into account that site-specific pre-disturbance plant surveys will be implemented in areas that contain potential habitat for these species. If any sensitive plant species are found, avoidance measures will be implemented unless the management action could improve habitat conditions for sensitive plant species without adversely affecting the viability of the affected sensitive plant species populations.

Alpine habitat-related sensitive species

Implementation of any of the alternatives for this project, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing** for any of the sensitive plant species known to occur or likely to occur on Shoshone National Forest as described above. These species include: Kotzebue's grass of Parnassus, ice cold buttercup, and Barratt's willow.

This determination is based on the recognition of known occurrences and/or suitable habitat for all the sensitive plant species within the Shoshone, and the possibility that these species could occur in future project areas and be affected by the actions associated with those projects. It also takes into account that site-specific pre-disturbance plant surveys will be implemented in areas that contain potential habitat for these species. If any sensitive plant species are found, avoidance measures will be implemented unless the management action could improve habitat conditions for sensitive plant species without adversely affecting the viability of the affected sensitive plant species populations.

Volcanic rocky slopes and montane shrubland habitat-related sensitive species

Implementation of any of the alternatives for this project, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing** for any of the sensitive plant species known to occur or likely to occur on Shoshone National Forest as described above. These species include: North Fork Easter daisy, Wyoming tansymustard, and Absaroka Range beardtongue.

This determination is based on the recognition of known occurrences and/or suitable habitat for all the sensitive plant species within the Shoshone, and the possibility that these species could occur in future project areas and be affected by the actions associated with those projects. It also takes into account that site-specific pre-disturbance plant surveys will be implemented in areas that contain potential habitat for these species. If any sensitive plant species are found, avoidance measures will be implemented unless the management action could improve habitat conditions for sensitive plant species without adversely affecting the viability of the affected sensitive plant species populations.

Granitic montane grasslands habitat-related sensitive species

Implementation of any of the alternatives for this project, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing** for any of the sensitive plant species known to occur or likely to occur on Shoshone National Forest as described above. These species include: tranquil goldenweed and entire-leaf goldenweed.

This determination is based on the recognition of known occurrences and/or suitable habitat for all the sensitive plant species within the Shoshone, and the possibility that these species could occur in future project areas and be affected by the actions associated with those projects. It also takes into account that site-specific pre-disturbance plant surveys will be implemented in areas that contain potential habitat for these species. If any sensitive plant species are found, avoidance measures will be implemented unless the management action could improve habitat conditions for sensitive plant species without adversely affecting the viability of the affected sensitive plant species populations.

Subalpine forests and krumholtz habitat-related sensitive species

Implementation of any of the alternatives for this project, as described above, **may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing** for any of the sensitive plant species known to occur or likely to occur on Shoshone National Forest as described above. These species include: whitebark pine. Some management elements of habitat restoration will have a "**Beneficial impact**" for the species across its range, but the determination remains the same due to the potential loss of individual plants of whitebark pine in these projects.

This determination is based on the recognition of known occurrences and/or suitable habitat for all the sensitive plant species within the Shoshone National Forest, and the possibility that these species could occur in future project areas and be affected by the actions associated with those projects. It also takes into account that site-specific pre-disturbance plant surveys will be implemented in areas that contain potential habitat for these species. If any sensitive plant species are found, avoidance measures will be implemented unless the management action could improve habitat conditions for sensitive plant species without adversely affecting the viability of the affected sensitive plant species populations.

Summary of conservation measures for sensitive plant species

The Shoshone National Forest has been actively managing for sensitive and rare plant species for at least the past two decades. Work since the 1986 Forest Plan as amended implementation focused on a Forest-wide floristic inventory by the Rocky Mountain Herbarium and the establishment of research natural areas and special interest areas that would protect areas of important rare plant biodiversity. The floristic work was completed in 2011. The establishment of research natural areas and special interest areas are part of the current forest plan effort.

Future work needs to address:

- Mapping distributions of Region 2 sensitive and Forest plants of local concern.
- Inventory of bryophytes and fungi. Researchers are just starting to understand their environmental and taxonomic diversity.

The whitebark pine strategy for the Greater Yellowstone Area (GYCC 2011) provides guidance to land managers for conserving whitebark pine across the Greater Yellowstone Ecosystem.

Summary of Effects to Resource

Generally, the more disturbance, the greater the probability of an adverse effect to rare plant habitat. This effect is mitigated by rare plant surveys, pertinent project design features, and best management practices. The exception is whitebark pine, where an increase of disturbance by management may have a Forest- and range-wide beneficial effect.

Not designating Bald Ridge and Pat O'Hara potential research natural areas will have the greatest effect on protection of rare plant populations found in calcareous montane grasslands, rocky slopes, and ridges habitat.

Overall, potential effects to rare plants would be least under alternatives C, D, and G, and greatest under alternatives F and E, with alternatives A and B falling between.

Cumulative Effects

Past actions that have added elements of protection to rare plants and their habitat on the Shoshone include the designation of the Swamp Lake Botanical Special Interest Area and the Line Creek Research Natural Area. Forest plan management area standards and guidelines provide direction for management. In proposed connected actions, Sawtooth Peatbeds Geological Special Interest Area and Little Popo Agie Moraine Geological Special Interest Area, and eight potential research natural areas will provide protection to maintain high quality occurrences of Region 2 sensitive plant species over time. The combination of these proposed actions are important to preserve rare plant habitat for their contributions to biological diversity at Forest, Greater Yellowstone Area, Forest Service region, and national levels.

Climate change combined with wild and prescribed fire activity in volcanic rocky slopes/montane shrublands, calcareous montane grasslands, calcareous rocky slopes and ridges habitat in all alternatives may lead in the future to a type conversion to cheatgrass and other noxious weeds. This, in turn, may lead to a loss of Forest rare plants and their habitat, which increases the risk of future listing.

Climate change combined with increased livestock grazing in alpine grasslands and wetlands in alternatives E and F may lead to the loss of rare plants and their habitat, which increases the risk of future listing.

Prescribed and wild fire may potentially lead to a cumulative adverse effect on Fremont's bladderpod habitat. The effects are the same across all alternatives.

Research natural area and special interest area designations are important considerations in evaluating the status of rare plant species, as recognized by the Forest Service, USFWS, or State natural heritage programs. Research natural area and special interest area designations are among the regulatory mechanisms (factor D) considered in determining global and state ranks of rare plants. Establishment of research natural area and special interest areas can help avert threats to plant species conservation by supporting long-term viability of species by consistent management (factor A). They are a proactive approach to potentially keep rare plants from being considered under the Endangered Species Act.

Alternatives A, E, and F have the least research natural areas proposed. Alternative B does not include two potential research natural areas that are critical to rare plant conservation. Some rare plants may have an increased risk of being listed if potential research natural areas are not established. Alternatives C, D, and G include all eight potential research natural areas.

Disturbance Processes

Fire and Fuels Management

Introduction

Fire and fuels management is not a resource, but rather a representation of how the Shoshone National Forest will respond to unplanned fires and vegetation conditions that affect the biological and physical resources as well as the social and economic aspects of the Forest. Wildfires are unplanned, but expected to occur. Fire is a naturally occurring disturbance process that has a significant influence on the landscape. The type and condition of the vegetation has a direct relation to fuels that are available to burn during fire season and, subsequently, the fire behavior and extent or size of a wildfire. The response to wildfire is guided by wildland fire management policies and by the land management goals and objectives expressed in the forest plan. In some situations, we use fire to accomplish a resource objective and in others we respond in a manner designed to protect a resource or value. Vegetation is manipulated with mechanical and prescribed fire treatments to protect values or accomplish resource benefit objectives where wildfire is not feasible. The analysis for fire and fuels management will address how the proposed land management goals and objectives for the various resources affect wildfire and hazardous fuels management actions that are implemented to accomplish the desired conditions for the Shoshone.

Legal and Administrative Framework

Laws

These acts, along with other land use laws, executive orders, and policies guide fire and fuels management on NFS lands. Other laws pertinent to fire and fuels management of NFS lands can be found in Forest Service Manual (FSM) 5100.

Organic Administration Act – June 4, 1897 (U.S.C.551): Authorizes the Secretary of Agriculture to make provisions for the protection of national forests against destruction by fire.

Economy Act of 1932 – June 30, 1932 (41 U.S.C. 686): Provides for the procurement of materials, supplies, equipment, work, or services from other Federal agencies.

Reciprocal Fire Protection Act – May 27, 1955 (42 U.S.C. 1856): Authorizes reciprocal agreements with Federal, state, and other wildland fire protection organizations.

Wilderness Act – September 3, 1964 (16 U.S.C. 1131, 1132): Authorizes the Secretary of Agriculture to take such measures as may be necessary in the control of fire within designated wilderness.

National Forest Management Act of 1976 – October 22, 1976 (16 U.S.C. 1600): Directs the Secretary of Agriculture to specify guidelines for land management plans to ensure protection of forest resources.

Clean Air Act of 1977 (42 U.S.C. 1857): Provides for the protection and enhancement of the Nation’s air resources.

Healthy Forests Restoration Act – December 3, 2003 (16 U.S.C. 6501). This act improves the capability of the Secretary of Agriculture and the Secretary of Interior to conduct hazardous fuels reduction projects across the landscape on NFS lands and National Park Service agency lands.

Tribal Forest Protection Act – 2004 (P.L. 108). This act authorizes the Secretary of Agriculture (with respect to land under the jurisdiction of the Forest Service) to carry out a project to protect Indian forest land or rangeland (including a project to restore Federal land that borders on or is adjacent to such land) under the Secretary's jurisdiction and bordering or adjacent to the Indian forest land or rangeland under the Indian tribe's jurisdiction.

Federal Land Assistance, Management and Enhancement Act of 2009. Authorizes a supplemental funding source for catastrophic emergency wildland fire suppression activities on Department of the Interior and NFS lands and requires the Secretary of the Interior and the Secretary of Agriculture to develop a cohesive wildland fire management strategy.

Regulation and Policies

Key policies and guidance that have been developed in support of enacted laws include the following:

- The National Forest Directives System (manuals, handbooks and their current amendments) outlines the administrative framework for fire management activities, which includes protecting resources and other values from wildfire and using prescribed fire to meet land and resource management goals and objectives. The framework in these manuals and handbooks provides for cost-efficient wildfire protection and embraces the positive roles that fire plays on NFS lands. Specifically, fire management guidance can be found in Forest Service Manual 5100, chapters 10 through 90, and Forest Service Handbooks 5109.14, 5109.17, 5109.18, and their subsequent amendments.
- Review and Update of the 1995 Federal Wildland Fire Management Policy (2001)
- Guidance for Implementation of Federal Wildland Fire Management Policy (2008)
- Interagency Prescribed fire Planning and Implementation Procedures Guide (2008)
- A National Cohesive Wildland Fire Management Strategy (2011)

Other Agreements

Wyoming Interagency Cooperative Fire Management Agreement (2012) is the primary agreement by which the Shoshone cooperates with its interagency partners regarding all aspects fire management. Participants to the agreement include Federal and State agencies, counties, and local fire departments. Annual operating plans are developed at the local and dispatch zone levels that address specific aspects of fire management activities.

Resource Protection Measures

Specific standards and guidelines designed to avoid or mitigate the effects from fire and fuels management activities, as well as provide direction regarding the use and management of fire, are addressed in the forest plan or Forest Service manuals and handbooks.

Methodology

Data for fire regime condition class and represented fuel types for the Shoshone were obtained from LANDFIRE[19] (USDA et al. 2011). The data were reviewed and edited to account for changed conditions on the Shoshone that were not represented in the current data downloaded from LANDFIRE. The changes were primarily related to recent fires that were not yet mapped and areas affected by insects that were not represented in the fuels layer. Historical fire occurrence, size, and cause were extracted from the National Interagency Fire Management Integrated Database (NIFMID) for 1970 to 2011. Projections for acres burned by wildfire and acres of vegetation treatments for the planning period were based on what has burned and been treated for the past 10 years (2002 to 2011). Key assumptions made were that vegetation, fuel, and climate conditions present in the past 10 years were likely to persist the next 10 to 15 years and, subsequently, so would the occurrence of wildfire in frequency and size. Acres treated using mechanical and prescribed fire methods were obtained from the Shoshone's database record of accomplishments.

Spatial and Temporal Context for Effects Analysis

The analysis area for fire and fuels management is the Shoshone National Forest. The effects to fire and fuels management were predicted for the planning period of 10 to 15 years.

Affected Environment

Wildland fire

Wildland fire is a general term describing any non-structure fire that occurs in the wildland. Current policy identifies two types of wildland fire: wildfire and prescribed fire. A wildfire is an unplanned ignition caused by lightning, or unauthorized and accidental human-caused fires. Prescribed fire is a planned management-ignited fire intended to accomplish one or more objectives.

During the last century, the Shoshone's fire management program was focused on fire suppression, with efforts to keep fires as small as possible (table 82, table 83, and figure 22). An insect epidemic has affected over 1 million acres of the Shoshone. The insect-killed trees, combined with periods of drought and warmer and drier than average summers as well as typical continental summer weather conditions, have created an increasing trend in acreage burned since 1998 (table 83, figure 23, and map 19). Within the last decade, wildfire management efforts have focused more on management responses that balance suppression efforts against the values to be protected from the fire, as well as managing for resource benefits. Management responses on the Shoshone have ranged from monitoring fires, to full containment and control. Fires inside and outside wilderness areas have been managed for a combination of protection and resource benefit objectives.

Since 1970, the Shoshone has averaged 27 wildfires annually, averaging 49 percent from natural ignition, 32 percent from escaped campfires, and 19 percent from other causes. Lightning-caused fires account for over 90 percent of the acres burned (NIFMID 2011).

[19] LANDFIRE (Landscape Fire and Resource Management Planning Tools) is interagency vegetation, fire, and fuel characteristics mapping program, sponsored by the United States Department of the Interior and the United States Department of Agriculture, Forest Service.

Table 82. Annual number of wildfires in Shoshone National Forest, 1970 through 2011

Size class	Size in acres	Number of fires
A	0 to 0.25	787
B	0.25 to 9.9	177
C	10 to 99.9	39
D	100 to 299.9	9
E	300 to 999.9	8
F	1,000 to 4999.9	13
G	> 5,000	9

The use of unplanned wildland fire to accomplish resource benefit objectives has become a major component of the wildland fire acres burned. Resource objectives identified in the 1986 Forest Plan as amended that can be accomplished using wildland fire included hazardous fuels reduction, wildlife habitat improvement, natural processes in wilderness, and other vegetation management. In 2008, the Gunbarrel Fire (approximately 68,000 acres) was managed for a combination of resource benefit and protection objectives, and more recently, in 2011, the Norton Point Fire (approximately 24,000 acres) was managed for multiple objectives as well. By increasing the opportunity for using fire as a natural process, a mosaic of burned and unburned areas will occur, producing a more natural patchwork of vegetation. In the last 10 years, nearly 183,000 acres of the Shoshone have burned because of wildfire; most of these acres were in designated wilderness. A similar amount of fire is anticipated on the Shoshone over the next 10 to 15 years, but the distribution of those fires could change. More acres outside wilderness areas are likely to burn. Several thousand acres associated with the Gunbarrel Fire burned outside wilderness.

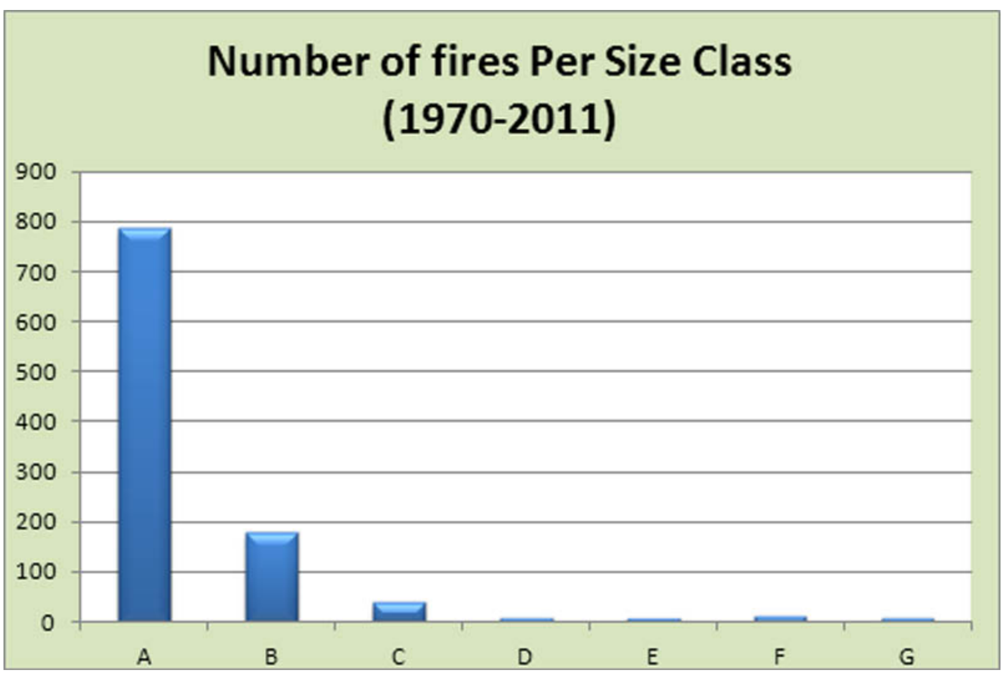


Figure 22. Number of fires in Shoshone National Forest by size, 1970 through 2011

Table 83. Annual acreage burned in Shoshone National Forest, 1970 through 2011

Year	Acres		Year	Acres		Year	Acres		Year	Acres
1970	1,358		1981	83		1992	33		2003	26,079
1971	55		1982	3		1993	3		2004	2
1972	2		1983	135		1994	10		2005	15
1973	90		1984	10		1995	104		2006	40,489
1974	189		1985	118		1996	1,935		2007	5,700
1975	467		1986	15		1997	1		2008	68,274
1976	1,992		1987	7		1998	3		2009	332
1977	15		1988	197,228		1999	190		2010	381
1978	54		1989	5		2000	1,725		2011	27,596
1979	1,204		1990	5		2001	5,416			
1980	236		1991	12		2002	13,451			

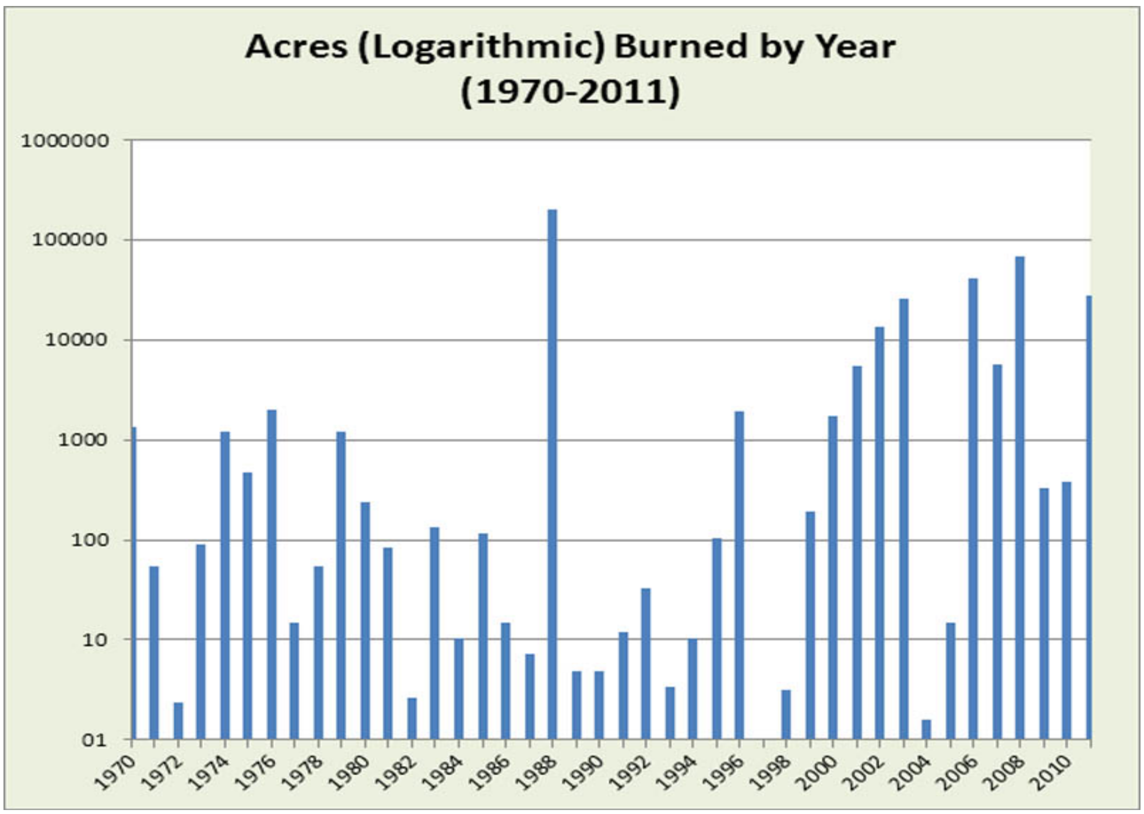


Figure 23. Annual acres burned in Shoshone National Forest (logarithmic scale), 1970 through 2011

Response to wildfire

The type and level of response to a wildfire is based on the land management goals and objectives. The land management goals and objectives for a given management area may be orientated toward protecting values at risk or using fire to accomplish a resource objective, or in some situations, a combination of both. In addition to the land management goals and objectives, the response to a wildfire is also guided by considering firefighter and public safety, costs, and other factors. All unplanned ignitions receive an appropriate management response. The appropriate management response concept provides managers with increased flexibility to implement a response based on an individual set of circumstances and conditions to use a full range of responses. The amended 1986 Forest Plan as amended allows the application of any management response on a Forest-wide basis, giving fire managers the latitude to choose from the full spectrum of response options to implement the best actions given a set of circumstances.

Appropriate management response has been, and would continue to be, applied at all levels when managing a fire for resource benefit and/or protection objectives, including initial attack.[20] In some situations, the management response would be an action that managers may take, and in others, it would be an action managers must take, depending on the circumstances in which a fire occurs and the preplanned objectives for an area. Examples of options managers may choose include:

- Monitoring from a distance
- Monitoring on-site
- Confinement
- Monitoring with limited contingency actions
- Monitoring with mitigation actions
- Initial attack
- Suppression with multiple strategies
- Control and extinguish
- Any combination of some or all of the above as well as other options

For all unwanted wildland fire (wildfire), the overarching goal of suppression would be applied in every case. The initial suppression action (initial attack) would usually focus on prompt and decisive control of the fire commensurate with public and firefighter safety and cost effectiveness. If initial or subsequent actions fail, control objectives may be modified and the tactical options that comprise the appropriate management response may change. As described above, the range of responses could include monitoring, or aggressive suppression actions, or some combination. Resource values to protect, expected fire behavior, availability of resources, probability of success, and firefighter and public safety are some of the factors that would be used to determine the appropriate management response.

The 1986 Forest Plan as amended was amended in June 2008 (amendment 2008-01) to allow wildland fire from unplanned ignitions[21] to be managed to accomplish resource benefits anywhere on the Shoshone when and where conditions are appropriate. Previously, use of wildfire to accomplish resource objectives was allowed only in designated wilderness areas on the Shoshone. In addition, management response options to wildfires were expanded Forest-wide to include the full range of options from monitoring to intensive suppression actions. Forest-wide and management area direction, standards, and guidelines that were redundant, process oriented, or no longer needed were removed or modified. The desired condition (goal) statement, general

[20] Initial attack is a planned response to a wildfire given the wildfire's potential fire behavior. The objective of initial attack is to stop the spread of the fire and put it out at least cost. It is an aggressive suppression action consistent with firefighter and public safety and values to be protected.
[21] An unplanned ignition is the initiation of a wildland fire by lightning, volcanoes, or unauthorized and accidental human-caused fires. Wildland fire is a general term describing any non-structure fire that occurs in the wildland.

direction, standards, and guidelines regarding fire management activities and related resource protection measures were added as part of the amendment.

The Shoshone has a significant amount of area where wildfire may be used to accomplish resource management objectives. Areas where values present have protection objectives are also contained within the Forest boundary. These areas include lands suitable for timber production, developed recreation sites and facilities, Forest administrative sites, utility corridors, communication sites, and permitted recreation residences and resorts. Private property and structures are adjacent to the Shoshone boundaries. Wildland-urban interface areas [22] have been identified in Community Wildfire Protection Plans for Fremont, Hot Springs, and Park County (see map 20). Within the identified wildland-urban interface areas, many of the previously mentioned values are found on the Shoshone, as well as adjacent private lands. Most of the wildland-urban interface areas are associated with areas in Fremont and Park Counties. Community Wildfire Protection Plans are periodically updated and the identified wildland-urban interface areas are likely to change as additional structures are built on private lands near the Shoshone.

Fire regimes

In ecosystems where periodic fire has historically played a role in maintaining vegetation structure and composition, fire exclusion has resulted in vegetation changes and allowed fuels to develop to unprecedented levels in many areas of the country, including some areas on the Shoshone. The departure of fire from its historic role contributes to ecosystem health and fire management problems. Symptoms of these problems include the development of unnaturally dense vegetation at broad scales and a heightened susceptibility to wildfires that are often uncharacteristically large, sometimes destructive, and costly to control.

By focusing on assessing resilience to fire disturbance, we will be able to adjust management actions to restore lands to a more healthy fire frequency and intensity.

Natural fire regimes are classified based on the role fire would play across a landscape in the absence of human intervention, but includes the possible influence of aboriginal fire use. Five natural fire groups are classified according to fire frequency (the average number of years between fires). The fire frequency is combined with characteristic fire severity that reflects the replacement of dominant overstory vegetation. The fire regimes are defined in table 84.

[22] In applying Title I of the Healthy Forest Restoration Act, wildland-urban interface is defined as an area within or adjacent to at-risk community identified in a Community Wildfire Protection Plan (CWPP). In the case where a CWPP is not in effect, wildland-urban interface may be defined as in an area 0.5 to 1.5 miles from the boundary, depending upon the potential threat from adjacent fuels, terrain, or fire regime condition class (USDA, USDI 2004).

Table 84. Fire regime groups and description

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

Fire regime condition class is used to measure ecological integrity and/or departure from reference conditions (NIFTT 2010). A stand is within fire regime condition class 1 when vegetation characteristics, fuel composition, and fire frequency, severity, and pattern are maintained within historical bounds for the fire regime. It is most relevant to measure long-term trends rather than annual changes.

At broad scales, 14 percent of the Shoshone's acres are in fire regime condition class 1. Approximately 63 percent of the Forest is in condition class 2. In general, the Forest has a considerable amount of vegetated acres in the late seral successional classes and a growing number of acres in the early seral successional classes; however, there is an absence of fire regimes that are in the mid-seral condition which is indicated by the large percentage of condition class 2. A summary of the number of acres by fire regime condition class is displayed in table 85.

Table 85. Fire regime condition class acres on the Shoshone National Forest

Fire regime	Condition class	Fire return interval	Burn severity	Acres	Percentage of the Forest
III	1	35 -200 years	Mixed	55,445	2.3%
	2			586,340	24.0%
	3			8,560	0.4%
IV	1	35- 200years	Stand-replacement	197,150	8.1%
	2			803,852	33.0%
	3			19,729	0.8%
V	1	200 + years	Stand-replacement	86,582	3.6%
	2			387,584	15.9%
	3			10,058	0.4%
Non-Classified	None	None	None	282,850	11.6%

Vegetation community types are associated with the various fire regime groups. Desired conditions and objectives for fire regime condition classes overlap with those described for the vegetation communities. Table 86 displays the relationship of the vegetation communities to fire regimes.

Table 86. Fire regimes and associated vegetation communities

Fire regime	Elevations	Associated vegetation community types
II	Low	Grasslands Sagebrush
	Middle	Grasslands Sagebrush
III	Low	Grasslands Sagebrush
	Middle	Grasslands Sagebrush Willow Douglas-fir lodgepole pine, spruce/fir, aspen
IV	Low	Willowriparian areas, sagebrush
	Middle	Willowriparian areas, lodgepole pine, spruce/fir, aspen
V	Middle	Lodgepole pine, spruce/fir, aspen
	High	Willow whitebark pine, spruce/fir, alpine

Over 102,000 acres have burned in the last 5 years, and 183,000 acres over the past 10 years on the Shoshone. In the past 10 years, an additional 44,300 acres have been treated using prescribed fire and/or received mechanical treatments that affected the fire regime condition class. The Gunbarrel Fire (2008) and the Norton Point Fire (2011) were managed for multiple objectives and, as a result, fire regime condition class was improved and hazardous fuels were reduced on approximately 68,000 and 24,000 acres, respectively. Since 2006, the Shoshone has managed several fires that have accomplished resource benefit objectives on an estimated 125,000 acres.

Hazardous fuels

Hazardous fuel conditions are present throughout much of the Shoshone (see table 87 and map 68). Some conditions are a result of fire exclusion and have resulted in changes in vegetation type and structure, such as sagebrush-grasslands being overgrown with juniper and other conifers, or aspen stands now dominated by conifers. Middle-elevation conifer stands have become mature and are homogeneous on a broad scale. They lack diversity in age or size classes and are more prone to large-scale, high-severity, stand-replacement wildfires rather than mixed severity. The natural fuel conditions of the mature spruce/fir forest and high-elevation subalpine forests are typically considered to be in a state of high hazard. Hazardous fuel conditions are also being augmented by an insect outbreak that has resulted in tree mortality on hundreds of thousands of acres.

Currently, the Shoshone is experiencing a beetle epidemic composed of Douglas-fir beetles, spruce beetles, western balsam bark beetles, and mountain pine beetles. Reconnaissance flights since 1999 have mapped approximately 1 million acres of infestation. These beetles kill trees by boring under the bark, girdling the trees, and introducing blue stain fungus. First, an increase in canopy fuels (dead needles) perpetuates crown fires, then, as the needles drop, the probability of crown fire decreases slightly and surface fire intensity increases as dead material accumulates. Observed fire behavior on the Shoshone over the past several years indicates that forest types in the gray stage (needles dropped) are highly susceptible to extreme fire behavior and very resistant to control actions when attempted.

High-fuel levels result in uncharacteristically high fire intensities and sizes that can cause undesirable resource impacts, making it difficult to manage wildland fires and more difficult to use prescribed fire safely as a management tool. Residential development is increasing on private lands adjacent to NFS lands, which increases the values to be protected from high fuel levels and wildland fire. Prescribed burns require extra planning and personnel during implementation to ensure infrastructure in adjacent developments is protected.

Table 87. Hazardous fuel conditions on the Shoshone National Forest

Hazard fuel rating*	Acres	Percentage of total burnable acres on the Forest
None (non-burnable)	570,021	NA
Low (flame length 0 to 4 feet)	696,189	37%
Moderate (flame length 4 to 8 feet)	345,500	18%
High (flame length 8+ feet)	826,440	44%

* Hazard fuel rating was based on potential flame lengths using Scott and Burgan 40 Fire Behavior Models. Data were obtained from LANDFIRE and FlamMap software was used to estimate flame lengths to determine the hazard rating (Low = 0 to 4 feet; Moderate = 4 to 8 feet; High = 8+ feet).

Another consequence of the increase in hazardous fuels conditions is the cost associated with fire suppression. While there have been only nominal increases in the average suppression costs per acre over the past several years, total fire suppression costs have increased substantially because of the increase in the number of acres burned each year. Protection of wildland-urban interface areas[23] is also contributing significantly to fire suppression costs. Impacts to communities are also increasing. Communities responsible for protecting private property are incurring additional economic costs from larger and more intense fires. And, a reduction in visitors to the area can lead to economic impacts to local communities.

In 1998, the Shoshone's prescribed fire program increased as part of the overall fire management program. With the 2000 National Fire Plan, funding increased to facilitate increases in staffing and equipment to further support the fire program. During the fall of 2002, the Shoshone engaged in a Forest-wide vegetation analysis, resulting in an integrated vegetation management program that included the use of prescribed fire and mechanical treatments to accomplish objectives. The 2003 Healthy Forests Initiative and Healthy Forests Restoration Act combined to provide the tools, funding, and expectation to begin treating hazardous fuels and improving fire regime condition class. More recently, the Forest Service Rocky Mountain Region has emphasized mitigating the effects of hazardous fuels and trees resulting from the bark beetle epidemic. The Shoshone has benefited from additional funding to reduce the associated hazards in priority locations.

The Shoshone hazardous fuel treatment strategy is composed of two parts. The first part is focused on planning and implementing projects in what would be considered the actively managed portions of the Shoshone, which includes urban interface areas, Forest Service developments and facilities, and suitable timber lands. Many of these projects have been integrated with timber and wildlife management objectives and are accomplished with a mix of mechanical and prescribed fire treatments. Priority locations include areas that have been identified in community wildfire protection plans for Fremont and Park counties. National Environmental Policy Act decisions have been completed for nearly all the projects that include priority areas identified in the community wildfire protection plans. Project implementation is

[23] Wildland-urban interface is the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetation fuels.

approximately 50 percent complete, with most of the remaining mechanical treatments on the Wind River and Washakie Ranger Districts.

The second part of the Shoshone's fuels treatment strategy has been to use lightning-ignited wildfires to accomplish fuels reduction on a landscape scale. In the priority areas where hazardous fuels treatments have been completed, we are afforded more opportunities to manage adjacent wildfires on a landscape scale to accomplish resource benefit objectives, which includes reducing hazardous fuels. As described earlier, we have been successful in managing wildfire for resource benefits to treat 125,000 acres of hazardous fuels since 2006. These fires have primarily occurred in wilderness and back country areas.

Over the past 10 years, nearly 57,000 acres have been treated by prescribed fire or mechanical treatments (figure 24) with an additional 183,000 acres of wildfire that have effectively reduced the accumulation of fuels and changed the resulting fire behavior in the future. The long-term fuels management for the Shoshone is to average approximately 6,000 acres per year from prescribed fire and mechanical treatments in the actively managed portions of the Shoshone, with an additional 180,000 acres or more expected from wildfire and prescribed fire being applied on a landscape scale over the next 10 years.

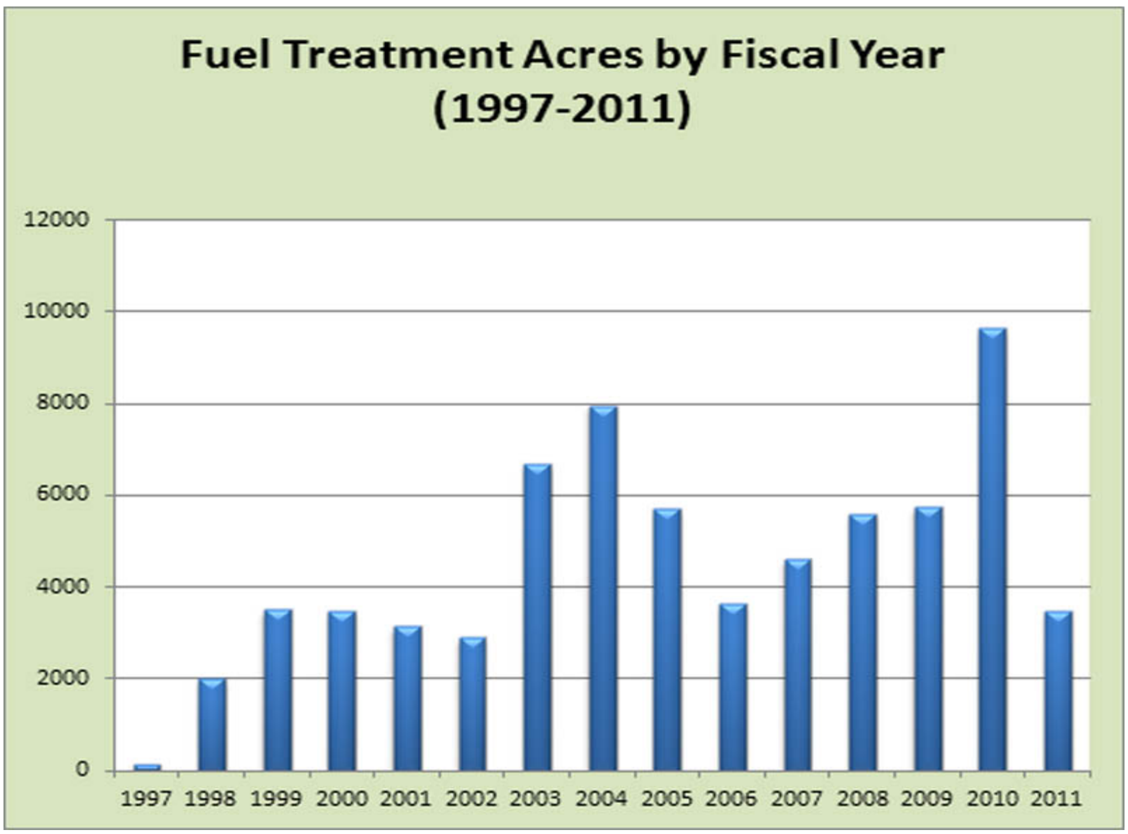


Figure 24. Acres of hazardous fuels reduction from mechanical and prescribed fire treatments, 1997 to 2011

The climate change report for the Forest predicts an increase in annual temperatures. The report also predicts a potential, but highly variable and uncertain, precipitation increase for the Greater Yellowstone Area for the long term beyond the planning period (Rice et al. 2012).

Desired Condition

Wildland fire plays a role in maintaining healthy, resilient ecosystems, as appropriate, for the vegetation type and management objectives. Fire disturbance contributes to vegetation diversity across the landscape. Stand-replacement fires reestablish seedling/sapling structural stages. Lower intensity fires contribute to intra-stand diversity by creating or maintaining vegetation patch size and density. Fire disturbances generally range in size from a few hundred to thousands of acres. Fire's natural role is reduced and occurs at smaller scales in areas where existing resource values and infrastructure limit the desirability of large-scale fires.

Hazardous fuel conditions have declined. Within the wildland-urban interface, the forest understory is discontinuous and relatively free of ladder fuels (trees and/or brush), trees are generally spaced to create open discontinuous canopies, and deciduous species are present where conditions are favorable. In areas that receive more frequent management actions, hazardous fuel conditions are lower and stands are younger and more diverse. In these areas, lower fuel levels and greater stand diversity provide more opportunities for controlling unwanted wildfire. In the remaining areas, vegetation and hazardous fuel conditions vary across the landscape, providing fewer opportunities for controlling wildfire when desired.

Environmental Consequences

Wildfire

Fire exclusion during the last century contributed to the presence of continuous areas of homogeneous forested cover types that are in older age classes and susceptible to insect and disease epidemics on a large scale. The Shoshone has over 1 million acres of represented forest types that have been affected by a series of insect attacks during the past 10 years. As a result, the Shoshone has large continuous areas of forest composed of dead trees that provide receptive fuels for ignition and growth of wildfires. When fire danger is high, large stand-replacement fires in any given season are possible. Stand-replacement fires (over 300 acres) have been occurring frequently over the past 10 years. Large fires have occurred during periods of that were characterized as being abnormally warm and dry, as well as during summers with typical continental weather patterns that were preceded by wet springs with above normal precipitation. Currently, the primary factor influencing the large fire growth can be attributed the extensive amount of dead and down fuel that readily burns when a fire danger rating[24] of high or greater is present.

Wildfire is expected to continue to be a significant influence on the landscape for the next 10 to 15 years. Despite the number of large fires and acres burned during the past 10 years, there are still extensive continuous forested areas that contain high loadings of dead and down fuel that are conducive to sustaining large fire growth. For all alternatives it is expected that approximately 90 percent of the wildfire acres burned would occur in forest cover types. This estimate is based on observations of fires on the Shoshone. The grassland and sagebrush cover types do not become significant carriers of fire until late August. Fuel conditions on the Shoshone are conducive to prolific spotting at short and long ranges and fires often skip over barren or "green" cover types such as grass and sagebrush during the early and middle portions of the fire season.

[24] Fire danger ratings for the Forest have been established based on an analysis of historical fuel condition, weather and fire occurrence (CIDC 2012). Fire danger rating levels are: low, moderate, high, very high, and extreme.

The estimated acres that could burn as a result of wildfire for alternatives A through D and G range between 182,900 and 185,200 acres. For alternatives E and F, the number of acres allocated to wilderness and back country management decreases and the management areas allocated toward active management increases. Since there would be emphasis on protecting timber values in management area category 5, there would likely be an increase in the use of suppression responses to manage fires and thus, less acres would be expected to burn from wildfires. It is estimated that for alternative E nearly 175,000 acres could be affected by wildfire and approximately 161,400 acres could burn under alternative F during the planning period. Table 88 displays a summary of the estimated acres that could burn from wildfire for each alternative.

Table 88. Projected acres that could experience wildfire by alternative

Alternative	Wildfire acres
A	185,200
B	182,900
C	184,100
D	184,000
E	175,000
F	161,400
G	182,900

Response to Wildfire

The full range of management response options would be available for all alternatives and could include monitoring or aggressive suppression actions, or some combination of different responses. All alternatives include management areas that allow for the use of wildfire to accomplish resource benefit objectives as well as management areas where the emphasis is to protect values. Wilderness and back country management areas (Categories 1, 2, and 3) offer the most opportunity to use wildfire to accomplish resource objectives, whereas the active management areas (Categories 4, 5, and 8) have more areas where protection of values is the primary objective. Alternatives A through D and G have similar amounts of land allocated to the wilderness and back country management areas and similar amounts allocated to the management areas where the primary objective is to protect values. Given that alternatives A through D and G have more acres where wildfires could be managed to accomplish resource benefit objectives, it is likely there would be more instances where monitoring and less aggressive actions would be implemented.

Alternatives E and F contain more acres of land suitable for timber production where protection objectives would be considered and more aggressive responses would be used more frequently. The presence of other values on the Shoshone that warrant a response to meet protection objectives remains constant for all the alternatives. These values include wildland-urban interface areas composed of permitted recreation residences and resorts, developed recreation sites and facilities, administrative sites, utilities, and tourism. Areas of wildland-urban interface composed of private property with structures are adjacent to some areas of the Forest. These areas also influence the response to a wildfire, but the presence is independent of all the alternatives and is expected to increase in the future.

The safety and welfare of firefighters and the public will be the overriding factor that influences the response to wildfires for all alternatives. There have been and will continue to be situations where response to a wildfire is based exclusively on the ability of firefighters to safely engage and manage a fire while also ensuring the safety of the public. In these situations, the desired land management resource benefit or protection objectives may not be met.

Cost of Managing Wildfires

Table 89 displays the estimated cost of managing wildfires for each alternative. The per acre cost of $212 ($207 for wildfire management and $5 for post-fire rehabilitation) used was based on actual cost for wildfires that occurred on the Shoshone National Forest from 2008 through 2012. Seven large fires that ranged in size from 214 to 68,148 acres were used to the derive costs. These fires were managed for protection and/or resource benefits objectives and management responses ranged from monitoring, partial suppression, point protection, and full suppression. The season of 2008 was selected as the starting year because it is the same year that the 1986 Forest Plan as amended was amended to allow the management of wildfires outside of wilderness as well as providing managers with the full range of response options for managing wildfire. The revised plan would continue with the same management direction that is currently in the amended plan. Based on the similarity in management direction, it was determined that the costs associated with managing large fires on the Forest would be representative of future costs for the next 10 to 15 years.

Table 89. Estimated wildfire management cost (2013 dollars)

Alternative	Wildfire acres	Wildfire management cost	Post-fire rehabilitation cost	Total Cost
A	185,200	$38,254,299	$884,763	$39,139,062
B	182,900	$37,779,218	$873,775	$38,652,994
C	184,100	$38,027,086	$879,508	$38,906,594
D	184,000	$38,006,431	$879,030	$38,885,461
E	175,000	$36,147,421	$836,034	$36,983,455
F	161,400	$33,338,250	$771,062	$34,109,312
G	182,900	$37,779,218	$873,775	$38,652,994

The level of response to wildfires will also influence the cost of managing wildfires. Generally, average per acre costs associated with large fires increase with the amount of aggressive suppression actions being taken. Aggressive suppression actions are taken to meet objectives associated with protecting values associated with wildland-urban interface, forest developments and facilities, utility corridors, special areas, wildlife habitats, cultural resources, and land suitable for timber production. Values to be protected are relatively constant across all alternatives except for alternatives E and F, where the acres that could be managed for timber production and other commodities increase substantially. As previously noted, use of more aggressive suppression actions are likely with alternatives E and F to meet protection objectives and, subsequently, the overall wildfire management costs could be higher than the table represents. In addition, the dollar savings received from managing fires that accomplish resource benefits on a landscape are not accounted for.

There are likely to be situations under all alternatives where the estimated costs associated with managing a fire would be prohibitive and it may not be possible to meet all desired resource protection or benefit objectives.

Fire Regime Condition Class

The Shoshone has an overabundance of fire regime condition class 2. The desired condition is to have more of the Forest in condition class 1 through either maintenance of areas that are currently in condition class 1 or conversion of areas that are in condition classes 2 and 3. All alternatives would contribute to improving fire regime condition class through the use of wildfire on a landscape scale and through the use of mechanical and prescribed fire treatments. Table 90 displays a summary of the anticipated acres affected for each alternative.

Alternatives A through D and G would affect the condition class on a range of acres between 218,700 and 221,300. The distribution of acres affected from management vegetation treatments (mechanical and prescribed fire) and wildfire are similar among alternatives A through D and G. Approximately 16 percent of the total would be affected through the use of prescribed fire and/or mechanical treatments. The remaining 84 percent of the total acres affected would be from wildfires.

Alternatives E and F would affect fire regime condition class on 212,400 and 201,100 acres, respectively. The distribution of acres affected by management vegetation treatments (mechanical and prescribed fire) and wildfire are similar between alternatives E and F; however, the distribution of acres between mechanical and prescribed fire changes as compared to alternatives A through D and G. Under alternatives E and F, more acres would be treated using mechanical or a combination of mechanical and prescribed fire than there would be for just using prescribed fire. This difference is attributed to the increase in acres that are suitable for timber production associated with alternatives E and F. The increase in land designated as suitable for timber production would result in more acres being treated using a preferred combination of mechanical and prescribed fire to meet timber production objectives and fewer acres being treated with prescribed fire only.

Table 90. Acres of fire regime condition class improved or maintained as a result of vegetation management and wildfire

Alternative	Mechanical only	Mechanical with prescribed fire	Prescribed fire only	Total mechanical and prescribed fire treatments	Wildfire acres	Total affected acres
A	5,700	9,770	20,700	**36,100**	185,200	**221,300**
B	5,730	9,640	20,400	**35,800**	182,900	**218,700**
C	5,570	8,900	20,500	**35,000**	184,100	**219,100**
D	5,670	9,390	20,500	**35,600**	183,700	**219,300**
E	6,260	11,600	19,500	**37,400**	175,000	**212,400**
F	7,090	14,600	18,000	**41,200**	161,400	**201,100**
G	5,730	9,640	20,400	**35,800**	182,900	**218,700**

Hazardous Fuels

Hazardous fuels conditions at the moderate to high level are prevalent in forest cover type across the Shoshone. In many of the forest types, this is consistent with the associated fire regimes (III, IV, and V) that have a low frequency of fire occurrence, but burn at a mixed or stand-replacement severity. Fire exclusion has resulted in large continuous areas of older age classes rather than patches of different age classes over the landscape. The typical hazardous fuel conditions have been exacerbated by a Forest-wide insect epidemic, which has increased the potential for large fire growth and extreme fire behavior. In most areas of the Shoshone, the problem with the condition of vegetation associated with fire regimes III, IV, V is primarily one of ecological restoration in management area categories 1, 2, and 3. In management area categories 4, 5, and 8, the hazardous fuels problem is a combination of restoration and threat to values that can be damaged or lost as a result of wildfire.

All alternatives would contribute to reducing hazardous fuels from vegetation treatments and wildfire. In general, the moderate to high hazardous fuels conditions found on the Shoshone are closely correlated forested cover types as well as fire regime condition classes in many instances. General observations of fire behavior on the Shoshone indicate that most of the large fire growth occurs in the forested cover types and that the grassland and sagebrush cover types do not become significant carriers of fire until later parts of the fire season (late August and September). Given this relationship, it is assumed that 90 percent of the acres burned will be in a moderate to high hazard condition. Mechanical and prescribed fire treatments are expected to be targeted specifically in areas where hazardous fuels conditions are a concern.

Alternatives A through D and G would affect hazardous fuels on a range of acres between 200,400 and 202,800. The distribution of acres affected from management vegetation treatments (mechanical and prescribed fire) and wildfire are similar among alternatives A through D and G. Approximately 18 percent of the total would be affected through the use of prescribed fire and/or mechanical treatments. The remaining 82 percent of the total acres affected would be from wildfires.

Alternatives E and F would affect hazardous fuels on 194,900 and 184,900 acres, respectively. The distribution of acres affected from management vegetation treatments (mechanical and prescribed fire) and wildfire are similar between alternatives E and F; however, the distribution of acres between mechanical and prescribed fire changes as compared to alternatives A through D and G. Under alternatives E and F, more acres would be treated using mechanical or a combination of mechanical and prescribed fire than there would be for just using prescribed fire. This difference is attributed to the increase in acres that are suitable for timber production associated with alternatives E and F. The increase in land designated as suitable for timber production would result in more acres being treated using a preferred combination of mechanical and prescribed fire to meet timber production objectives and fewer acres being treated with prescribed fire only.

Table 91 illustrates the estimated acres of hazardous fuels that would be reduced as a result of vegetation treatments and wildfire.

Table 91. Acres of hazardous fuels reduced as a result of vegetation management and wildfire

Alternative	Mechanical only	Mechanical with prescribed fire	Prescribed fire only	Total mechanical and prescribed fire treatments	Wildfire acres	Total affected acres
A	5,700	9,770	20,650	**36,100**	166,600	202,800
B	5,730	9,650	20,400	**35,800**	164,600	200,400
C	5,570	8,900	20,540	**35,000**	165,700	200,700
D	5,670	9,390	20,490	**35,600**	165,300	200,900
E	6,260	11,650	19,520	**37,400**	157,500	194,900
F	7,090	14,630	18,000	**41,200**	145,200	184,900
G	5,730	9,650	20,400	**35,800**	164,600	200,400

Direct and Indirect Effects

For each of the resource program areas described below, the environmental consequences for fire and fuels management are compared by alternative, based on key indicators of disturbance for each type of activity. In general, the effects on fire and fuel management vary based on the goals and objectives; standards and guidelines; and actions associated with specific resources as well as the management area allocations. Wildfire occurrence and acres burned; response to wildfire including options likely to be used, exposure of firefighters and costs; fire regime condition class; and hazardous fuels are aspects of fire and fuels management that can be affected by other resource management actions. Each of the resources listed below are evaluated for the effects on these aspects of fire and fuels management. Effects on fire regime condition class and hazardous fuels are quantified. Effects on the type of response to wildfire likely to be implemented, firefighter safety, cost, and changes in frequency of human-caused wildfire are described based on the relative change to the existing condition and management direction, which is represented by alternative A.

Effects from Timber Harvesting: Acres of fire regime condition class maintained and improved and hazardous fuels reduced as a result of timber harvest are similar for alternatives A through D and G (table 92). The use of mechanical vegetation treatments would have a similar affect as a wildfire from the standpoint of disturbance mechanism. Acres treated range between 6,030 and 7,080 for these alternatives. Affected fire regime condition class acres and hazardous fuels for alternatives E and F would be 8,510 and 12,220, respectively, and are a result of the increase in commodity production objectives associated with the two alternatives.

Table 92. Acres of fire regime condition class maintained or improved and hazardous fuels reduced as a result of timber harvest

Indicators	Alternative						
	A	B	C	D	E	F	G
Acres of FRCC maintained or improved	7,080	6,880	6,030	6,600	8,510	12,220	6,880
Acres of hazardous fuels reduced	7,080	6,880	6,030	6,600	8,510	12,220	6,880

For all alternatives, timber harvesting would reduce hazardous fuel loadings on harvested acres, and subsequently, resistance to control would be lowered. In some wildfire situations, it would allow fire managers to respond with less aggressive options which have the benefit of less exposure and risk to firefighters to meet land management objectives. The probability of successfully meeting protection objectives increases while also reducing cost. Recent fire history[25] on the Shoshone provides evidence of this occurring (Weldon et al. 2008).

Given the similarity in timber harvest acres associated with alternatives A through D and G, there would not be any differences or change from the existing response options likely to be used for a wildfire. The same mix of aggressive and less aggressive options would continue. The exposure and risk to firefighters as well as wildfire management cost would not change from existing levels for alternatives A through D and G.

The types of wildfire response options implemented could change with alternatives E and F. Since the amount of timber harvest acres increase, the associated benefits are likely to increase. The beneficial changes in wildfire response options, exposure and risk to firefighters, and cost would be slight for alternative E and somewhat greater for alternative F.

The frequency of human-caused wildfire would not change with alternatives A through D and G. Due to the increased use and presence of mechanical equipment associated with timber harvesting that can accidentally start a wildfire; there could be an increase in the frequency of human-caused wildfire. The relative increase as compared to alternatives A through D and G would be slight for alternative E, with a greater increase for alternative F. However, the overall change would not be great.

Effects from Roads and Trails Management: Roads and trails provide public access to the Shoshone and with that access comes an increase in the potential for human-caused wildfire. People start approximately 51 percent of the wildfires that occur on the Shoshone. While alternatives B through G show an increase of 2 to 3 miles of new roads, alternatives B, D, E, F, and G show varying increases in the miles of motorized trail additions. This increase in motorized access is likely to increase the number of people in portions of the Shoshone, and thus, an increase in the number of human-caused fires is possible. Alternative D could result in a slight increase and alternatives B, E, F, and G could have more of an increase. There would be no change in the potential for human-caused fires associated with alternative A, as the miles of motorized trails do not change. Since motorized trails decrease in alternative C, so would the related potential for human-caused fire. While there are differences among the alternatives, the relative change from the existing human-caused fire associated with motorized access would not be considered great for any of the alternatives.

Effects from Insects and Disease: The primary effect to fire and fuels management from insect and disease is related to tree mortality and the subsequent increase in fuels that are available to burn. The greater the extent of an infestation, the more likely that fire behavior and the response to wildfire will be influenced. Trees that are in what is known as the red stage still have dead needles attached and are much more receptive to fire spread than green trees due to lower moisture content of the fine fuels. Crown fires are more likely accompanied by rapid rates of spread when weather and fuel moisture conditions are conducive to ignition. Once the needles fall from the trees, they are then referred to as being in the gray stage. Although they are not quite as volatile as trees in the red stage, expansive areas of insect-killed trees in the gray stage burn readily in a wider range of weather and fuel conditions, as compared to green forests not

[25] The Gunbarrel Fire burned over 68,000 acres in the North Fork of the Shoshone River in 2008. Numerous resorts and residences were threatened, but successfully defended. Prior to the year of the fire, timber harvesting to reduce hazardous fuels was conducted to throughout the North Fork corridor.

affected by insects. Situations where forests are in the gray stage are compounded by the increase in dead fuels that accumulate on the ground and add to the potential for surface fires.

In the past 10 years, insects and disease at epidemic levels have affected over 1 million acres of forests on the Shoshone. Conifer tree species found on the Forest have been affected at a landscape-level scale. Most of the affected areas on the Shoshone are now in the gray stage; however, newly infested areas in the red stage continue to occur. These conditions have had and are likely to continue to have a profound effect on the fuel profile and the associated fire behavior. Wildfires on the Forest are occurring at a landscape scale as part of the natural process characteristic of the fire regimes found on the Shoshone. Large stand-replacement fires are likely to continue to be a common occurrence, and at times, exhibit extreme fire behavior. All alternatives have land management objectives that recognize and depend on wildfire as tool that can be used to accomplish desired conditions at a landscape level. Given the fire behavior characteristics and the remote and rough terrain of the Shoshone, there are often limited options available when developing and implementing fire management strategies to meet protection objectives. Overall, there is little difference among any of the alternatives that will alter the insect and disease situation on the Shoshone and that will have a major effect on the size and intensity of wildfires at the landscape level, which are likely to occur for the next 10 to 15 years.

All alternatives have vegetation treatments that provide some mitigation associated with insect- and disease-infected stands. These treatments can be effective at changing the fuel profile and reducing fire behavior at a small scale provide healthy stands and defensible space around values where protection objectives exist, such as developed campgrounds and wildland-urban interface areas. Alternatives A through D and G treat about the same amount of vegetation prone to insect and disease problems in these areas and would not be a change from existing levels. Alternatives E and F use timber harvesting and other vegetation treatments on more acres and would provide slightly more mitigation to insect and disease problems at a small scale, but the overall change and impact that insects and disease have on wildfires on the Shoshone would not be great.

Effects from Recreation: Visitors recreating on the Forest are a potential source of ignition for wildfires. The primary source of human-caused fires on the Shoshone is from escaped campfires. Other sources include smoking, fireworks, and mechanical equipment. While human-caused fires account for approximately 51 percent of the ignitions on the Forest, the vast majority of the acres burned are from fire started by lightning. However, the potential for large fires attributed to human-caused fires associated with people recreating on the Forest is possible. Other than the effects-related increases in motorized access noted previously, there are no significant differences in the expected recreation uses for all the alternatives that would result in changes in the frequency of human-caused fires.

Effects from Noxious Weeds and Invasive Species: Noxious weeds can affect fire regime condition classes (FRCC 2010). An infestation of noxious weeds can result in an uncharacteristic vegetation condition, alter the fire regime, and affect ecological integrity. Fire occurrence can be altered as well as the long-term vegetation composition of a landscape. Several noxious weeds are present on the Shoshone; however, cheatgrass (*Bromus tectorum*) has the most potential to affect fire regime condition class. The species can spread rapidly into disturbed areas, including those where wildfire and prescribed fire have occurred. All alternatives have ground-disturbing management activities that can result in the introduction and spread of noxious weeds as well as management actions, standards and guidelines that provide for detection, prevention, and containment of noxious weeds. Overall differences among the alternatives are not great, and potential effects on natural fire regimes will continue to be a concern.

The presence of noxious weeds and invasive aquatic species can affect wildfire management actions as well. The use of prescribed fire in some areas may be prevented due to the presence and/or potential for noxious weeds. In some situations, more aggressive management actions may be needed to keep a wildfire from reaching an infested area, thus increasing the exposure of firefighters and wildfire management costs. Invasive aquatic species can affect fire management activities by preventing use of some water sources needed for fire suppression due to the potential to spread invasive species to non-infested waters. Optimum areas needed for fire camps and helibases may need to be avoided due the presence of noxious weeds. Both invasive weeds and aquatics require equipment to be cleaned and washed before entering and being used in an area. These actions all add to the cost of managing fire. Overall differences among the alternatives are not great and the effects to wildfire management actions will continue as a regular part of operations.

Effects from Mineral, Oil, and Gas Development: Areas that become developed for minerals, oil, or gas may require management actions to protect them if sites are threatened by a wildfire. The actions would vary based on the location, presence of hazardous fuels, exposure and risk to firefighters, and values on the site. Implementation of more aggressive actions would increase cost and exposure to firefighters. All alternatives estimate potential for development to be low to very low. There would be no change from current expectations nor are there any differences as to the expected wildfire response options among alternatives.

Effects from Wildlife Habitat Management: Wildlife habitat management desired conditions, goals and objectives, standards, and guidelines are consistent across all the alternatives. In general, the use of wildfire and prescribed fire to accomplish wildlife habitat management goals and objectives are either common or not in conflict with vegetation and fuels management objectives in most instances. Protection of sage-grouse (*Centrocercus urophasianus*) habitat from wildfire is proposed for all alternatives as well as standards and guidelines that add some restrictions on the use of prescribed fire in sagebrush. These changes in wildlife management from the 1986 Forest Plan as amended have some potential to affect fire management.

Sagebrush cover type is currently being used as the management indicator for sage-grouse on the Forest. There are approximately 39,000 acres of sagebrush. When developing a response to wildfires, sagebrush cover types mapped as sage-grouse habitat would be considered a value to protect, based on stated land management objectives. In some situations, this could include implementing a more aggressive response action on all or a portion of a fire to meet the protection objectives. However, the amount of sage grouse habitat mapped at this time is less than 2 percent of the burnable vegetation on the Forest. In addition, sagebrush stands and grasslands are not significant carriers of fire on the Forest until late August in most fire seasons. This characteristic could reduce the number of situations when a more aggressive response action is needed to protect sage-grouse habitat.

The effect on response to wildfire for all alternatives would be a slight increase in the use of more aggressive fire management actions. This could also include a slight increase in the cost of managing a fire and exposure of firefighters. The overall change from the existing approach for managing wildfire would not be great. The proposed changes for protecting sage grouse habitat would have only a minor effect on the use of prescribed fire for reducing hazardous fuels. The standards and guidelines that propose restricting some use of prescribed fire in sagebrush allow enough flexibility to use prescribed fire in situations where needed to reduce hazardous fuels for all alternatives.

Effects from Heritage Management: Heritage resources are present throughout the Forest. Some of these resources can be damaged or destroyed by fire when located in areas where burnable vegetation is present. Protection of these sites is an objective that can influence the type of response to a wildfire in some situations. The response may be as simple as clearing vegetation from around the site or applying water to the site with a sprinkler. Some situations may require use of more aggressive actions that involve more resources and financial commitments. Implementing hazardous fuels reduction projects in advance of a wildfire to protect a site is also an option.

There are no differences regarding heritage resource management among the alternatives. Protection of heritage sites from wildfire has been occurring on the Forest and response options used would continue to be the same for all alternatives.

Effects from Land Use Authorizations: Permitted land use authorizations such as resorts, recreation residences, youth camps, utility corridors, and communication sites generally have protection objectives that include preventing loss or damage from wildfires. Numerous sites on the Forest are in locations that have been and are likely to continue to be threatened by wildfires when they occur. Protection of these sites generally requires the use of more aggressive management actions to suppress threatening fires. The more aggressive actions typically involve more exposure and risk to firefighters as well as increased costs. The extent and need for more aggressive fire suppression actions can be and have been reduced on the Forest by planning and implementing hazardous fuels reduction projects in advance of a wildfire starting. This strategy has been implemented under the 1986 Forest Plan as amended for several years and has allowed for the use of less aggressive suppression action such as point protection rather perimeter control where fuels reduction projects have been completed. The Forest is continuing to plan and implement these types of projects.

None of the alternatives propose a significant increase in permitted facilities and developments that would increase the number of potential situations where more use of aggressive suppression actions would be needed to meet protection objectives. All the alternatives propose to continue to allow vegetation management activities that reduce hazardous fuels in areas where structures and other developments need protection from wildfires. Therefore, there are no differences among the alternatives.

Wilderness and RNA Allocation: The primary objective of fire management in wilderness is to permit lightning-caused fires to play, as nearly as possible, their natural ecological role within wilderness. The objectives regarding fire management for research natural areas is similar, provided the effects from the fire are consistent with the objectives for the research natural areas.

Although natural-caused wildfire may be desirable in wilderness areas and research natural areas, it is possible that it may not be applicable in some of these areas due to their proximity to high value areas, or unbroken expanses of fuels leading to areas of high value resources or improvements. These high value areas include wildland-urban interface areas located on and off the Forest, developed recreation sites, administrative sites and facilities, and lands suitable for timber production. For any fires within designated wilderness or research natural areas requiring suppression actions, the logistics may be more difficult and cost of suppression may be higher than other areas due to restrictions on use of mechanized equipment and access limitations.

This effect may be offset by reduced costs associated with use of less aggressive actions of expending funds for suppression and by the resource benefits derived from allowing fire on the landscape. Wilderness management objectives of allowing fire to play its natural role also has the benefit of restoring, improving, or maintaining the health of the ecosystem. Areas in which wildfires actually occur are less likely to experience fuels buildup that would result in uncharacteristically intense fires, which could cause losses of key ecosystem components.

Current forest plan direction allows for the use of wildfire within and outside of wilderness. This direction continues under all the proposed alternatives. Recommended wilderness increases for alternatives C and D. Although the expansion would be primarily into back country areas where the opportunity and expected acres of wildfires managed for resource benefits would not change, there would be some increase in the total number of acres where using wildfire to accomplish resource benefits would be the primary objective and a reduction in the areas where protection of values is the primary objective. The changes in protection acres from the existing levels are approximately 60,000 acres for alternative C and 30,000 acres for alternative D. While these changes are not great, they are enough to have some effects on indicators for wildfire management. Due to the increase in recommended wilderness and subsequent decrease in motorized access, there would be a decrease in human-caused fires in alternative C and a slight decrease in alternative D. There would be an increase in the use of less aggressive response options in alternative C and a slight increase in alternative D. The risk and exposure to firefighters and wildfire management cost would be lower with alternative C and slightly lower in alternative D. Although there are differences among alternatives C and D and alternatives A, B, E, F, and G, they are small.

Effects from Lands Allocated to Management Area: The combined effects from the topics analyzed above are summarized in table 93. There is little or no difference between alternatives A, B, and G for all the indicators. The effects would be similar to current levels. For the alternatives where there are changes and differences, it is important to note that none of the changes would be substantial increases or decreases from existing levels.

A decrease in human-caused fires would be expected for alternatives C and D due a reduction in motorized trail access and less use of mechanized equipment to treat vegetation. The opposite effect would occur for alternatives E and F, where an increase in motorized access and use of mechanical equipment to treat vegetation would be associated with more land being allocated toward management area categories 4 and 5.

For alternative C, there would be an increase in the use of less aggressive response options due to the increase in lands allocated to recommended wilderness and a corresponding decrease in the lands allocated toward more active management (management area categories 4 and 5). The same effect and rationale would occur for alternative D, but would not be as great as in alternative C. The change would be slight. Use of more aggressive actions would decrease for alternative C and slightly decrease for alternative D. Conversely, alternatives E and F would result in an opposite effect. Use of less aggressive response options would decrease and use of more aggressive responses would increase with alternatives E and F. This effect is a result of the increase in area allocated to management area categories 4 and 5, which would contain more values with protection objectives, primarily lands suitable for timber production. The changes in exposure and risk to firefighters and fire management cost parallel the changes associated with use of more aggressive suppression options for alternatives C through F.

The effects on fire regime condition class and hazard fuels from lands allocated to management areas are the same as those described above in the General Effects section.

Table 93. Effects from lands allocated to management areas

Indicators	Alternative						
	A	B	C	D	E	F	G
Change in frequency of human-caused wildfire	none	none	decrease	slight decrease	slight increase	increase	none
Change in use of **less** aggressive response options	none	none	increase	slight increase	slight decrease	decrease	none
Change in use of **more** aggressive response options	none	none	decrease	slight decrease	slight increase	increase	none
Change in exposure and risk to firefighters	none	none	decrease	slight decrease	slight increase	increase	none
Change in wildfire management costs	none	none	decrease	slight decrease	slight increase	increase	none
Acres of FRCC maintained or improved	221,300	218,900	219,100	219,300	212,400	201,100	218,900
Acres of hazardous fuels reduced	202,800	200,400	200,700	200,900	194,900	184,900	200,400

Cumulative Effects

Past, current, and reasonably foreseeable cumulative effects for fire and fuels were considered and analyzed. The activities listed in the cumulative effects table (see table 20) were considered in the cumulative effects analysis for fire and fuels. The following cumulative effects were discussed in the context of cumulative effects expected over the next 10- to-15-year period. The area of consideration for these cumulative effects is primarily encompassed within the boundary of the Shoshone existing and expected urban interface areas on lands adjacent to the Shoshone boundary taken into consideration. Although fire history was researched back to the early 1900s, fire statistics used in estimating fire risk and acres burned by wildfire included the years 1970 through 2011.

Wildfire, Fire Regime Condition Class, and Hazardous Fuels

The cumulative effect of fire exclusion during the last century, in combination with a series of insect attacks during the past 10 years has resulted in large continuous areas of forest cover types composed of dead trees that provide receptive fuels for ignition and growth of wildfires. Large stand-replacement fire has been occurring with increased frequency over the past 10 years and is expected to continue for the next 10 to 15 years. In addition, during the past 10 years, the implementation of land management direction for the current forest plan reflected changes in Federal wildland policy. These changes included more use of wildland fire to accomplish resource objectives and less use of aggressive suppression actions in situations where resource values were low and risks to firefighter safety were a concern. The end result was more acres were allowed to burn as compared with earlier periods where most fires were suppressed as quickly as possible.

The 10-year moving average for the number of fires over the past 30 years was at 28 per year in 1982. The 10-year moving average fell to a low of 20 per year from 1998 to 2000 and has risen to an average of 27 fires in 2011. The overall annual average for number of fires since 1970 is 27. The influence of climate change on fire frequency and size is uncertain for the near term as the dominant influence on wildfire occurrence at this time appears to be related to the condition of the fuels on the Forest combined with extended warm and dry periods typical for July, August, and September. During the past 10 years, large fires on the Forest have occurred during years of what were characterized as abnormally warm and dry, as well as during years that had cool wet springs with above normal precipitation. Large fires have been absent during some years with low snowpack, early runoff, and below normal annual precipitation. Implementation of the 1986 Forest Plan as amended, which seeks to use fire on a landscape scale to accomplish resource management objectives, and changes in Federal wildland fire policy have also influenced the size of fires. Other than the potential influences climate change may have had on the extent of the insect epidemic which has changed the fuels profile, it is difficult to assess the extent of the cumulative effects from climate change for the past 10 years as well as the next planning period of 10 to 15 years.

If the projected climate changes occur, the long-term result could be an increase in the frequency of fires and a shift in fire regimes on the landscape (e.g., where ground-disturbing management activities result in increased invasive plants) under any alternative. Areas could become more productive and burn more severely than before (Rice et al. 2012).

Although an increase in fire size is a possibility, the potential may be mitigated due to the amount of fire that has burned during the last 10 years, along with what is expected for the upcoming planning period. The estimated range of acres burned by wildfire plus what is forecasted for the next planning period range from 328,000 for alternative E and nearly 350,000 acres for alternative A. When combined with the projected mechanical and prescribed fire treatments, there would a substantial change in the continuity of fuels across the landscape. There would likely be more barriers (previously burned areas) to the spread of large severe burning stand-replacement wildfires. Previously burned areas may burn again with shorter time periods between the last fires. These areas would likely burn with much less intensity due to the presence of more forest types in earlier successional stages that are less susceptible to large stand-replacement fire. While there is a difference in the estimated acres that would have burned over a 20- to-25-year period, the differences in cumulative effects among the alternatives is not substantial.

Response to Wildfire

The Shoshone has been using less aggressive suppression actions since 2001. In addition, the forest plan amendment in 2008 allows for the use of wildfire to accomplish objectives outside of wilderness. Most wildfires on the Shoshone have and will continue to receive a suppression response, as current policy does not allow the human-caused fires to be used for accomplishing resource benefits. Unwanted fires that escape initial attack may still receive something less than a full suppression response when values at risk are low, exposure and risk to firefighters are high and/or management cost are not commensurate with the values at risk. In some situations, the use of lightning-ignited fires to accomplish resource objectives is not always feasible and fires will be suppressed. All of these management and policy factors are expected to be similar for all alternatives and are expected to have the same influences on the number of acres burned on the Shoshone during the next 10 to 15 years. The one additional factor that could influence the response to wildfires would be an increase in wildland-urban interface. None of alternatives propose any significant changes to the current amount of permitted residences, resorts, or other developments on the Shoshone that would affect wildfire response options. However, increases in wildland-urban interface on areas adjacent to the Shoshone are expected. An increase in wildland-urban interface areas would likely require that more aggressive response options be implemented to meet protection objectives. The increased use of aggressive actions would increase the risk and exposure to firefighters and increase overall costs.

Insects and Disease

Introduction

Insects and diseases are disturbance processes in the forested ecosystem. They occur at differing intervals of time and can be large or small in scale as far as how much of the forest is affected at any given time. Endemic populations of forest pests are generally a natural part of the forest. They function to recycle nutrients and cause successional changes in the forest. When populations increase to epidemic levels, there can be consequences that reduce the ability to achieve desired future conditions. Insects and diseases may cause losses in timber volume and value, potential growth of forest vegetation, native plant species and forage condition, quantity and quality of wildlife habitat, recreation opportunities, visual aesthetics, and changes in fire and fuel conditions.

In general, a healthy forest contains endemic populations of forest pests. They usually kill isolated, overmature, and stressed trees on an annual basis. A healthy forest is able to keep insect and disease populations from reaching epidemic levels. The main goal of integrated forest pest management is to keep the forest in a healthy condition. Generally, the most effective means of reducing the size of epidemics is reducing the susceptibility of the forest stands to insects and diseases. This is typically best accomplished through silvicultural techniques to change the forest conditions on the landscape.

Generally, stands of lodgepole over 80 to 100 years in age are susceptible to epidemic mountain pine beetle outbreaks. Engelmann spruce over 100 to 150 years is susceptible to Engelmann spruce bark beetle outbreaks. When trees are healthy, they can repel beetle attacks by flows of resin that pitch the beetles out. Overmature trees and trees growing in dense stands are less resistant to attack. This is particularly true during times of stress, such as drought or after a fire. If beetle populations reach epidemic levels, they successfully attack even the most vigorous trees.

Sound forest management is regarded as a way to develop stands that are more resistant to insect and disease epidemics. Integrated pest management strategies involve the collection of available knowledge on pest/host relationships and identifying thresholds for unacceptable damage. Integrated pest management requires consideration of a full range of management strategies and techniques before prescribing treatment designed to reduce damage from any forest pest. Strategies include indirect control (which focuses on increasing forest resistance to epidemics) and direct control (which focuses on reducing the actual insect or disease population). Management strategies can include biological, chemical, mechanical, or manual control and prescribed fire to manage populations.

Over the past 12 years, widespread bark beetle epidemics have occurred on the Shoshone. All the major bark beetles have been in epidemic status on at least parts of the Shoshone during this time (see table 94). It should be noted that even though an acre may be counted as affected, in all cases not every tree on that acre was killed. In addition, in mixed conifer stands multiple species of bark beetles may be impacting the various species.

Table 94. Acres of insect-caused mortality on the Shoshone National Forest, 2000 through 2009, 2010, 2011

Beetle species	Acres affected 2000 through 2009	Acres affected 2010	Acres affected 2011
Spruce beetle (*Dendroctonus rifipennis*)	256,310	57,362	32,364
Douglas-fir beetle (*Dendroctonus pseudotsuqae*)	251,477	4,705	1,060
Mountain pine beetle (*Dendroctonus ponderosae*)	645,671	227,137	183,825
Western balsam bark beetle (*Dryocoetes confuses* Swaine)	117,299	39,811	19,149
Spruce budworm (*Choristoneura occidentalis*)	11,003	3,743	13,883

Legal and Administrative Framework

National Forest Management Act: Requires assessment of alternative management actions to facilitate balanced, integrated approaches to resource protections and development and implementation of sound management practices to prevent excessive losses due to pests.

Cooperative Forestry Assistance Act of 1978: Sets forth the basic Federal authority for forest insect and disease management and provides for cooperation with states and private individuals.

Code of Federal Regulations 36 CFR 219.16 (a)(2)(iii) allows for the harvesting of stands of timber that have not reached CMAI (Culmination of Mean Annual Increment) “which are in imminent danger from insect or disease attack.”

Code of Federal Regulations 26 CFR 219.27 sets the minimum specific management requirements to be met in accomplishing goals and objectives for the National Forest System. 36 CFR 219.27(a)(3) requires that all management prescriptions utilize principles of integrated pest management to prevent or reduce serious, long lasting hazards and damage from pest organisms, consistent with the relative resource values involved. 36 CFR 219.27(c)(2) discusses the allowable sale quantity (ASQ) and states: “Nothing in this paragraph prohibits, salvage or sanitation harvesting of timber stands which are substantially damaged by fire, windthrow, or other catastrophe, or which are in imminent danger of insect or disease attack and where such harvests are consistent with silvicultural and environmental standards.” 36 CFR 219.27(c)(7) states: “Timber harvest and other silvicultural treatments shall be used to prevent potentially damaging populations increases of forest pest organisms. Silvicultural treatments shall not be applied where such treatments would make stands susceptible to pest-caused damage levels inconsistent with management objectives.”

Resource Protection Measures

Numerous Forest-wide and management area prescription standards and guidelines exist concerning vegetation. Forest management has been used to increase resilience to insect and disease outbreaks. Sanitation and salvage sales are one forest management tool that may be used to suppress, or to utilize merchantable products affected by insect and disease activity where necessary and allowed.

Affected Environment

Insects and diseases can affect the production of timber resources, wildlife habitat, older stands, recreation opportunities and can change fire risk. Insects and disease are also a key component of ecosystem processes, creating habitat and serving as prey for many wildlife species.

The most serious insect pest of pine throughout the West is the mountain pine beetle (*Dendroctonus ponderosae*). This is a native beetle that can attack and kill all of the pine species (lodgepole, whitebark, and limber pine) in the Shoshone National Forest. Mountain pine beetle activity in lodgepole pine has historically occurred throughout the forest, with the most recent past outbreak occurring in the mid-1970s in the Dubois area. Whitebark and limber pine have been a less frequent host of mountain pine beetle, although an epidemic in the 1930s occurred in Yellowstone National Park and certainly caused widespread mortality on the forest as well. Efforts to minimize the mountain pine beetle population have taken place throughout the post settlement history.

The mountain pine beetle can reach epidemic proportions and kill significant numbers of their hosts. Although beetle behavior is well understood in relation to lodgepole pine stands, the same cannot be said of whitebark and limber pines. In lodgepole pine, the beetle generally attacks large-diameter, overstory trees, but once an epidemic starts, smaller trees can also be killed (Amman and Cole 1983). The death of overstory trees influences stand structure and composition, and can lead to stand conversion to other species.

The mountain pine beetle generally completes its life cycle in one year in lodgepole pine, although at higher elevations, it can take two years (McGregor and Cole 1985). Adults typically emerge sometime in July or August and attack standing green trees. On successfully attacked trees, adults lay eggs and larvae develop under the bark. Immature larvae overwinter under the bark, and then finish feeding in the spring and early summer. The developing larvae feed on the phloem, killing the tree.

Mountain pine beetle populations in lodgepole pine are in a large part dependent on the conditions present in the forest. In lodgepole pine, susceptibility to mountain pine beetle is based on three factors (Amman et al. 1977):

- Average tree diameter
- Average tree age
- Location by latitude and elevation

Less work has been done on mountain pine beetle behavior in whitebark and limber pine. What is known is that brood production is fairly high in limber pine, indicating that beetles do very well in this species (Cerezke 1995). It is also been shown, that like lodgepole, larger tree diameter and higher stand density are important drivers in whitebark (Perkins and Roberts 2003). It is assumed that a similar situation exists for limber pine. The apparent attack thresholds for whitebark are slightly lower than in lodgepole.

In lodgepole pine, factors that can be managed to reduce a stand’s susceptibility to beetles include reducing average diameter and age and/or reducing stand density. Treating the stands to reduce susceptibility would provide the most long-term defense against a mountain pine beetle epidemic. In lodgepole pine, thinning is effective at reducing future losses to the mountain pine beetle (Amman et al. 1988, Cole 1989, Gibson 1989, McGregor et al. 1987). Since beetles are attracted to the largest trees initially, removal of large-diameter material is also effective at reducing loss during epidemics (Cahill 1978, Cole et al. 1983, McGregor et al. 1987). Clearcutting lodgepole pine stands removes the risk of beetle infestation.

In areas where beetle populations have already become established and started increasing, sanitation harvesting can be considered. Sanitation efforts prior to the beetle flight period (July to August) may serve to reduce localized beetle spot expansion. However, sanitation harvesting on a small scale does not prevent future bark beetle migration from adjoining areas.

Silvicultural treatments for reducing beetle damage in whitebark and limber pine would be similar to those in lodgepole. Based on what is known, whitebark and limber pine stands should be treated to remove the largest diameter trees and reduce stocking levels in a stand to reduce mountain pine beetle risk.

Rating the overall forest’s relative risk for mountain pine beetle was done using the current structural stages. For the pines, tree diameter seems to be the biggest risk factor, so stands in structural stage 4A/B/C were considered high hazard. Stands in all other stages were considered low hazard. There was no attempt to put stands into moderate categories.

Thirty-one percent of the identified whitebark and limber pine stands are in a condition that would be considered high hazard for a mountain pine beetle outbreak. There are 69 percent of the whitebark/limber pine stands that are in a low hazard condition due to tree size or density. Areas of whitebark and limber pine are currently being attacked by mountain pine beetle. In areas where beetles have already built up, the risk to the surrounding high hazard and even to lower hazard stands is significant. Over the past 15 years, over 500,000 acres of 5-needle pine have been affected by mountain pine beetle on the Forest. This includes stands that are considered as either whitebark or limber and also stands that may contain a component of 5-needle pine, but are considered some other forest type. At this time, these stands may be the most heavily impacted by insects and diseases (white pine blister rust is also mapped) of any forest type on the forest. The mortality occurring in 5-needle pine stands seems to be of the magnitude of that which occurred in the 1930s when it was stated that “All whitebark pine stands of the Yellowstone National Park and adjacent national forests were seriously depleted during the duration of this epidemic” (Evenden 1944).

Thirty percent of the lodgepole pine on the Shoshone is in a state of high hazard for a mountain pine beetle outbreak. The remaining 70 percent is low hazard. Currently, there is a large and ongoing, landscape-level mountain pine beetle epidemic occurring in most areas with lodgepole pine. Over the past 15 years (1996 to 2011), about 263,000 acres of lodgepole pine has been affected to some degree on the Forest. In some cases, this is a lighter infestation, such as 1 to 5 trees per acre, while in much of the area a heavy infestation is killing entire stands. Large areas of the lodgepole cover type are no longer at high hazard for beetles, as the beetle has reset the forest to an earlier structural stage.

The most important threat to spruce is the spruce beetle (*Dendroctonus rufipennis)*. The spruce beetle is a native bark beetle that occurs throughout the range of spruce in North America. The beetle is typically found at endemic levels in downed trees and large pieces of slash. Epidemic populations most often occur after large disturbances, such as windthrows, create a large volume of suitable host material for the beetle to inhabit and reproduce. Once populations reach an epidemic stage, all sizes of standing green spruce can be attacked except for seedlings and saplings. However, the spruce beetle is most often focused on the larger trees within a stand. Epidemics develop as small spruce beetle outbreaks, which increase and coalesce into large areas of infested trees as the beetle continues to attack and kill vast acreages of the cover type (Massey and Wygant 1954, Holsten et al. 1999). Recovery and regeneration of affected stands may be very slow; often spruce is replaced by subalpine fir which, over time, is replaced by spruce again as the fir dies (Schmid and Hinds 1974).

Spruce beetle, unlike mountain pine beetle, is attracted to, and often builds up in, damaged trees. Frequently this is in windthrown or blowdown trees; however, fire-scorched trees also are susceptible. Rasmussen et al. (1996) found an increased number of spruce beetles in trees that were scorched up to a certain level of damage. Once scorching exceeded 60 percent of the basal circumference girdled, trees were no longer as suitable for spruce beetle infestation. This is something to be considered when using prescribed fire. Many of the larger spruce may have bark thick enough to survive lighter prescribed burns, however, if they are scorched to a certain degree, they can be more susceptible to spruce beetle attack. Stands that contain a large number of larger, partially scorched spruce could be centers for spruce beetle buildup and epidemics.

The spruce beetle usually requires two years to complete a generation; in high elevations it can take three years. Adults fly, attack host trees, and lay their eggs in June and July. Larvae develop under the bark and remain there to overwinter. Larval development continues the following spring and summer, with new adults emerging in August. These adults then hibernate beneath the bark until the following June and July.

Spruce stands that are most susceptible to spruce beetle outbreaks generally have the following characteristics (Schmid and Frye 1976):

- Located in creek bottoms.
- Have large-diameter host trees.
- Have high basal areas.
- Have a large proportion of spruce in the canopy.

Spruce beetle is a concern that should be noted in stands that have large mature and overmature trees. Windthrow events in or near these stands can lead to mortality of standing green trees (Schmid and Hinds 1974).

Seventy-one percent of the spruce/fir cover type rate as a high hazard for a bark beetle outbreak across the forest. Twenty-nine percent rate in a low hazard condition. Over the past 15 years, some 300,000 acres have been affected by spruce beetle on the Forest. Many of these acres have been significantly impacted, with all spruce trees down to 5 to 6 inches in diameter being killed. There continues to be significant spruce beetle populations in parts of the Forest, indicating that even more stands would be affected in the future.

The western balsam bark beetle (*Dryocoetes confusus*) infests a number of western conifers, but is most significant in subalpine fir. It contributes to subalpine fir decline, which is a poorly understood problem in this species. It is a significant problem on parts of the Shoshone, particularly the southern end; it kills both large-diameter and small-diameter trees. The decline appears to be associated with the western balsam bark beetle and root disease. The beetle appears to have a 2-year life cycle. Attacking beetles introduce a virulent fungus (*Ceratocystis dryocoetidis*) (Kend. and Moln), that contributes to the decline of the attacked tree. This insect/root disease association appears to be important in converting fir/spruce stands to predominantly spruce stands over long periods.

As there is no accepted method for risk rating stands for western balsam bark beetle, a conservative estimate for the number of stands at risk would be to use numbers similar to what the spruce beetle show. It is likely that far more fir is at risk, since the beetles will attack and kill much smaller trees than is typically seen with spruce beetle. Western balsam bark beetle and subalpine fir decline has had generally less impact across the Forest. Presently, somewhere around 17,000 acres have been impacted by some mortality of fir trees. Much of this mortality has been located in the southern part of the Shoshone.

The Douglas-fir beetle (*Dendroctonus pseudotsugae*) is a native insect that attacks Douglas-fir throughout its range in North America. It has a single generation per year, generally overwintering as newly emerged adults. Its life cycle is similar to other bark beetles, with new adults infesting host trees in the summer.

The Douglas-fir beetle is usually found at low densities in the forest. It is often found building to epidemic populations following other disturbance events such as windthrow or fire (Furniss 1962, Furniss et al. 1981). After these disturbance events, beetles can reach levels where surrounding green trees are attacked and killed.

Stands of Douglas-fir can be rated as to their susceptibility to Douglas-fir beetle based on stand density, average stand age, and the amount of Douglas-fir in the stand (Weatherby and Thier 1993, Negron 1998, Negron et. al 1999).

Currently, 53 percent of the Douglas-fir stands are in a condition that leaves them susceptible to large-scale Douglas-fir beetle mortality. The other 47 percent are in a less susceptible state, based on tree size and density. A number of areas have had significant Douglas-fir beetle-caused mortality over the past decade, and high levels of mortality are still occuring in the Clarks Fork area. Any stands that are in the high hazard category and even many that are borderline between high and low hazard in these areas could be significantly affected. The Douglas-fir beetle has affected over 200,000 acres across the forest over the past 15 years. During this epidemic, Douglas-fir stands in heavily impacted areas lost almost 80 percent of the Douglas-fir basal area and had reduction in tree size from 14 inches diameter at breast height (d.b.h.) to 8 inches d.b.h. (Allen et al. 2006). There are ongoing epidemics of Douglas-fir beetle on the forest, so the impact on this cover type is not over.

Western spruce budworm (*Choristoneura occidentalis*) also exists on the Shoshone. Stands usually are able to survive attacks for a year or two, however, four to five years of continuous defoliation may result in top-killing and tree mortality. This defoliation would make the trees vulnerable to attack by other insects and diseases.

Western spruce budworm has been at relatively low levels over the past 15 years; however, there has been a noted increase in acres defoliated the last 2 years. The acres affected increased to 12,000 in 2011, mostly in the northern part of the Shoshone.

The gypsy moth (*Lymantria dispar*), has been accidentally introduced into areas in and around the forest on a few occasions during the last 20 to 30 years. As of now, it is not known to have an established breeding population in this area. Chances of further introductions and the possibility of this insect becoming established in this area are increasing. As more people from infested areas visit and bring campers and recreational vehicles that could harbor gypsy moths into the area, the chances of this insect being brought in increase.

The gypsy moth is a serious threat to all forest resources. It will feed on the leaves of over 300 trees and shrubs, predominantly hardwoods (Liebhold et al. 1995). If gypsy moths become established in the Shoshone, the biggest threat would be to riparian and aspen communities.

A number of other exotic forest pests could, in theory, become established. As with the gypsy moth, any exotic insects that are found should be handled using an eradication plan as soon as possible.

Aspen decline is associated with a variety of canker and stem and root decay pathogens that cause stands to decline, die, and fall apart over time. The usual suspects are stem decays (*Ganoderma applanatum* and *Phellinus tremulae*), root decay (*Armillaria ostoyae*), canker diseases (*Cytospora* sp., *Ceratocystis fimbriata*, and *Hypoxylon mammatum*).

Dwarf mistletoe (*Arceuthobium* spp.) and Comandra blister rust (*Cronartium comandrae*) in lodgepole pine cover the most acres of any disease problems on the Shoshone. Dwarf mistletoe increases mortality and decreases growth and seed production. Young trees can be killed, while mature trees may take years to show noticeable damage. The mistletoe infection lowers the resistance of trees to attacks by other diseases and insects.

Dwarf mistletoe spreads at a relatively slow rate through a forest stand. Over long periods of time, especially in the absence of fire, lightly infested dwarf mistletoe stands become severely infested as the pathogen intensifies and spreads. Fire is an important regulator of dwarf mistletoe occurrence, particularly where large-scale stand-replacing fires have occurred. These fires eliminate the dwarf mistletoe-infested overstory and understory pines and allow new seedlings to grow free of the plant parasite.

Comandra blister rust is a native rust fungus that requires two different hosts to complete its life cycle—bastard toadflax and hard pines such as lodgepole and ponderosa. The spores are spread by wind from the Comandra plants to infect pine needles and new shoots. The fungus then grows into the branch and creates a canker that kills the branch. These cankers often produce spores that appear as rust-colored blisters; the spores travel from the pine to infect the Comandra plant. As the fungus grows in the tree branch, it will advance toward the tree stem. If the fungus forms a girdling canker on the stem, then the top of the tree dies, causing top-kill (Mielke 1957).

Timber harvest is one tool for controlling diseases such as dwarf mistletoe and Comandra blister rust on the Shoshone. Areas of high mistletoe risk or infestation are a prime consideration when locating and designing timber sales. Current strategies to control Comandra blister rust are generally aimed at reducing the disease rather than preventing infections. One option is to harvest the heavily infected stand while trees they are still usable.

White pine blister rust (*Cronartium ribicola*), an exotic disease, infects limber and whitebark pine trees on the Shoshone. The rust fungus also infects alternate hosts of currant or gooseberry plants (*Ribes* spp.) to complete its life cycles. The wind spreads fungal spores from the Ribes plants to infect pine needles. After a short infection time, the fungus will develop cankers that girdle and kill branches and eventually stems. Around the edges of these cankers, the fungus produces blisters of spores that travel by wind to infect the Ribes plants. While spores from Ribes can travel a great distance and still be viable, most pine infections in Wyoming occur in areas where Ribes plants grow in close proximity to the trees (Mielke 1943).

Limber and whitebark pines are being infested severely in many parts of the Forest by white pine blister rust. In places where this disease has moved through in the past, such as Idaho (in western white pine), mortality can be as much as 90 to 95 percent of the cover type. It is unknown what the final impact will be on the Shoshone; however, there are places where the disease has already killed a high percentage of the host trees.

Armillaria root disease does occur in the forest, and likely Annosus, and perhaps others. Root diseases can be major factors in causing growth loss and even outright mortality in forest stands. Root diseases can be stress factors that increase the likelihood of bark beetle attacks on trees when beetles are at endemic levels. Root diseases can also be major factors in causing tree failures, and so are important organisms in and around developed recreation areas.

Direct and Indirect Effects

Management area designation can influence the occurrence of insect and disease activity and what, if any, actions are taken to minimize impacts.

Natural disturbance events (larger scale and less frequent occurence) will continue to operate regardless of the alternative; however, the scale upon which natural processes operate as the primary agents of change would vary by alternative. Alternatives C and D would allow natural processes to predominate, and vegetative management activities of insect and disease populations are less likely. Since insect risk is medium or high on much of the forest, it is possible that many of these acres at risk of insect damage would be attacked within the next 50 years. The same could be said of the disease situation on the Shoshone. With the current high levels of infection, it is likely there would be continued high levels of tree mortality and stand structural changes over the next 50 years. The potential exists for large areas of the Forest to be subject to large-scale events when high-risk conditions occur.

The emphasis on management activities to prevent or reduce pest populations varies from one alternative to another, and may correspond to levels of timber harvest or other activities that promote greater habitat diversity. Aternative F allocates the most area for management areas 5.1 and 5.4, followed by alternatives E, B, G, and A, which would change the mix of age classes, density, and species makeup of forest stands, would have the greatest effect on reducing impacts from insects and diseases. These effects would generally be restricted to the managed parts of the Shoshone. Large areas of the Shoshone would still be influenced by natural processes. Alternatives C followed by D would emphasize natural processes being the major change agent and would have greater risk to loss from insect and diseases.

Effects from Fire and Fuels Management: Large wildfires would likely reduce forest pests that exist in areas where extremely hot fires burn over. Fires can also reduce stand density and make stands more resistant to attack. However, lower burning intensities associated with parts of most wildfires and most prescribed fires can severely weaken the resistance of trees to pest attacks by damaging root systems and cambial tissues. This can, in turn, lead to increasing populations and subsequent outbreaks of some pest species.

Estimated acres that could burn as a result of wildfire for alternatives A through D range between 182,900 and 185,200 acres. It is estimated that for alternative E, nearly 175,000 acres could be affected by wildfire and approximately 161,400 acres could burn under alternative F during the planning period. In alternatives that have more wildfire there is the potential for there to be more acres that are susceptible to insect epidemic as a result of the trees being weakened by fire.

The extent and frequency of large fires often increase following major bark beetle outbreaks, as currently seen throughout the Rocky Mountains. Large-scale insect and disease disturbances can create an increase in dead and down fuels.

Effects from Administrative Site Management: Costs of vegetative management treatments may be higher for administrative sites due to more intensive treatments (e.g., spraying of individual trees and removal of hazard trees) than for vegetative management treatments across general forest areas. More intensive vegetative treatments near administrative sites may occur to ensure that vegetation surrounding administrative sites is not degraded due to the activity of insects and diseases (e.g., tree falling on a building). Vegetative management around administrative sites would not vary from one alternative to another.

Effects from Timber Management: Timber harvesting and timber stand improvement provide opportunities to prevent or reduce pest outbreaks. Harvesting trees provides an opportunity to remove diseased and high-risk trees. Clearcuts and other final harvest methods provide opportunities for long-term protection and prevention of insect and disease outbreaks. Stands most susceptible to insect damage and most infected with mistletoe can be harvested and replaced with mistletoe-free young stands. In stands scheduled for overstory removal, shelterwood, or uneven-aged management, individual suppressed or dying trees can be removed, increasing the overall growth and vigor of remaining trees. In commercial and precommercial thinning operations, susceptibility to insects and disease would be decreased by increasing the growth and vigor of the remaining trees.

Under all alternatives, there exists potential for salvage and/or sanitation cuts to harvest dead or damaged timber and to attempt to slow or impede infestations from spreading. The degree to which these harvests are undertaken would largely depend upon the risks associated with the potential infestation spread into healthy stands, public safety, the presence of high value resources, and the resource emphasis of the infected or adjoining area.

Timber management can help create forests with increased age and species diversity. The more diversity that is present in an area, the less likely large-scale epidemics would occur.

Alternative F has the greatest allocation to management area 5.1, which emphasizes vegetative mangement activities and would have less area left at high risk to insect and disease outbreaks, followed by alternatives E, B, G, A, and D. Alternative C would have the greatest area left at high risk to insect and disease outbreaks.

Effects from Wilderness Management: Within wilderness, insect epidemics proceed naturally, and as stands age, they become more susceptible to large epidemics. Alternatives C and D, which recommend additional wilderness, would increase the acres where this situation exists. The acres of wilderness for the other action alternatives would not increase and would remain the same as alternative A.

Effects from Recreation and Travel Management: In developed and dispersed sites, where trees are often impacted by camping activities and overall health and vigor are reduced by soil compaction from recreational uses, insects and diseases can occur at higher levels. Pest management activities would be intensified under all alternatives to protect developed recreation sites. Costs may be higher than for the general forest to ensure that vegetation in and around developed recreation areas is not degraded, causing safety hazards due to insects or disease. This would not vary substantially from one alternative to another.

Alternatives C and D emphasize more wilderness, back country, and non-motorized recreation and would have less area with management activity for prevention or reduction of insects and diseases. Alternatives F and E include more management area 5.1 areas and would allow for the most vegetation management activities, followed by alternatives B, G, and A, respectively, and would allow access for activities that may prevent or reduce insect and disease impacts.

Effects from Scenic Resource Management: Generally, the more restrictive the scenic integrity objective, the greater the potential for some pests to be present at potentially damaging levels. Alternative C, followed by D, would limit the amount of forest management practices across a larger area of the forest and would lead to denser stands and increased likelihood of bark beetle infestations and continued increases in mistletoe. However, alternatives C then D would have the least potential to spread diseases, such as root diseases. Conversely, alternative F includes the most area available for vegetation management activities, followed by alternatives E, B, G, and A, respectively. While alternatives F and E would decrease the potential for bark beetle infestations and continued increases in mistletoe more than the other alternatives, they would have the most potential to spread diseases such as root diseases on treated acres, followed by alternatives B, G, and A, respectively.

Effects from Wildlife Habitat Management and Mature Tree Management: In general, alternatives with more acres of unmanaged land favor older age classes of vegetation and tend to favor buildup of forest pests. Those that have more managed land favor a wide range of age classes, greater vertical diversity, and greater species diversity, and tend to reduce the risk of larger scale insect epidemics. The alternatives with the least to most acres of management areas allocated for some vegetation management are C, D, A, B, G, E, and F, ranging from 312,833 acres in alternative C to 635,397 acres in alternative F.

Cumulative Effects

Natural Processes

Increasing forest stand density, age, and size are causing an increased hazard of insect and disease outbreaks on a greater number of acres. Silvicultural treatments can offset these effects. Changes to vegetation structural stage from silvicultural treatments can create forests that are more resistant to large-scale outbreaks on the Forest. Salvage operations would occur in management areas where timber production is emphasized or where needed to reduce hazards in high-use recreation areas.

As forest stands age, they pass through different stages of susceptibility to insects and diseases. Generally, mature forest stands are at the highest risk of insect and disease activity where impact may exceed management objectives. As the forest ages, the susceptibility to insect and disease outbreaks would greatly increase.

Hazard-reducing activities would be treatments that change stand structure prior to an insect or disease occurrence. The more acres left to be governed by natural processes, the better the chance of large-scale disturbance. With large areas left to natural processes, even treated acres would assume some hazard if they are near disturbances.

One of the biggest considerations would be the public acceptance of leaving much of the forest land in prescriptions that are allowed to follow natural processes. The current state of the forested vegetation on the Shoshone is at a point where natural disturbances are creating landscape-level changes now and into the near future. The areas where natural processes predominate would have changes that are more significant than those where management takes place. The continued growth and aging of the forest would create conditions that would continue to be highly susceptible to insect and disease disturbance. Those areas where forest management is used on a larger scale would be less susceptible to landscape-level changes; however, disturbances that start in areas driven by natural processes could cause change in these areas. Insect and disease populations in management area designations that emphasize natural processes are difficult, if not impossible to manage within the management area boundary, and substantial effects can also affect adjacent management areas.

Alternatives F and E would implement the greatest amount of hazard-reducing activities and would have the greatest reduction in insect and disease activity, followed by alternatives B, G, A, then D. Alternative C would implement the least amount of hazard-reducing activities and would have the greatest potential for insect and disease activity.

The *Climate Change on the Shoshone National Forest,Wyoming* (Rice et al. 2012) documents the anticipated effects from climate change on insects and pathogens as follows:

> ***"Effects from Climate Change on Insects and Pathogens:*** *Climate change may be altering the dynamics between bark beetles and forests. Increased temperatures may be one factor that results in higher rates of insect outbreaks when suitable hosts are available (Logan and Powell 2001; Romme and others 2006). Under a warmer climate, many forest insects will experience greater survival, reproduction, and development rates (Bentz 2005; Hicke and others 2006). Range expansions are possible as more habitat becomes suitable for host establishment (Bale and others 2002; Ryan and others 2008). Likewise, increased drought stress and warmer temperatures may cause some plant species to exhibit a decline in their capacity to resist insect attack (Ayres and Lombardero 2000). Bentz and others' (2010) modeling study projected a large increase in the probability of spruce beetle outbreaks and a moderate increase in the probability of mountain pine beetle outbreaks over the next century on the Shoshone and GYE [Greater Yellowstone Ecosystem]. Future beetle outbreaks may shift northward and upward in elevation, be highly variable spatially and temporally, and result in forest ecosystem regime shifts beyond historical bounds (Bentz and others 2010). These outbreaks also leave behind dead and decaying trees that have decreased wood product value (Lowell and others 2010).*
>
> *Bark beetles will likely follow the range of hosts as they track changes in climate, abandoning areas where the climate becomes too warm (Bentz 2005). Concurrently, bark beetles are capable of responding to climate changes faster than tree species (Bentz 2005). Evidence of this expansion has already occurred in British Colombia, Canada, where an increased area of mature pine stands in recent decades has resulted in unprecedented outbreaks of mountain pine beetle (Kurz and others 2008). Thus, elevated temperatures at higher altitudes could allow for mountain pine beetles to attack five needle pines-suitable hosts that, to date, have been buffered from attack by harsh climate (Logan and Powell 2001). Carroll and others (2006) found an increase in mountain pine beetle presence in formerly unsuitable habitat in Canada that "can only be explained by changes in climate." Overall the potential consequences to ecosystem services include reduced aesthetic and commercial timber value on the landscape and an increase in the variability and number of forested areas turning into [Carbon] sources after beetle outbreaks at higher elevations on the Shoshone."*

Invasive species

Introduction

This discussion addresses terrestrial invasive plant species and aquatic invasive species that can adversely affect native species composition and ecosystem structure/function. Non-native species are a serious threat to the resource values on the Shoshone. Invasive species management is closely coordinated with county, state, and private efforts.

Legal and Administrative Framework

Laws

The Plant Protection Act of 2000 (7 U.S.C. 7701 et seq.) as amended by the Noxious Weed Control and Eradication Act of 2004 (P.L. 108-412). Among other provisions, the Plant Protection Act authorizes the Secretary of Agriculture to prohibit or restrict the importation, entry, exportation, or movement in interstate commerce of any plant, plant product, biological control organism, noxious weed, article, or means of conveyance, if the Secretary determines that the prohibition or restriction is necessary to prevent the introduction into the United States or the dissemination of a plant pest or noxious weed within the United States. The Act defines the term “Noxious Weed.”

Wyden Amendment (P.L. 109-54, Section 434). Under this authority, the Forest Service may enter into agreements to support or conduct invasive species management activities on aquatic and terrestrial areas owned by local and State governments, Tribes, other Federal agencies, and private individuals or organizations, to benefit and protect the National Forest System and other resources within a watershed at risk from invasive species.

Clean Water Act of 1977 (33 U.S.C. 1251, 1254, 1323, 1324, 1329, 1342, 1344; 91 Stat. 1566). This act amends the Federal Water Pollution Control Act of 1972. Invasive species management to improve watershed condition supports the Act’s charge to maintain the ecological integrity of our nation’s waters, including the physical, chemical and biological components.

National Environmental Policy Act of 1969 (16 U.S.C. 4321). The provisions of NEPA and the Council on Environmental Quality implementing regulations apply to invasive species management (FSM 1950; FSH 1909.15).

Wilderness Act of 1964 (16 U.S.C. §§1131 et seq.). Integrated pest management actions in wilderness are authorized to meet provisions of the Act and be consistent with Forest Service policy and guidance for wilderness management.

Federal Insecticide, Fungicide, and Rodenticide Act, (7 U.S.C. s/s 136 et seq.). This act describes pesticide regulations and requirements related to hazardous material use and worker protection standards for employees in the planning and application of pesticides.

Regulations

The authority to manage for invasive species on NFS lands and other lands under Forest Service control is delegated from the Secretary of Agriculture to the Under Secretary for Natural Resources and Environment at Title 7, Code of Federal Regulations (CFR), section 2.20 (7 CFR 2.20). This authority has been delegated in turn from the Under Secretary for Natural Resources and Environment to the Chief of the Forest Service at Title 7, Code of Federal Regulations, section 2.60 (7 CFR 2.60). Title 36, Code of Federal Regulations (including Parts 221, 222, 228, 241, 251, 261, 290, 292, 293, 296, and 297) provides additional authorities to manage and regulate invasive species across the NFS, including establishing requirements and prohibitions to prevent and control aquatic and terrestrial invasive species. In addition, Forest Service regulations at 36 CFR 222.8 acknowledge the agency's obligation to work cooperatively in identifying invasive species (including noxious weeds) problems and initiating control programs in aquatic and terrestrial areas of the NFS.

Policy on Noxious Weed Management. Departmental Regulation 9500-10 (DR 9500-10) (January 18, 1990). Establishes U.S. Department of Agriculture (USDA) policy to manage and coordinate noxious weed activities among USDA agencies to improve the quality and ecological conditions of crop and rangeland in the United States.

Departmental Regulation 9500-4. USDA policy on wildlife, fish, and plant habitat management on NFS lands and waters. This regulation provides that the USDA will promote the concept and use of integrated pest management practices in carrying out its responsibilities for pest control, and will seek to alleviate damage by plant and animal pests to farm crops, livestock, poultry, forage, forest and urban trees, and wildlife and their habitats.

Native Plant Materials Policy (FSM 2070). This Forest Service manual gives direction on the use of native plant materials in re-vegetation, rehabilitation, and restoration of both aquatic and terrestrial ecosystems across the NFS.

P**esticide Use Management and Coordination Policy (FSM 2150)**. This manual provides agency policy and guidance on the use of pesticides as part of an integrated pest management approach. Additional guidance provided in the Pesticide Use Management Handbook (FSH 2109).

Executive Order

Executive Order 13112 issued February 3, 1999 (E.O. 13112). Directs Federal agencies to: (1) identify actions that may affect status of an invasive species; (2)(a) prevent introduction of such species; (b) detect and control such species; (c) monitor population of such species; (d) provide for restoration of native species; (e) conduct research on invasive species and develop technologies to prevent introduction of such species; (f) promote public education of such species; and (3) not authorize, fund, or carry out actions likely to cause the introduction or spread of invasive species in the United States or elsewhere unless the benefits of the action clearly outweigh the harm and the agencies take steps to minimize the harm.

Forest Service Manual and Handbook Direction

FSM 2150 Pesticide-Use Management and Coordination. This manual provides direction for pesticide-use management and coordination on all NFS lands.

FSH 2109.14 Pesticide-Use Management and Coordination Handbook. This handbook provides guidelines to forest land managers who are responsible for planning and selecting qualified project personnel (FSM 2150) and conducting efficient pesticide-use projects.

FSM 2900 for Invasive Species Management. This 2012 directive provides foundational comprehensive guidance for managing invasive species on aquatic and terrestrial areas of the National Forest System. It replaces FSM 2080.

National Strategy and Implementation Plan for Invasive Species Management. USDA Forest Service, FS-805 October 2004. This document describes the four invasive species program elements: prevention, early detection and rapid response; control and management; and rehabilitation and restoration.

Regional Strategy

Rocky Mountain Region Invasive Species Management Strategy, 2005. This document describes the overall management strategy for invasive species in Region 2 of the Forest Service. Forest action plans are developed from this document.

Rocky Mountain Region Invasive Species Management Strategy, Aquatic Nuisance Species, 2009.This document describes the overall management strategy for aquatic nuisance species in Region 2 of the Forest Service. Forest action plans are developed from this document.

Wyoming State Laws and Strategies

Wyoming State and County Declared Noxious Weeds. List of weeds declared as noxious in the State of Wyoming.

Wyoming Weed and Pest Control Act of 1973 and Weed and Pest Control Act Rules and Regulations. This act governs the use of pesticides in the State of Wyoming, establishes weed and pest districts, and is the basis for weed and pest control in the State.

Wyoming Game and Fish Commission Aquatic Invasive Species Management Plan, 2010. Wyoming's overall invasive species management plan.

Shoshone National Forest

Shoshone National Forest Noxious Weed Environmental Assessment, 1999. This environmental assessment outlines Shoshone National Forest noxious weed control.

Shoshone National Forest Invasive Plant Action Plan, 2007. This plan outlines Shoshone National Forest noxious weed control operations.

Certified weed-free products special orders. R2-2013-03; Order no. 02-97-02; Order no. 04-00-059. Special orders that help prevent the spread of noxious weed seeds in hay, straw, mulch, or forage products.

Shoshone National Forest Aquatic Nuisance Species Action Plan, 2011. The overall Shoshone action plan for managing aquatic nuisance species.

2010 Wyoming Aquatic Invasive Species Act (Enrolled Act 62).This is a comprehensive law which provides for prohibition of aquatic invasive species, inspection and decontamination of watercraft, and authority for the WGFD and Wyoming State Parks and Cultural Resources to develop rules and regulations.

Invasive Plant Species

Resource Protection Measures

Many invasive plants (such as smooth brome or Kentucky bluegrass), though not necessarily considered noxious, can replace native vegetation. The Federal Noxious Weed Act of 1974 authorizes the Secretary of Agriculture to use an integrated weed management approach to control and contain the spread of noxious weeds on NFS and adjacent lands. Through that act, the Forest Service has an obligation to work cooperatively in identifying noxious weed problems and to develop cooperative education and control programs in areas where NFS lands are located. Current Forest Service direction for revegetation is to use genetically local (at the ecological subsection level) native species and desirable non-native species where technically and economically feasible. Revised plan standards and guidelines are intended to direct management to maintain and improve natural vegetative conditions and native plant and animal communities and habitats. The Shoshone will continue to conduct a noxious weed management program that will minimize the spread of State-listed species, and that implements an integrated program focusing on prevention, early detection, and timely treatment of priority species.

Methodology

We used noxious weed inventory data for the Shoshone and the Greater Yellowstone Ecosystem area to assess the potential threat of invasive plant spread across revised Forest Plan alternatives.

Spatial and Temporal Context for Effects Analysis

The primary spatial context used for invasive plant analysis is the area within the Shoshone National Forest boundary. Noxious weed location information from the Greater Yellowstone Ecosystem is used to analyze potential spread on the Shoshone. The timeframe of the analysis is 15 years or the life of the revised Forest Plan.

Incomplete and Unavailable Information

The Shoshone has not conducted a weed risk assessment. This is planned for when the Shoshone completes an invasive plant analysis.

The size and difficulty of access of the Shoshone can make updating and collecting new information on weed spread difficult. This may lead to under estimating and over estimating some populations.

Affected Environment

Invasive plants are defined as “an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health” (FSM 2900).

Noxious weeds are defined as “any plant or plant product that can directly or indirectly injure or cause damage to crops, livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health or the environment” (FSM 2900).

The State of Wyoming designates and maintains a list of “noxious weeds.” Only species considered non-native on this list are emphasized for Shoshone control efforts. Noxious weeds and invasive plants are used synonymously in this document.

Invasive plant infestations negatively affect forest and rangeland environments and wildlife habitat, can prevent managers from meeting objectives, may reduce native genetic diversity, disrupt recreational use, reduce resource production, degrade water quality, and cause economic loss. The threat to ecological systems from invasive plants is acute and expanding. Invasive plants can disrupt natural processes, impact native species and their plant communities. Invasive plants are a threat to forage capacity for big game, especially on winter ranges, and can reduce winter range carrying capacity. They also pose an economic threat to downstream and adjacent land owners and livestock operations. Potential forage reductions both on and off the Forest can threaten the viability of livestock operations. Large-scale treatments can be cost prohibitive to adjacent private land owners. Under climate change, more rapid expansion of invasive plants, especially cheatgrass, may impact native species and natural ecosystem processes.

Prior to the 1986 Forest Plan as amended, Canada thistle was the most common invasive plant found on the Shoshone. This plant is now considered a lower threat across the Greater Yellowstone Ecosystem and control efforts have been shifted to the more invasive and greater environmentally damaging plants such as leafy spurge, knapweed, toadflax, houndstongue, musk thistle, and oxeye daisy. These species have greatly increased in the Greater Yellowstone Ecosystem in the last 26 years.

Several large plant infestations occur on the Shoshone. These include Dalmatian toadflax in the South Fork of the Shoshone River drainage; leafy spurge, cheatgrass, and musk thistle in the Sinks Canyon area; and oxeye daisy along U.S. Highway 212 and along the Wiggins Fork. Knapweed (spotted, diffuse, and Russian), yellow toadflax, common tansy, houndstongue, and whitetop occur as scattered populations mostly along trails, trailheads, and road corridors.

The following summary of noxious weed species present on the Shoshone was taken from the Shoshone National Forest 2011 GIS layer. Table 95 shows 25 species infesting approximately 8,420 acres of the Shoshone.

Table 95. Occurrence and acres of noxious weeds on the Shoshone

Common name	Acres	Notes
Absinth wormwood	1	
Black henbane	11	
Bull thistle	250	
Canada thistle	1,290	Underestimated
Cheatgrass	2,220	Underestimated
Common mullein	40	
Common tansy	7	
Dalmatian toadflax	2,990	Underestimated
Diffuse knapweed	3	
Dyers woad	<1	
Field bindweed	7	
Houndstongue	470	Underestimated
Leafy spurge	130	
Marsh sowthistle	<1	Underestimated
Musk thistle	180	
Oxeye daisy	310	Underestimated
Perennial pepperweed	4	
Russian knapweed	20	
Saltcedar	5	Off Forest
Scentless false mayweed	<1	
Scotch thistle	13	Overestimated
Spotted knapweed	290	
Sulphur cinquefoil	3	
Whitetop	1,707	
Yellow toadflax	6	
Total Acres	8,420	

Climate change

Changing climate is a potential influence that may have dramatic future effects on the spread of invasive plant species. Rice et al. (2012) described potential climate change on the Shoshone. Predicted climatic shifts may result in changes in kind, amount, and distribution of precipitation. Subsequently, the type, distribution, and spread of invasive plants will also have the probability of changing. Lower-elevation grassland and shrubland habitat will become drier and habitat will shift upward in elevation.

Control efforts

An environmental assessment for management of invasive plants on the Shoshone, completed in 1999, uses an integrated management approach: manual and mechanical treatments, herbicide application, and use of biological agents (USDA Forest Service 1999). Management and control efforts are conducted by Forest employees, as well as through cooperative efforts with Park, Fremont, and Hot Springs County Weed and Pest Control Districts. The Shoshone Invasive Plant Action Plan (2007) is a strategic document which quantifies program objectives and identifies annual priorities.

Annually, the Shoshone treats approximately 2,000 acres in cooperation with local and State agencies. Most of the areas treated are small infestations of less than 0.1 acre. The actual areas surveyed for invasive plants during early detection rapid response[26] activities are much greater.

Control efforts focus on early detection rapid response programs for eliminating small infestations and containing the spread of larger populations of invasive plants. Small populations of invasive plant species have the potential to spread over thousands of acres and change native plant community composition and land productivity. The lands most threatened include the Shoshone's big game winter ranges.

Horse pack, backpack, utility terrain vehicle, and truck-mounted sprayers are used in chemical control efforts. Herbicides selected are appropriate for conditions and used following label direction.

Bio-control efforts are less intensive than early detection rapid response activities. The primary focus is on Dalmatian toadflax in the South Fork of the Shoshone River drainage and Canada thistle populations scattered across the Shoshone.

Mechanical control efforts are used to prevent seed dispersal. Musk and bull thistle can be chopped down before seed maturity. Spotted knapweed (after flowering occurs) can be pulled, bagged, and burned to limit seed spread. Herbicide application is the major treatment option before the flowering time period.

Education and Prevention

The Shoshone National Forest is an active member of the Greater Yellowstone Coordinating Committee's Noxious Weed subcommittee. This group is composed of national forests, national parks, wildlife refuges, BLM, County Weed and Pest districts, and local cooperative weed management areas. The group works together on invasive plant mapping efforts, educational publications, and best management practices across the Greater Yellowstone Area.

[26] Early detection rapid response is a weed program in the Forest Service that emphasizes the early detection and rapid treatment of weeds.

For over a decade, the Shoshone has been involved with Park, Fremont, and Hot Springs counties with the development of cooperative weed management areas. Six are currently active: Dubois/Crowheart, Popo Agie, South Fork Shoshone River, Clarks Fork, North Fork of Shoshone, and Grass Creek. Education efforts are focused through cooperative weed management area participation. Weed tours and spray days conducted by the various cooperative weed management areas occur on a regular basis. The Park County cooperative weed management area formed a volunteer early detection group to hike various Shoshone trails in search of new infestations.

The certified weed-free program has expanded in the last 10 years. Signs, brochures, hunter contacts, and law enforcement involvement in the program have dramatically increased. County weed and pest organizations are partners providing the inspections to certify weed-free forage products. Forest Service enforcement of weed-free regulations is an important part of our partnership with the counties.

Prevention practices

Prevention practices are paramount to a good weed management program. These include equipment cleaning; using weed-free forage, seeds, mulch, and gravels; and weed inventory for all ground-disturbing projects. Wildfire prevention practices include washing arriving vehicles, weed-free camp locations, and analyzing invasive plant fire-related issues. Invasive species expansion on the landscape will continue with climate change, wild or prescribed fire, livestock, wildlife, and forest recreation. These trends need to be addressed by increasing early detection rapid response programs.

Desired Condition

Existing occurrences of terrestrial invasive species are declining. New populations of invasive plants are neither establishing nor spreading to adjacent lands. Shoshone goals include (1) reducing adverse impacts; (2) eradicating spotted knapweed; (3) reducing other weed species; and (4) preventing new establishments.

No new establishment of aquatic invasive species occurs on the Forest. As a result, native and selected non-native aquatic species are managed within their natural potential.

Environmental Consequences

Regarding the risk of weed invasions and/or expansion of populations, the alternatives vary in level of land disturbance. In general, the more emphasis the alternative has on active management or potential of disturbance, the greater the likelihood of weed spread. All alternatives contain a Forest-wide desired condition that states that new invasive plant species are treated and populations are contained or eradicated. Integrated pest management approaches are used, including best management practices that limit introduction, intensification, and spread due to management activities. Areas requiring re-vegetation use locally adapted, native plant species where feasible and appropriate. Agreements with cooperative weed management areas assist in noxious weed control across jurisdictional boundaries.

Direct and Indirect Effects

For each of the resource areas described below, the environmental consequences for invasive plants to forest resources are compared by alternative, based on key indicators of disturbance for each type of activity. The environmental consequences for aquatic resources including riparian and stream habitat and the biota that use them are also compared by alternative.

In general, alternatives that include greater potential levels of ground-disturbance activities for various resource uses in shorter periods of time within a drainage tend to pose greater risks for increasing spread of aquatic invasive plant species.

Effects from Timber Harvesting: Activities associated with timber harvest create areas of disturbed or bare soil that provide conditions that can result in expansion or introduction of noxious weed populations. Skid trails, decking and landing sites, and areas treated with dozers or roller-choppers for reforestation efforts all create opportunities for noxious weed infestation or expansion. Motorized transportation is common, and potential for spread of invasive plants is great. Prevention measures can help reduce this effect. Timber sale contracts require cleansing of harvesting and construction equipment. Any reseeding efforts require the use of seed (and mulch) free of noxious weed seed. Effective implementation, administration, and compliance of watershed conservation practices and other project design criteria are critical in avoiding the spread or introduction of noxious weeds under any alternative.

Based on the overall amounts of projected estimated harvest, alternatives F and E, respectively, have the highest risk of spreading invasive plant species from timber harvesting and associated road activities. Alternatives C and D, respectively, would have the least possibility for spread of invasive plant species because there is more wilderness and non-motorized emphasis with fewer road activities anticipated. Alternatives B and G provide timber harvest and road levels similar to the existing levels under alternative A, and would be between the extremes and similar in their effects on the potential to spread invasive plant species.

Effects from Roads and Trails Management: Roads or trail use, maintenance, and construction can increase areas of soil disturbance that contribute to the spread of invasive plant species and provide a vector for introducing invasive plant species. The amount of road construction and stream crossings generally varies directly with the amount of suited land that has been allocated for vegetative management activities and overall allowable motorized use.

In considering the alternatives, effects would be greatest in alternatives E and F, followed by alternatives A, B, D, and G, which would have similar impacts and somewhat less potential for spread of noxious weeds. Alternative C would have the least potential for spread of noxious weeds.

Effects from Disturbance Processes (fires/fuels management): Wildfire and prescribed fire have great potential to spread invasive plants because of the human activities, motorized transportation, potential for ground-disturbing activities, and large number of acres that can be affected. Wildfires, suppression activities, and prescribed burning can create areas of bare soil and areas of reduced vegetation cover, both of which provide ideal conditions for invasive plants to spread rapidly, especially if populations already exists in or adjacent to a burned area.

Wildfire will likely continue to create new populations of Canada thistle because of the abundant Canada thistle seed in most landscapes. Where present in the landscape, Dalmatian toadflax has the potential to increase dramatically after both wild and prescribed fire. In areas of Basin and Wyoming big sagebrush and black sage, cheatgrass has the potential to establish and dominate the landscape. Where eradication is not possible, invasive plant spread may be minimized by managing for a healthy native plant community, and by carefully managing fire rehabilitation efforts.

Fire suppression and support equipment and crew vehicles can carry weed seeds and plant parts. All alternatives include provisions for washing fire-related vehicles to reduce chances of carrying noxious weed seed.

In considering the various alternatives, all are similar with relatively little difference. Alternatives F and E are expected to have more prescribed and wildfire management activities, and alternatives C and D, potentially the least. Alternatives A, B, and G would be between the extremes and be fairly similar in their effects on the spread and management of invasive plants.

Effects from Livestock Grazing and Big Game, and Rangeland Vegetation Management: The majority of permitted livestock are cattle and horses. Livestock can introduce invasive plants by transporting seeds in their hooves, hair or wool, or digestive systems. Horses and sheep, in particular, are known to consume several species of invasive plants after plants are mature and have produced viable seed. Big game animals can also introduce and spread invasive plants in the same way that domestic livestock can.

Livestock used by outfitters/guides and recreational users can also be a source of weed delivery from infested private lands. New populations can be started at their campsites, within their permitted area of operation, and along trails. Special use permit clauses require that operators comply with the regional weed-free hay closure order.

Rangeland vegetation projects that have potential to create areas of bare soil, such as prescribed fire in sagebrush habitats or mechanical treatment for conifer encroachment, create the possibility of introducing or expanding noxious weed populations. In such cases, design criteria are required to prevent or control weed populations.

Alternative C would reduce the total animal unit months of livestock grazing use compared to existing levels under alternative A, and would have the least potential to spread invasive species. Alternatives B, A, D, and G maintain similar levels of allotments and animal unit months of livestock grazing use; the same as the current forest plan allocation and would have similar effects. Alternative E would increase animal unit months of livestock grazing use compared to alternative A for the same number of allotments, and have the potential for increased livestock impacts to aquatic resources. Alternative F would include the highest number of allotments and animal unit months of livestock grazing use compared to current levels and have the most potential for introduction and spread of invasive plant species.

Effects from Recreation: Recreational use is estimated to increase overall during the planning period. The balance between motorized and non-motorized recreational uses is anticipated to vary by alternative emphasis.

Recreational activities may be responsible for the greatest spread of noxious weed populations because of the number of people with their vehicles, horses, and accessories that visit the Shoshone, and the wide area they cover. Noxious weed expansion is most likely to occur along roads and trails. Once established along the travelway, if left untreated, the populations begin to spread laterally from the travel corridor. Some expansion occurs at trailheads and popular horse-camping areas. Weed seeds and plant parts are brought in on vehicle undercarriages and tires, off-road vehicles, horse trailers, hay and feed products, boots and shoes, camping and fishing equipment, etc. Any activities that create bare or disturbed soil provide conditions for invasive species establishment and spread in areas including roads and roadsides, trails and trailheads, parking lots, developed and dispersed camping sites, popular fishing locations, heavy-use areas around summer homes and lodges, ski runs, and construction areas. Off-road vehicle travel has high potential to introduce and spread invasive plants.

The weed-free forage special order provides a mechanism for limiting spread of invasive plants by those using pack and saddle livestock. Since no such protection is in place for motorized vehicles, alternatives that allow for greater levels of motorized travel (in summer) are likely to provide greater opportunity for spread of invasive plants.

All alternatives would limit motorized travel to designated routes, and as a result, help limit potential spread of invasive plants. In considering the various alternatives, alternatives F and E are expected to have the greatest amount of area available for motorized recreation, and alternatives C and D the least. Alternatives A, B, and G would be between the extremes and be similar in their effects on invasive plant species.

Overall, alternative F would have the highest risk for potential spread of invasive plant species with the most area allocated for motorized recreational use, followed by alternative E. Alternatives C and D would have the least potential for spread because these alternatives have the most areas allocated for non-motorized uses. Alternatives A, B, and G would be between the extremes and be similar in their effects on potential to spread invasive plant species.

Effects from Oil and Gas / Mineral and Energy Development: The largest current activity associated with mining on the Forest, is limited to gravel pits to extract mineral materials for road construction purposes or individual permits for landscaping use off-Forest. Additional mineral operations could result in exploration activity, and if sites go into production, it could result in increased travel. Production sites (including frequent presence of maintenance vehicles) often create areas of disturbed soil, providing areas for noxious weed infestations. Restoration of these areas following production would involve monitoring and treatment of invasive plants. The potential for these activities is very small based upon past activity levels on the Shoshone. There is nothing in this analysis that indicates an increase in future levels of development. Effects from oil and gas/mineral and energy development would be the same across all alternatives.

Gravel pits are generally located in areas with minimal impacts to aquatic resources. The development of mineral materials is not expected to be significant with any alternative.

Existing mining operations, for locatable minerals, are typically small, limited in number, and regulated by revised Plan standards and guidelines. Increases in mining activity are not anticipated for the future, but cannot be ruled out.

Mining effects could include land disturbances and processing activities that may affect surface and ground water quality, water quantity, and timing of release. For this analysis, aquatic resource effects from mining are assumed to be proportional to the amount of land available for locatable minerals. Potential impacts to aquatic habitats and populations are expected to be minor for all alternatives, as there are no expected proposals for large mineral development operations because of minimal, if not non-existent, potential for development of these resources.

Alternatives A, B, E, F, and G have the same area available for locatable minerals exploration and have the greatest risk of adverse effects. Alternatives C and D have less land available because recommended wilderness areas may eventually have minerals withdrawn from development. These alternatives would have lower risk of adverse effects from this activity than the other alternatives. Forest standards, guidelines, and project design features with proper implementation, administration, and compliance would minimize the effects to aquatic resources from mining activities, should they occur.

Effects from Wildlife Habitat Management: Wildlife species can transport noxious weed seeds in the same ways livestock can. Wildlife or fisheries enhancement projects that disturb the soil surface (such as fish structures) can increase weed populations. Setting back of succession stages using fire and mechanical treatments in improving big game winter ranges has the potential effect of increasing cheatgrass, Dalmatian toadflax, musk thistle, and other weed species.

The effects from wildlife management would be the same across all alternatives.

Effects from Threatened, Endangered, and Sensitive Species Management: In general, the habitat requirements in and around each known or discovered threatened, endangered, or sensitive species location will be protected, restored, or enhanced. Invasive plant control treatments may need to account for the presence of rare plant species and adjust timing and type of herbicide.

The effects from threatened, endangered, and sensitive species management would be the same across all alternatives.

Effects from Soil and Watershed Management: Soil and watershed restoration or improvement projects are intended to improve condition of the land, that is, to repair or restore areas of disturbed conditions. Road decommissioning (with monitoring) can reduce the areas populated by invasive plants. Restoration of cheatgrass infestations has the potential to improve long-term soil productivity and improve watershed condition class.

There could be a greater disturbance to the land in the short run as a project or treatment is implemented, which could also increase the possibility of noxious weed expansions. In the long run, however, there should be an overall reduction in areas of bare soil and the reestablishment of native plants.

The effect from soil and watershed management would be the same across all alternatives.

Effects from Heritage Management: Effects from managing heritage resources are anticipated to be very minor in scope or acreage. If known sites are evaluated for possible nomination to the National Register (involving soil disturbance through pit evacuations, for example), noxious weed seed could be brought in, resulting in introduction or spread of invasive plants. Effects from managing heritage resources would be the same across all alternatives.

Effects from Land Use Authorizations and Adjustments: An individual land exchange could result in a potential loss or gain of noxious weed infestations on the Shoshone, depending upon the size and location of the exchange and whether either the offered or selected lands contained existing populations. If an exchange results in a subdivision, or development where human activity will be greatly increased, the likelihood of new infestations of invasive plants will also be greatly increased. The effects from possible land exchanges would be the same across all alternatives.

Utility corridors include installation of overhead voltage lines and buried electric, cable, telephone, or other utility system lines. Effects involve the creation of areas of bare soil. Utility corridors are subject to permit provisions that include monitoring and treatment for noxious weed infestation and spread. Effects of utility corridors would be the same across all alternatives.

Wilderness and RNA Allocation: Wilderness areas have a positive effect to prevent the spread of invasive plants due to the potential of fewer disturbances. However, wilderness areas result in difficulty of access to treat invasive plants. In considering the alternatives, alternatives C and D have more emphasis on wilderness addition and alternatives A, B, E, F, and G have the least.

Summary of Effects to Resource

Alternative C would allow the least ground-disturbing activity and would result in the least risk of noxious weed spread, followed by alternatives D, A, B, G, E, and F, respectively.

Cumulative Effects

The cumulative effects table (table 20), includes the list of past, present, and reasonably foreseeable future activities that were considered with regard to cumulative effects to invasive species. This discussion considers effects of invasive species since their first appearance on the Shoshone through the next planning period (estimated at 10 to 15 years).

For invasive plants, the analysis considers effects of invasive species on the Shoshone, and in the adjacent three-county area. The key indicators for invasive species analysis are amount (acres) of invasive species and the amount (acres) of treatment.

On and off the Forest, invasive plants and invasive plant species often become established where ground-disturbing activities have created areas of bare soil, and where a seed source is present. Bare ground has resulted from past activities including livestock grazing, timber harvest, recreation, and road or trail development. Seed sources have included recreational livestock, permitted livestock, and motorized vehicles. Their populations have increased throughout the three counties. The county Weed and Pest Districts map noxious weed occurrences, and their maps show the amount and type of invasive species.

Invasive species on and off the Forest are expected to increase as the populations of local communities increase, “baby-boomers” retire, and more people nationwide continue to seek places like the Greater Yellowstone Area to recreate and retire. All-terrain vehicle use, in particular, has seen a dramatic increase recently, and that is expected to continue.

Noxious weed populations on the Shoshone can be directly influenced by activities on adjacent lands, and vice versa. For this reason, it is critical that cooperative efforts continue in these areas, and with county and State efforts at education and control. As more travelers come from out of state, certification and treatment becomes increasingly important in noxious weed management on-Forest. Urbanization is expected to continue to result in spread of invasive plant species off Forest. As new residents come to communities adjacent to the Shoshone, education and control become increasingly important. Watercourses are important vectors for invasive species, and since the NFS lands are at the head of the watersheds, Shoshone invasive species populations could spread to non-Forest land via this avenue.

The Shoshone is expending weed control funding through county programs to control weed species on adjacent private lands (through authority in the Wyden Amendment). Management and control efforts are cooperative efforts with Fremont, Park, and Hot Springs County Weed and Pest Control Districts. The Weed and Pest Districts work closely with private land owners and other USDA agencies and County Conservation Districts to treat existing populations and to educate people on the topic of invasive species. Prevention and education efforts have increased for members of the public and Shoshone employees.

Climate change

Rice et al. (2012) predicted climatic shifts may result in lower-elevation grassland and shrubland habitat becoming drier and invasive plant habitat will shift upward in elevation. This will create a greater potential for cheatgrass and other new noxious weed infestations to spread on the landscape where ground-disturbing management activities occur.

Aquatic Invasive Species

Resource Protection Measures

A key strategy of the Forest is to treat all waters as if they have aquatic invasive species or the potential to be invaded by aquatic invasive species whether or not they have been confirmed. The primary vector for transportation and establishment is through water, mud, and fine sediments. As a result, our primary resource protection measure is to thoroughly clean, inspect, and dry all equipment being used and moved between streams or lakes both on and off forest to prevent establishment. With a more mobile society and increased use, the threat of aquatic invasive species establishment increases.

The Forest staff works closely and coordinates with the WGFD and the Greater Yellowstone Coordinating Committee on these efforts for information exchange and consistency in sampling and monitoring procedures.

Methodology

For this integrated analysis, we incorporated historical information, current survey and monitoring data, relevant research, reports, and publications. We used this information to determine the aquatic invasive species that are currently found in and around the forest, their current distribution, and potential for spread. Information was compiled and obtained from the *Shoshone National Forest Aquatic Nuisance Species Action Plan* (USDA Forest Service 2013) that is updated annually. The action plan includes a strategy to periodically survey and monitor high use streams and lakes on the Forest. Known, confirmed occurrences on or near the Forest have been mapped but many waterbodies have not been sampled due to logistics and cost.

This analysis assumes that the amount of land management disturbance is generally proportional to aquatic resource effects. The actual risks and consequences are dependent on a variety of project-level factors, including the type of disturbance and location relative to water resources (e.g., type of timber harvest and amount and type of roads involved, including stream crossings).

Spatial and Temporal Context for Effects Analysis

To determine aquatic effects, we analyzed potential short-term impacts and long-term benefits to riparian, stream, and lake habitats and the aquatic biota that depends on them, addressing a variety of land management activities proposed in various alternatives over the planning period (about 15 years). We utilized information from the integrated Watershed Conservation Framework, which analyzes information at the 6th hydrologic unit code[27] (HUC) level.

[27] A hydrologic unit code (HUC) is a geographic area representing all or part of a surface drainage basin or distinct hydrologic feature. A 6th-level hydrologic unit boundary ranges in size from 10,000 to 40,000 acres and is named and coded with 12 digits.

Incomplete and Unavailable Information

The Shoshone has not completed a detailed survey for aquatic invasive species primarily because of logistics and costs. Instead, high-use areas are periodically sampled. Additionally, all waters are treated as if they contain aquatic invasive species.

Affected Environment

Aquatic invasive species were not known to be an issue and were not addressed in the 1986 Forest Plan as amended. More recently, various aquatic invasive species have spread or have the potential to become established throughout the Rocky Mountain West and the Forest.

Aquatic invasive species known to occur in and around the Forest have been identified. Whirling disease has been confirmed in various streams on or near the Forest. Didymo has been confirmed on the Middle Popo Agie just off the Forest downstream through the town of Lander. New Zealand mudsnails have been found in two localized locations in connected drainages downstream off the Forest. Zebra and quagga mussels have not been found in the State, but have been found in various nearby reservoirs and lakes adjacent to Wyoming. They are of particular concern due to the high potential for spread from neighboring contaminated reservoirs and lakes facilitated primarily through watercraft and the significant adverse effects they can cause to water facilities and aquatic ecosystems if they become established.

Desired Condition

No new establishment of aquatic invasive species occurs on the Forest. As a result, native and selected non-native aquatic species are managed within their natural potential.

Environmental Consequences

In general, alternatives that include greater potential levels of ground disturbance activities for various resource uses within a drainage, particularly access to watercourses, tend to pose greater risks for impacts to aquatic and riparian resources that may increase spread of aquatic invasive species.

Direct and Indirect Effects

Effects from Timber Harvesting: This analysis assumes the amount of timber harvest increases the potential effects to aquatic resource effects proportionally. The actual risks and consequences are dependent on a variety of project-level factors including: type of harvest and location relative to water resources, amount and type of roads, and stream crossings and types.

Effective implementation, administration, and compliance with Forest Service Regional and National BMP Directives and project-specific design criteria are critical to avoiding or minimizing impacts to aquatic resources and potentially affected streams under any alternative. Actual areas harvested and harvest type in any given year varies depending on alternative and budget levels. Site-specific effects to aquatic and riparian resources would occur as a result of a variety of factors including harvest levels and type, location of harvest relative to aquatic resources, amount of roads and type, the number and type of stream crossings, the number and types of equipment used at the project level.

Based on the overall amounts of projected estimated timber harvest, alternatives F and E, respectively, would have the highest risk of effects to aquatic resources and potential for aquatic invasive species establishment from timber harvesting and associated roads. Alternatives C and D, respectively, would have the least amount of impacts because there is more wilderness and non-motorized emphasis with fewer open roads. Alternatives B and G provide timber harvest and road levels similar to the existing forest plan levels, which would generally maintain commodity production, motorized use, and species conservation, and help minimize establishment of aquatic invasive species.

Effects from Roads and Trails Management: The amount of road construction and stream crossings generally varies directly with the amount of suited land that has been allocated for vegetative management activities and overall allowable motorized use.

Alternatives F and E, respectively, would have the most road construction and overall motorized use of any of the alternatives considered, due to the larger amount of management area 5.1 and more anticipated vegetative management activity and motorized use. These alternatives would have the most potential for spread of aquatic invasive species. Alternatives C and D, respectively, would have the least amount of expected road-related impacts and spread of aquatic invasive species because there is more wilderness and non-motorized emphasis. Alternatives A, B, and G provide a road and trail system similar to the existing condition.

Effects from Disturbance Processes (fires/fuels management): Generally, the chances for wildfire are similar for all alternatives. Risk for wildfire may be reduced somewhat under alternatives F and E, which propose the most prescribed fire and timber harvest, but would also result in the most amounts of habitat disturbance. Alternatives C and D, respectively would result in the least amount of mechanized vegetative management for fuels treatments and prescribed fire activities. Alternatives B, G, and A would include activities to help prevent catastrophic fires helping to minimize short-term impacts to aquatic resources, while helping to prevent the establishment of aquatic invasive species.

Generally, the chances for wildfire are similar for all alternatives. It would be reduced somewhat with the alternatives that propose the most prescribed fire and timber harvest, but would also result in the highest level of habitat disturbances (alternatives F and E, respectively). Alternatives C and D, respectively propose the least amount of prescribed fire and timber harvest. Alternatives G, B, and A propose direction and management area allocations to help prevent catastrophic fires while helping to minimize short-term impacts to aquatic resources, management indicator species, and sensitive fish species, while helping to prevent the establishment of aquatic invasive species.

Fire suppression activities can use large amounts of water. These activities have the potential to transport and move water and aquatic invasive species from various sources both on and off the Forest. Shoshone National Forest Fire Resource Protection Guidelines have been developed and are updated annually to minimize the potential spread of aquatic invasive species from fire suppression activities.

Effects from Livestock Grazing and Big Game: Impacts for aquatic invasive species may occur when support vehicles cross streams. Alternatives G, B, A, C, and D maintain the same by number of allotments and AUMs as the current forest plan allocation and would have similar effects. Alternative C would reduce the total AUMs significantly, compared to alternatives A, B, and G, and would have the least impacts. Alternative E would increase AUMs substantially, compared to alternatives A, B, and G for the same number of allotments and have the potential for increased livestock impacts to aquatic resources. Alternative F would have the most increase in number of active allotments and permitted AUMs compared to current levels and have the most potential for aquatic resources impacts, although the allotments should be administered to standard.

Effects from Recreation: Recreational use is estimated to increase overall during the planning period. The types of recreational uses would change under the various alternatives.

Summer Recreation: Most summer developed and dispersed recreation sites are located near streams, lakes or valley bottoms. The potential influence of developed and dispersed recreation sites on aquatic resources varies across the Shoshone. Some sites are located in riparian habitats and so corresponding influences would be anticipated there. Dispersed summer recreation sites are expected to have more negative impacts on aquatic resources, because they were not established with specific design criteria or standards and guidelines, and thus, do not provide the same level of resource protection as managed developed sites.

Recreation impacts to water resources on the Shoshone are generally related to streamside recreation use including roads and trails, camping, water-based recreation, and indirect potential effects from upland recreation activities. Motorized off-road non-winter recreation travel can cause riparian area degradation and adverse water quality impacts. Horse, bike, and foot traffic generally have less impact but can cause localized effects, especially where trails parallel or cross streams. Lakes and streams, especially those with fish that attract anglers or provide good hunting opportunities in the area can receive significant impacts from recreational livestock and foot traffic, if not managed properly. Water-based recreation is increasing and degradation can occur if proper facilities are not in place and use is not managed.

The direct impacts to fish populations and fishing experiences are expected to be proportional to overall summer use increases. The magnitude and extent of summer motorized recreation trends have a greater effect on aquatic resources and potential to introduce aquatic invasive species than non-motorized recreation. Increased recreation impacts on aquatic habitats are assumed to be proportional to the acres available to summer motorized recreation.

Fishing is an activity that occurs on the Shoshone. Access to streams, lakes, and reservoirs provides a variety of angling opportunities in locales that range from easily accessible developed sites to remote subalpine wilderness areas.

Fishing and associated equipment can contribute to the propagation and distribution of aquatic invasive species, which can damage aquatic biota and disrupt aquatic ecosystems.

Alternative F has the highest risk for potential adverse effects to aquatic resources from increased summer motorized recreation, followed in descending order by alternatives E, A, B, G, D, then C, with the least potential. Alternative G is about 40,000 acres less than alternative A.

Effects from Oil and Gas / Mineral and Energy Development: The potential for mineral and oil and gas development is low to very low under any alternative. Surface occupancy with stipulations is lowest for alternatives G, C, D, B, E, and A in ascending order. Alternative A is about six times greater than alternative G. Effects from minerals-related activities are anticipated to have little to no impact on spread or introduction of aquatic invasive species under all alternatives due to the current low probability of development.

Summary of Effects to Resource

Alternative C would allow the least ground-disturbing activity and would result in the least risk of introduction and spread of aquatic invasive species, followed by alternatives D, A, B, G, E, and F, respectively.

Cumulative Effects

The cumulative effects table (table 20) includes the list of past, present, and reasonably foreseeable future activities that were considered with regard to cumulative effects to invasive species. This discussion considers effects of invasive species on the Shoshone through the next planning period (estimated at 10 to 15 years). The analysis for aquatic species is bounded by the 6th-level hydrologic unit code watershed boundaries.

Alternative C is expected to have the least impact to aquatic and riparian resources, and alternative F would have the most effect on those resources. The effects are expected to be similar across the entire Forest, over the life of the revised Plan, with regard to cumulative effects on aquatic and riparian resources.

Another effect would be the reconstruction of highways within the Forest boundary. There can be both short-term and long-term effects from these types of activities. Currently, there is reconstruction planned for a portion of the Beartooth Highway on the Beartooth Plateau and the Louis Lake Road on the Washakie District during the planning period. Although there would be short-term disturbances, through implementation, administration, and compliance of forest plan standards and guidelines, the Forest Service Regional and National BMP Directives, and specific project design features, there would be long-term benefits to aquatic resource habitat conditions and aquatic passage through improved road and stream crossing design techniques.

As further development and human use is anticipated adjacent to the Shoshone, there is potential for aquatic invasive species to become established on the Shoshone primarily due to motorized equipment, boats, recreational equipment, livestock, and human use.

In addition to whirling disease, New Zealand mudsnails, zebra and quagga mussels, non-native fish species can displace native species through competition and/or hybridization, and threaten native species population viabilities in the aquatic ecosystems where they have been introduced. The effects from non-native fish species introductions are discussed in more detail in the fisheries section.

Climate change

Climate change has the potential to reduce summer flows in streams, increase spring runoff events, and increase summer water temperature (Rice et al. 2012). Aquatic invasive species are a potential risk factor for stream trout populations.

People and Communities – Goods and Services

Commercial Livestock Grazing

Introduction

Stockmen have been using the grasslands of this continent since the first Spanish settlers arrived in the early 1500s. Grazing by domestic livestock has occurred on rangelands of the Shoshone National Forest since the late 1800s. The industry has been an integral part of community economies, development, and lifestyles. For the livestock producer today, summer forage on the Shoshone National Forest often represents a vital part of their total program. Term grazing permits for livestock grazing, normally issued for 10-year periods, are in effect primarily on the eastern half of the Shoshone National Forest. Permittees pay a grazing fee for use of forage each year and are required to abide by the terms and conditions of their permit which address livestock and land ownership, maintenance of range improvements, resource concerns and livestock management practices, etc. Most permitted livestock spend about three to four months out of the year on the Forest, less time if allotments are at higher elevations. Implementation of required management practices and annual and long-term effects of livestock use on the environment are monitored. Through adaptive management adjustments are made, as needed, to assure compliance with permits, standards and guidelines and to address other resource concerns.

Legal and Administrative Framework

Laws

These acts, along with other land use laws, executive orders, and policies guide management of rangeland resources and commercial livestock grazing on NFS lands. Other laws pertinent to rangeland management and livestock grazing on NFS lands can be found in Forest Service Manual (FSM) 2200.

Sustained-Yield Forest Management Act of 1944 and the Multiple-Use Sustained-Yield Act of 1960 allow for the production of multiple quality goods and resources at sustained levels over time, including rangeland forage for commercial livestock grazing.

Endangered Species Act (ESA) of 1973: Requires Federal agencies to conserve threatened and endangered species.

Federal Noxious Weed Act of 1974: Authorizes the Secretary to cooperate with other Federal and state agencies and individuals in carrying out measures to eradicate, suppress, control or prevent the spread of noxious weeds.

Forest and Rangelands Renewable Resources Planning Act of 1974: Provides for maintenance of land productivity and the need to protect and improve the soil and water resources.

National Forest Management Act (NFMA) of 1976: “It is the policy of the Congress that all forested lands in the NFS shall be maintained in appropriate forest cover with species of trees, degree of stocking, rate of growth, and conditions of stand designed to secure the maximum benefits of multiple use sustained yields. Plans developed shall provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet the overall multiple-use objectives, and within the multiple-use objective” This act identifies information and requirements concerning NFS grazing and browsing resources.

Section 8 of the Public Rangelands Improvement Act (PRIA) of 1978 – this section allows for consultation and cooperation in the development and execution of allotment management plans for grazing permits.

Federal Crop Insurance Reform and Department of Agriculture Reorganization Act of 1994 amended the 1987 Agricultural Credit Act to provide for mediation of grazing permit cancellation and suspension actions as a part of the existing administrative appeals process.

Section 504 of the Rescissions Act of 1995, Public Law 104-19, directs the Forest to complete site-specific National Environmental Policy Act analysis and decisions on allotments on a scheduled basis.

Regulation and Policies

Regulations and policies have been passed in support of these laws and require the following:

- Code of Federal Regulations (CFR) 36
    - 219 Planning
    - 222 Range Management
    - 241 Fish and Wildlife
- Forest Service Manual **2200** – this manual summarizes laws and regulations governing rangeland management and forest planning.
- Forest Service Manual **2600** – this manual summarizes laws and regulations governing fish and wildlife
- Forest Service Handbook 2209.13 – Grazing Permit Administration Handbook
- Forest Service Handbook 2609.13 – Wildlife and Fisheries Program Management Handbook
- Region Two Rangeland Analysis and Management Training Guide

Other Agreements

Memoranda of Understanding for Forage Reserves: Forage reserves are allotments under a term grazing permit but may be utilized by other permittees that have been temporarily displaced due to wild or prescribed fire, drought, or other situations that have made forage unavailable.

Non-use for Resource Protection Agreements: These agreements may be entered into to provide long-term non-use needed to address recovery of rangeland resource conditions, provide forage on a temporary basis to allow resource recovery on other area grazing units, provide temporary resolution of conflicts created by grizzly bear or wolf predation on livestock, or provide supplemental forage in times of drought to assist area livestock operators and lessen the resource impacts of grazing.

Allotment Management Plans: Developed through site-specific environmental analysis, an allotment management plan uses forest plan direction and current issues to determine desired conditions and a broad strategy on how to meet desired conditions. They describe site-specific grazing strategies, stocking, structural and non-structural range improvement needs, and coordination with other resources. The output, or animal unit months (AUMs), is a result of the allotment management plan requirements, range improvements, and the ability of the permit holder to manage forage and livestock.

Resource Protection Measures

Region 2 of the Forest Service developed the Watershed Conservation Practices Handbook (FSH 2509.25), which provides direction for resource managers within the context of existing laws, regulations, and policies. The Forest Service Regional and National BMP Directives lists standards and design criteria designed to protect, maintain, and enhance the integrity of soil and aquatic ecosystems. Standards and design criteria are referenced under a guideline in the revised Plan.

Methodology

The analysis area for rangelands and commercial livestock grazing is the NFS lands of the Shoshone National Forest, with particular focus on the existing commercial livestock grazing allotments.

The National Forest Management Act of 1976 requires the identification of the suitability of lands for resource management. An analysis to determine lands capable of producing forage and suitable for grazing livestock was completed as part of the forest plan revision. Although an area may be deemed capable and suitable for use by livestock in the revised Forest Plan, a project-level analysis evaluating the site-specific impacts of the grazing activity, in conformance with NEPA, is required to authorize and dictate the management of livestock grazing on a specific allotment.

The assessment of capable and suitable rangelands was accomplished using GIS. This process is described in detail in appendix B.

Spatial and Temporal Context for Effects Analysis

Although commercial livestock grazing historically occurred on nearly every area of the Shoshone, the special context for this analysis is limited to existing allotments, both vacant and active, inside and outside of wilderness and the grizzly bear primary conservation area. Additionally, the counties adjacent to the Shoshone were considered in respect to the associated permit-holding ranch operations and potential impacts to open space. The timeframe considered accounts for historic livestock use (from 1900 on) but the primary focus is on the past 25 years since the 1986 Forest Plan as amended was implemented.

Affected Environment

Wild ungulates have grazed the lands within the Shoshone and the surrounding region for thousands of years (Knight 1994). As a result, the native plants and plant communities have evolved to tolerate various levels of intensity, timing, frequency, and duration of grazing and browsing. Domestic livestock grazing in the area probably began with the horse herds of the Americans Indians. By the mid-1800s, Euro-American settlers brought livestock with them as they settled in the valleys and plains surrounding the mountains (Knight 1994). Before the Yellowstone Timber Reserve was established, large herds of unregulated livestock were brought into and through what is now the Shoshone. During this time, heavy and improperly managed livestock grazing was the norm. Significant changes have occurred in the management and level of commercial livestock grazing activities on the Shoshone over the past 100 years and have accelerated in the past 20. From a high point in the early 1900s, commercial sheep grazing has been in a steady decline on the Shoshone (table 96). The initial decline in sheep numbers was primarily due to adjustments to stocking rates that reflected a more sustained use of the range resource. The decline in sheep animal unit months continued through the 1970s, and continued to decline in subsequent decades, though at a slower rate, reflecting declining demand and increased importation of wool and mutton from overseas. The last 10 years have seen the removal of all but one commercial sheep-grazing permit due to an increase in predator/livestock conflicts and concern over the potential for disease transmission from domestic sheep to bighorn sheep. In contrast to commercial sheep use, the levels of permitted cattle grazing and demand for allotments have changed little for many decades. Improved livestock management; consolidation of vacant sheep allotments with cattle allotments, where appropriate; and construction of fences and off-site water sources have led to improved livestock management and distribution.

Table 96. Changes in management and alignment of allotments, 1986 to present

Clarks Fork Ranger District				
Allotment	**1986 Forest Plan as amended**		**2012**	
	Type of use	**Status**	**Type of use**	**Status**
Bald Ridge	Cattle and Horse	Active	Cattle and Horse	Active
Basin	Cattle and Horse	Active	Cattle and Horse	Active
Face of the Mountain	Cattle and Horse	Active	Cattle and Horse	Active
Little Rock	Cattle and Horse	Active	Cattle and Horse	Active
Bench	Cattle and Horse	Active	Cattle and Horse	Active
Table Mountain	Cattle and Horse	Active	Cattle and Horse	Non-Use for Res. Protection
Bennett Creek *	Sheep and Goat	Active	Cattle and Horse	Active
Little Rock 017 *	Sheep and Goat	Active	Cattle and Horse	Active
Deep Creek *	Sheep and Goat	Active	Cattle and Horse	Active
Line Creek *	Sheep and Goat	Active	Cattle and Horse	Active
Stockade *	Sheep and Goat	Active	Cattle and Horse	Active
Peat Beds	Sheep and Goat	Active	Sheep and Goat	Vacant
Burnt Mountain	Sheep and Goat	Active	Sheep and Goat	Vacant
Crandall	Cattle and Horse	Active	Cattle and Horse	Active
Reef Creek	Cattle and Horse	Active	Cattle and Horse	Active
Ghost Creek	Cattle and Horse	Active	Cattle and Horse	Active
Lake Creek	Cattle and Horse	Active	Cattle and Horse	Forage Reserve
Greybull Ranger District				
Allotment	**1986 Forest Plan as amended**		**2012**	
	Type of use	**Status**	**Type of use**	**Status**
Aspen	Cattle and Horse	Active	Cattle and Horse	Active
Cottonwood	Cattle and Horse	Active	Cattle and Horse	Forage Reserve
Deer Creek	Cattle and Horse	Active	Cattle and Horse	Active
Gooseberry	Cattle and Horse	Active	Cattle and Horse	Forage Reserve
Guard Station	Cattle and Horse	Active	Cattle and Horse	Active
Rennerberg	Cattle and Horse	Active	Cattle and Horse	Active
Wood River	Cattle and Horse	Active	Cattle and Horse	Active
Kirwin	Cattle and Horse	Active	Cattle and Horse	Active
Dick Creek	Cattle and Horse	Active	Cattle and Horse	Active
Sunshine	Cattle and Horse	Active	Cattle and Horse	Active

Table 96. Changes in management and alignment of allotments, 1986 to present

Greybull	Cattle and Horse	Active	Cattle and Horse	Active
Timber Creek	Cattle and Horse	Active	Cattle and Horse	Active
Francs Peak*	Sheep and Goat	Active	Sheep and Goat	Vacant
Meeteetse Creek	Sheep and Goat	Active	Cattle and Horse	Active (Meeteetse)
Carter Mountain	Sheep and Goat	Active	Cattle and Horse	Active (Meeteetse)
Pickett Creek	Cattle and Horse	Active	Cattle and Horse	Active
Piney	Cattle and Horse	Active	Cattle and Horse	Active
Sage Creek (on-off)	Cattle and Horse	Active	Cattle and Horse	Active
Sugarloaf	Cattle and Horse	Active	Cattle and Horse	Active
Twin Peaks	Sheep and Goat	Active	Sheep and Goat	Vacant
East Fork*	Sheep and Goat	Active	Cattle and Horse	Active
Washakie Needles	Cattle and Horse	Active	Cattle and Horse	Active
Yellow/Steer	Sheep and Goat	Active	Sheep and Goat	Vacant

Wapiti Ranger District

Allotment	1986 Forest Plan as amended		2012	
	Type of use	**Status**	**Type of use**	**Status**
Belknap	Cattle and Horse	Active	Cattle and Horse	Active
Hardpan/Table Mtn.	Cattle and Horse	Active	Cattle and Horse	Active
Rock Creek	Cattle and Horse	Active	Cattle and Horse	Active
Bull Creek (on-off)	New Allotment	n/a	Cattle and Horse	Active
Carter Creek (on-off)	New Allotment	n/a	Cattle and Horse	Active
Big Creek	Cattle and Horse	Active	Cattle and Horse	Active
Jim Mountain	Cattle and Horse	Active	Cattle and Horse	NF Winter Range Allot
Dunn Creek	Cattle and Horse	Active	Cattle and Horse	NF Winter Range Allot
Green Cr.	Cattle and Horse	Active	Cattle and Horse	Active (Rand Cr.)
Pearson	Cattle and Horse	Active	Cattle and Horse	Active (Robbers Roost)
Logan Mountain	Cattle and Horse	Active	Cattle and Horse	Active (Robbers Roost)
Rattlesnake	Cattle and Horse	Active	Cattle and Horse	Active (Robbers Roost)
Trout Creek	Cattle and Horse	Active	Cattle and Horse	Active (Robbers Roost)
Bobcat	Cattle and Horse	Active	Cattle and Horse	Active
Community	Cattle and Horse	Active	Cattle and Horse	Active
Hunter Creek	Cattle and Horse	Active	Cattle and Horse	Active
Ishawooa Hills	Cattle and Horse	Active	Cattle and Horse	Active
Ishawooa Mesa	Cattle and Horse	Active	n/a	Closed (1987)
Valley-Boulder	Cattle and Horse	Active	Cattle and Horse	Active

Washakie Ranger District

Allotment	1986 Forest Plan as amended		2012	
	Type of use	**Status**	**Type of use**	**Status**
Bayer Mountain	Cattle and Horse	Active	Cattle and Horse	Active
Ed Young Basin	Cattle and Horse	Active	Cattle and Horse	Active
Maxon Basin	Cattle and Horse	Active	Cattle and Horse	Active
Dickinson Park	Cattle and Horse	Active	Cattle and Horse	Horses active, cattle vacant

Table 96. Changes in management and alignment of allotments, 1986 to present

Frye Lake	Cattle and Horse	Active	Cattle and Horse	Active
Hays Park	Cattle and Horse	Active	Cattle and Horse	Active
Meadow Creek	Cattle and Horse	Active	Cattle and Horse	Active
Middle Fork	Cattle and Horse	Active	Cattle and Horse	Active
Sawmill Creek	Cattle and Horse	Active	Cattle and Horse	Active
South Pass	Cattle and Horse	Active	Cattle and Horse	Active
Squaw Creek	Cattle and Horse	Active	Cattle and Horse	Active
Pine/Willow	Sheep and Goat	Active	Sheep and Goat	Active
Slate Creek	Sheep and Goat	Active	Sheep and Goat	Active
Beaver Creek	Cattle and Horse	Active	Cattle and Horse	Active
Atlantic	Sheep and Goat	Vacant	Sheep and Goat	Vacant
Atlantic City	Cattle and Horse	Active	Cattle and Horse	Active
Wind River Ranger District				
Allotment	**1986 Forest Plan as amended**		**2012**	
	Type of use	**Status**	**Type of use**	**Status**
Dunoir	Cattle and Horse	Active	Cattle and Horse	Active
Doby Cliff	Cattle and Horse	Active	Cattle and Horse	Active
Fish Lake	Cattle and Horse	Active	Cattle and Horse	Active
Horse Creek	Cattle and Horse	Active	Cattle and Horse	Active
Ramshorn	Cattle and Horse	Active	Cattle and Horse	Active
Parque Creek	Cattle and Horse	Active	Cattle and Horse	Active
Red Creek	Cattle and Horse	Active	n/a	Closed (1987)
Union Pass	Cattle and Horse	Active	Cattle and Horse	Active
Warm Springs	Cattle and Horse	Active	Cattle and Horse	Active
Whiskey Mountain	Cattle and Horse	Active	Cattle and Horse	Active
Wiggins Fork	Cattle and Horse	Active	Cattle and Horse	Active
Wind River	Cattle and Horse	Active	Cattle and Horse	Active
Bear Creek	Cattle and Horse	Active	Cattle and Horse	Active
Salt Creek	Cattle and Horse	Active	Cattle and Horse	Active

*Indicates appropriate portions of the sheep and goat allotment were combined with an adjacent cattle and horse allotment. The remaining portions remain in vacant status as S&G Allotments.

An animal unit month (AUM) is the unit of measure used to report and compare the amount of commercial livestock grazing that takes place on the national forest. An AUM is the equivalent to the amount of dry forage consumed by a 1,000-pound non-lactating cow in one month (approximately 780 pounds or 28 pounds per day). See figure 25. Recreation visitor livestock and permitted outfitter and guide pack and saddle livestock are not included in this category.

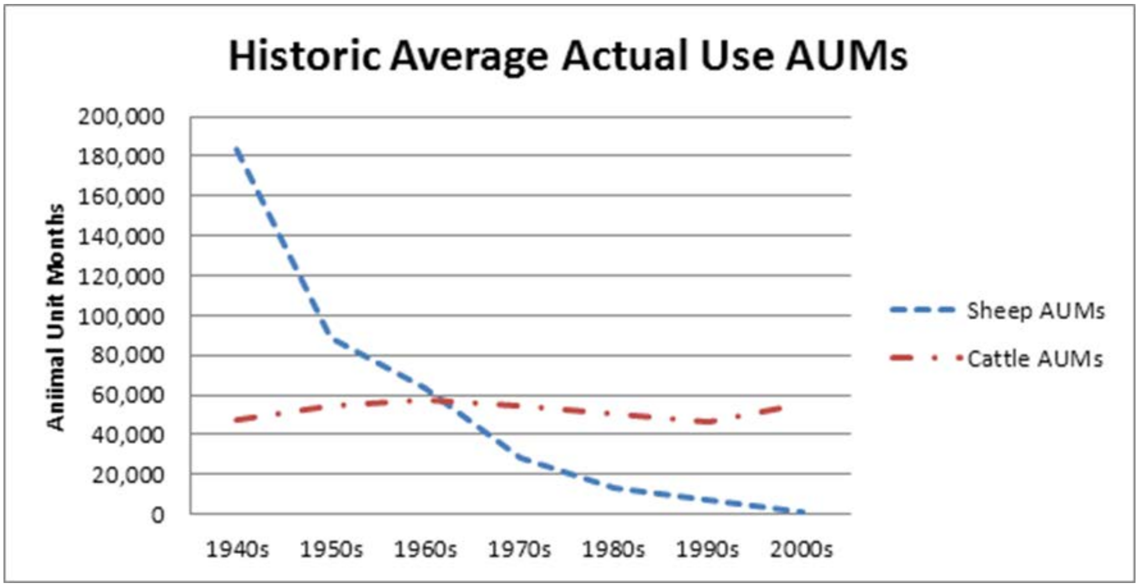


Figure 25. Historical permitted commercial livestock grazing, by decade

Figure 26 and figure 27 demonstrate the difference between authorized use levels and the permitted use levels. This gap is accounted for as non-use. Non-use, or partial non-use, of an allotment may occur for one of two reasons: the first is non-use for personal convenience, and the second is non-use for resource protection. Non-use for personal convenience indicates that grazing use was offered, but the permittee declined to use it. Non-use for resource protection is normally associated with non-use due to a prescribed or wildfire, during a period of severe drought, or implementation of a "forage reserve." A forage reserve allotment is held through a term grazing permit, but is not typically stocked by the permit holder. It is stocked as needed when another allotment is unavailable due to resource conditions, predator conflicts, or rest following a vegetative treatment.

In response to localized drought conditions or predation problems, some allotments have sporadically been in non-use or partial non-use status resulting in actual grazing use being considerably lower than permitted use. In addition to the reduced numbers of livestock grazing, some grazing seasons were temporarily shortened. However, permitted animal unit months are not affected by this.

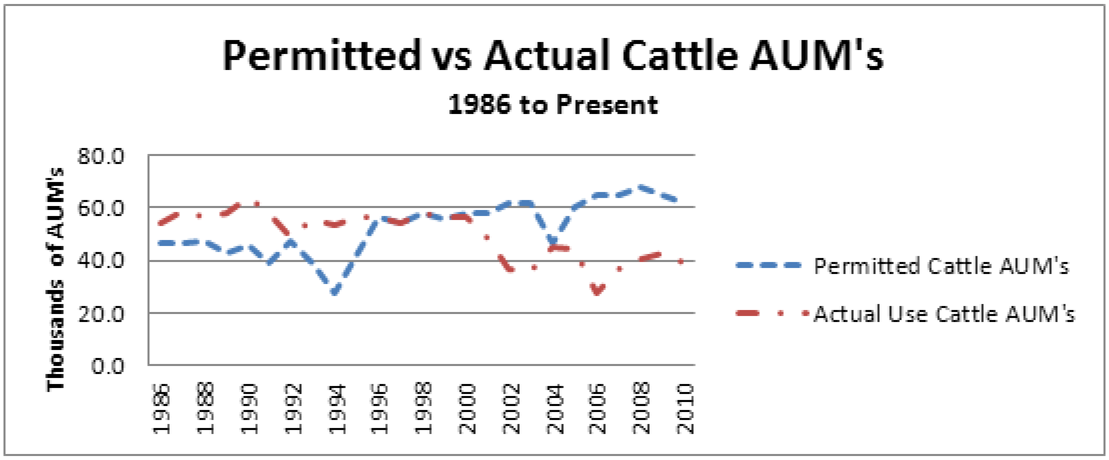


Figure 26. Permitted versus actual use cattle AUMs, 1986 to present

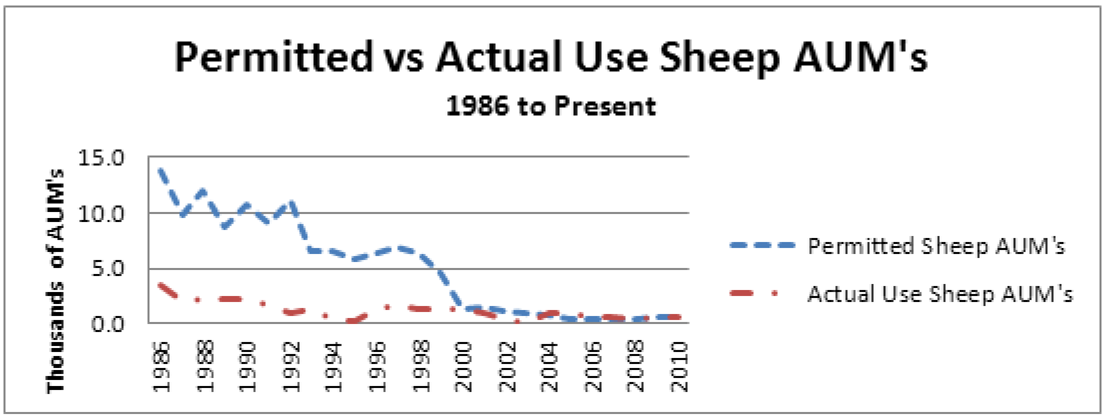


Figure 27. Permitted versus actual use sheep AUMs, 1986 to present

Permitted grazing use by commercial livestock has never reached the levels the existing forest plan projected to be available. Those projections were based on extensive implementation of both structural and vegetative range improvements. In addition, there was no accounting for the reduced demand for sheep grazing, disease transmission issues, or impacts from large predators. Presently, cattle grazing use is approximately 79 percent and sheep grazing use is approximately 2 percent of projected levels. While demand for cattle grazing allotments has remained high, sheep allotments have been vacant due to a lack of interest resulting from a depressed market, predation problems, and conflicts with wildlife. Because of this lack of need, a decision notice from an environmental analysis determined that due to the potential for disease transmission between bighorn sheep and domestic sheep, no permits would be issued for domestic sheep grazing on the vacant sheep allotments located on the Clarks Fork and Greybull Ranger Districts.

There are currently 88 commercial livestock grazing allotments on the Shoshone, most of which are permitted for cattle grazing. The few remaining sheep allotments that have not been partially or totally combined with adjacent cattle allotments are vacant (e.g., there is no permit currently in effect, but the allotment remains available for grazing upon appropriate NEPA analysis and decision).

Table 97. Permitted and actual use livestock grazing, 1986 to present

Year	Cattle and Horse AUMs			Sheep and Goat AUMs			Total AUMs		
	Permitted	Actual use	Actual use % of permitted	Permitted	Actual use	Actual use % of permitted	Permitted	Actual use	Actual use % of permitted
1986	46.3	54.6	118%	13.7	3.5	26%	60	58.1	97%
1987	46.5	58.6	126%	9.8	2	20%	56.3	60.6	108%
1988	47.6	56.4	118%	11.9	2.3	19%	59.5	58.7	99%
1989	43	57.9	135%	8.8	2.3	26%	51.8	60.2	116%
1990	45.9	64.3	140%	10.7	2.3	21%	56.6	66.6	118%
1991	39.3	57.7	147%	9	1.6	18%	48.3	59.3	123%
1992	47.1	49.1	104%	11	0.9	8%	58.1	50	86%
1993	39.2	56	143%	6.6	1.4	21%	45.8	57.4	125%
1994	27.4	53.6	196%	6.6	0.4	6%	34	54	159%
1995	42.2	56.8	135%	5.9	0.2	3%	48.1	57	119%
1996	56.8	56.8	100%	6.4	1.3	20%	63.2	58.1	92%
1997	54.2	54.2	100%	6.9	1.6	23%	61.1	55.8	91%
1998	58.2	58.2	100%	6.4	1.4	22%	64.6	59.6	92%
1999	55.7	56.5	101%	4.5	1.3	29%	60.2	57.8	96%
2000	58.2	56.5	97%	1.4	1.3	93%	59.6	57.8	97%
2001	58.4	48.2	83%	1.5	1	67%	59.9	49.2	82%
2002	61.6	36.7	60%	1.1	0.4	36%	62.7	37.1	59%
2003	62.1	36	58%	1	0	0%	63.1	36	57%
2004	46.5	45	97%	0.7	1	143%	47.2	46	97%
2005	60.1	44	73%	0.5	1	200%	60.6	45	74%
2006	65	27.4	42%	0.5	0.6	120%	65.5	28	43%
2007	65	36.8	57%	0.5	0.6	120%	65.5	37.4	57%
2008	67.6	40.3	60%	0.5	0.5	100%	68.1	40.8	60%
2009	64.8	43.1	67%	0.6	0.6	100%	65.4	43.7	67%
2010	61.6	38.7	63%	0.6	0.6	100%	62.2	39.3	63%
Avg.	52.8	49.7		5.1	1.2		57.9	50.9	

Livestock grazing (and in some instances, grazing by recreational livestock and large wild ungulates) tends to have the greatest influence on the following areas:

- Low-gradient riparian and wetland areas.
- Fine-textured soils with a minimal amount of rock, cobble, or boulders.

- Open canopy or low shrub vegetation types.
- Areas with naturally available water (although there may be some avoidance of standing water areas).
- Areas of concentration due to natural or manmade obstacles, i.e., narrow drainages, fence lines, salting locations, and developed livestock water structures.
- Alpine soils

The magnitude of the influence depends on the timing of use, the kind and class of livestock (sheep versus cattle: cow/calf versus yearlings), the intensity of grazing use, the duration and frequency of grazing, and the associated management practices, including the level of active permittee management and involvement. Most allotments are managed through a modified-rotation grazing system, designed specifically for the allotment. These rotation systems are designed to use most or all of the pastures each year, but will generally avoid the use of an individual pasture at the same time in succeeding years. A few cattle allotments are grazed under a season-long system where livestock distribution is controlled with water, salt, and herding. Salt is located to help draw livestock away from riparian areas, and most permit holders regularly herd livestock out of riparian areas and into other areas of available forage. Site-specific NEPA analysis is completed during the allotment management planning process. The Shoshone National Forest has completed a 15-year schedule to update and revise allotment management plans as mandated by the 1995 Rescissions Act. Project-level allotment NEPA decisions were developed using the goals and objectives as well as the standards and guidelines of the approved forest plan. More specific grazing prescriptions can be developed during the allotment management planning process to address site-specific issues. Permitted livestock numbers and season of use are often based on past actual and permitted use levels. Allotment management plans establish site-specific goals and objectives, and management strategies to achieve them. Management strategies may include levels of grazing use, seasons of use, rotations, and a schedule for implementing range-improvement projects such as fences and water developments. Commercial livestock are generally authorized through issuance of a term grazing permit, typically for a 10-year period. These permits include numerous terms and conditions that describe responsibilities of the permit holder such as validation, payment of grazing fees, ownership requirements of livestock and base property, livestock management, range improvement maintenance and construction, and more. Once approved, the allotment management plan becomes a part of the permit.

A rangeland capability and suitability analysis was completed for the revised Forest Plan and FEIS. The capability analysis provides basic information regarding the potential of the land to produce forage in a sustainable manner for livestock and wildlife without damage to the soil and water resources.

The analysis began with a review of the capability of the land to produce forage. Capability was based on vegetation and soil types capable of producing forage and its relative availability to livestock. Areas not capable of providing livestock grazing were identified, based on various resource concerns such as: rock outcropping, wetlands, slope greater than 40 percent, and accessibility to forage (e.g., fenced or isolated areas). Vegetation type was used to determine the most appropriate livestock kind, i.e., alpine vegetation types for sheep, upland vegetation types for cattle. Private land within allotments was not analyzed.

The rangeland capability analysis identified 378,529 acres capable of supporting commercial livestock grazing on the Forest. This represents about 16 percent of the Shoshone.

Acres of capable rangeland by allotment are displayed in table 98. All acres were generated by GIS and may not exactly match actual allotment acres. Even though some allotments contain small amounts of capable acres, grazing may still be occurring based on site-specific conditions not covered in this strategic analysis. Therefore, changes to rangeland capability and suitability may occur at the project scale, using site-specific data.

Table 98. Shoshone National Forest grazing allotments—existing condition

Allotment Name	Total Allotment Acres	Suitable Acres	Percent of total acres	2012 level of permitted livestock use in AUMs	2012 stocking rate acres/AUM
Aspen	2,099	449	21%	201	2.2
Atlantic City	968	857	89%	48	17.8
Bald Ridge	24,609	8,526	35%	2,644	3.2
Basin	69,275	18,583	27%	1,422	13.1
Bayer Mountain	5,626	1,525	27%	190	8.0
Bear Creek	34,909	14,303	41%	2,475	5.8
Beartooth[1] and	30,327	19,034	63%	1,366	18.9
Face of the Mountain	8,280	6,843	83%		
Beaver Creek	1,031	666	65%	99	6.7
Belknap	10,885	2,597	22%	941	2.8
Bench	28,414	10,491	37%	1,197	8.8
Big Creek	18,730	4,770	25%	85	56.1
Bobcat	6,515	2,285	35%	133	17.2
Bull Creek	402	100	25%	33	3.0
Carter Creek	164	21	13%	20	1.0
Community	14,993	6,660	44%	523	12.7
Cottonwood	6,687	1,129	17%	195	5.8
Crandall and	17,478	4,763	27%	1,134	6.4
Reef Creek	11,244	2,500	22%		
Deer Creek	4,416	1,126	26%	186	6.1
Dick Creek	10,622	3,571	34%	1,328	2.7
Dickinson Park	22,140	4,847	22%	896	5.4
Doby Cliff	801	568	71%	132	4.3
Dunoir	53,245	15,740	30%	1,406	11.2
Ed Young Basin	11,341	5,701	50%	906	6.3
Fish Lake	12,746	3,397	27%	1,098	3.1
Frye Lake	21,699	4,821	22%	498	9.7
Ghost Creek	10,744	5,705	53%	1,827	3.1
Gooseberry	10,730	1,549	14%	301	5.1
Greybull	34,619	20,912	60%	1,203	17.4

Table 98. Shoshone National Forest grazing allotments—existing condition

Allotment Name	Total Allotment Acres	Suitable Acres	Percent of total acres	2012 level of permitted livestock use in AUMs	2012 stocking rate acres/AUM
Guard Station	13,230	1,847	14%	442	4.2
Hardpan	15,219	5,211	34%	1,883	2.8
Hays Park	8,670	4,777	55%	541	8.8
Horse Creek	28,240	8,033	28%	521	15.4
Hunter Creek	1,596	748	47%	143	5.2
Ishawooa Hills	1,129	890	79%	400	2.2
Kirwin and	17,589	3,946	22%	303	17.6
Wood River	4,050	1,396	34%		
Lake Creek	18,873	7,000	37%	1,819	3.8
Little Rock	4,902	3,210	65%	260	12.3
Maxon Basin	3,794	1,509	40%	348	4.3
Meadow Creek	1,351	1,151	85%	81	14.2
Meeteetse[3]	5,822	3,247	56%	260	12.5
Middle Fork	26,469	9,545	36%	903	10.6
North Fork Winter Range[5]	4,528	2,073	46%	300	6.9
Parque Creek	13,426	3,613	27%	568	6.4
Pickett Creek	14,275	7,030	46%	1,569	4.5
Pine Willow S&G	18,301	9,753	53%	208	46.9
Piney	13,730	6,935	51%	566	12.3
Ramshorn	16,212	4,158	26%	613	6.8
Rand Creek	1,584	391	25%	158	2.5
Rennerberg	1,349	309	23%	87	3.6
Robbers Roost[6]	50,642	22,623	45%	3,893	5.8
Rock Creek	16,832	4,517	27%	1,648	2.7
Sage Creek	922	430	47%	69	6.2
Salt Creek	8,264	5,489	66%	2,162	2.5
Sawmill	9,392	4,028	43%	716	5.6
Slate Creek S&G	8,695	6,027	69%	200	30.1
South Pass	4,833	2,705	56%	120	22.5
Squaw Creek	6,302	2,018	32%	190	10.6
Sugarloaf & East Fork[4]	19,985	4,408	22%	607	7.3
Table Mountain	13,794	3,370	24%	2,006	1.7
Timber Creek[2]	10,009	2,329	23%	507	4.6
Union Pass	39,777	14,133	36%	2,672	5.3
Valley Boulder	3,376	1,504	45%	138	10.9

Table 98. Shoshone National Forest grazing allotments—existing condition

Allotment Name	Total Allotment Acres	Suitable Acres	Percent of total acres	2012 level of permitted livestock use in AUMs	2012 stocking rate acres/AUM
Warm Springs and	16,877	5,183	31%	3,194	6.4
Wind River	45,297	15,205	34%		
Washakie Needles	7,753	3,627	47%	542	6.7
Whiskey Mountain	12,423	5,003	40%	133	37.6
Wiggins Fork	44,550	11,955	27%	2,673	4.5
Totals and Averages	1,039,800	375,368	40%	55,930	9.7

[1] The Beartooth C&H Allotment includes the former Stockade, Little Rock, Line Creek, Bennett Creek and Deep Creek S&G Allotments.

[2] The Timber Creek C&H Allotment includes portions of the former Francs Peak S&G Allotment.

[3] The Meeteetse C&H Allotment is comprised of the former Meeteetse Creek and Carter Mountain S&G Allotments.

[4] The Sugarloaf C&H Allotment includes the former East Fork S&G Allotment.

[5] North Fork Winter Range Allotment is comprised of the former Dunn Creek and Jim Mountain C&H Allotments. Livestock are managed to maximize wildlife winter range forage quality and quantity.

[6] The Robbers Roost C&H Allotment is comprised of the Pearson, Rattlesnake, Logan Mountain and Trout Creek C&H Allotments.

Climate Change

Climate change is another effect on all vegetation groups, and thus, by default, on commercial livestock grazing. Although outside the control of the Shoshone, the potential effects are described in Rice et al. (2012). These potential effects include, but are not limited to, changes in kind, amount, and distribution of precipitation. Alpine vegetation is predicted to decrease in extent and increase in fragmentation. Lower-elevation grassland and shrubland habitat will become drier and habitat will shift upward in elevation (Rice et al. 2012). The result of these potential changes could be an increase in suitable cattle forage and decrease in alpine sheep forage. Another consideration is that, relative to the timeframe of a warming climate change, there have been periods of decreased temperature and increased precipitation more in line with the 15- to 20-year planning period. Commercial livestock grazing is able to quickly adapt to annual and long-term changes in resource conditions through stocking adjustments and management practices.

Desired Condition

Provide a reliable and consistent level of native rangeland forage for permitted commercial livestock production. This resource helps local ranches maintain an economical operation that, in turn, maintains open space adjacent to the Forest, which is integral to meeting desired resource conditions and maintaining the economic and social sustainability of local communities.

Environmental Consequences

The most significant environmental consequence to livestock grazing from any alternative is the effect it would have on the availability of suitable livestock grazing acres and AUMs. Table 99 summarizes the Forest-wide totals by alternative. Lands generally suitable for livestock grazing are displayed on maps 21–23. Commercial livestock grazing allotments are displayed on maps 24 and 26. See appendix F for more detailed alternative information by allotment.

Table 99. Livestock summary effects by alternative for the Shoshone National Forest

	Alts A, B, D, G	Alt. C	Alt. E	Alt. F
Acres within allotments	1,039,800	1,039,800	1,039,800	1,302,815
Capable acres within allotments	891,751	891,751	891,751	992,751
Suitable acres within allotments	375,368	216,847	375,368	415,370
AUMs	55,930	31,406	58,382	61,549

Table Note:

Alternative F includes new allotments or additions to existing allotments created from capable rangeland outside wilderness and not already within an existing allotment. AUMs by alternative are based on the current, most recent or adjacent allotment stocking rate to establish an estimate of suitable acres per AUM. Capable and suitable acres are generated by computer model and GIS for analysis and alternative comparison purposes. They are not intended to establish or set specific use or stocking rates. Those decisions are made during allotment-level NEPA analysis and are based on utilization monitoring and resource trend data.

The standards and guidelines in alternatives A through D and G are identical; alternatives E and F do not include the guideline of allocating forage for big game on crucial winter range. Any other changes from those in the1986 Forest Plan as amended are primarily for clarification and update, and in most cases, reflect changes that are currently implemented. There are some differences in standards and guidelines between revised management prescriptions. The mix of these prescriptions is different among alternatives, and this difference in the mix is the main reason for any difference in effects among alternatives. On a Forest-wide basis, differences are usually small, often subtle, and difficult to quantify.

The total number of permitted livestock AUMs on the Shoshone has decreased significantly since the early 1940s, almost exclusively in domestic sheep grazing. At the same time, incidence of significant areas of overgrazing are no longer reported to occur. Range management practices are much improved from those at the turn of the century and these changes are reflected in the current rangeland conditions (2210 Allotment Files).

Competition for limited national forest resources and a permittee’ s ability to manage livestock to meet standards and guidelines, goals, and management area direction all affect the feasibility of maintaining permitted AUMs and the viability of a livestock operation. Permitted grazing levels (AUMs) are an objective of the revised Forest Plan to display an appropriate use of the national forest. Actual grazing use levels are not an objective, but rather a product of livestock grazing while applying management to meet standards, guidelines, and management area direction. Permittee involvement and commitment are critical to sustaining current AUMs under term permit. At today’s stocking levels, across all alternatives, it is possible for all permittees to succeed in managing livestock within these parameters. It is possible that some permittees may be able to manage in a manner that would allow for an increase in AUMs on their allotment. Likewise, consistent failure to meet standards and objectives or the inability to properly manage livestock could result in temporary or permanent reductions in permitted numbers (and AUMs under permit) or significant changes in management.

Direct and Indirect Effects

For each resource area or activity described below, the environmental consequences to commercial livestock grazing are compared by alternative, based on key indicators of disturbance and impact.

Effects from Timber Harvesting: Timber harvest can provide increased forage (transitory range) that would be available for livestock and wildlife grazing. Any increase in stocking to use this additional forage would only be permitted on a short-term basis. Transitional range forage capacity decreases over time as the over story grows back and shades out the grass understory, eventually reducing it to a level that does not provide enough grazing to be accounted for. Generally, transitory range will be managed to provide a temporary alternative to traditionally grazed areas on the allotment, thus reducing grazing pressure throughout the area. As timber is harvested, it may also open up areas to livestock that were not previously available. These newly accessible areas would be used in the same way as transitory range because over time, access will gradually be lost. These newly created access routes may also cause livestock control and management problems if the previously unharvested timber stands were used as natural barriers between pastures or allotments. In this case, there would be increased operating costs to the Forest Service and permittee in the form of additional fence construction and maintenance. In part, because of all the variables, both positive and negative, on livestock grazing from timber harvesting activities and the limited areas impacted, there is little difference in the level of effects among the alternatives.

Effects from Roads and Trails Management: The primary impact to livestock grazing from roads and trails management is focused on the level of motorized access to and on an allotment. Generally, the greater ease and availability of motorized access into and throughout the allotment, the more efficient and cost effective the management of livestock and maintenance of structural improvements can be performed. Livestock are trailed or trucked to and from grazing allotments along roads, and permittees access cow camps and various pastures using Shoshone travelways. Many existing roads and trails follow historically established livestock trails.

In areas of limited access, the line officer may allow a permittee motorized use for such things as transportation of fence and/or water development materials, noxious weed control, and salt distribution, but these decisions are discretionary and are made on a case-by-case review of the proposal and circumstances. In addition to providing more convenient and cost-effective allotment access to the permittee, the availability of motorized use can also affect the ability, method, efficiency, and speed with which the USFWS and/or WGFD personnel are able to respond to incidences of large predators killing livestock.

Motorized recreational opportunities and use on allotments can increase the difficulty of maintaining positive control of livestock, i.e., gates may be left open and livestock are inadvertently or purposely moved, which complicates allotment management and increases management costs. Structural range improvements generally receive less disturbance and vandalism with recreational vehicles restricted to designated roads and trails; however, permit holders would need more time to obtain prior authorization to travel off roads or trails in their allotment.

Of the action alternatives, alternative F would allow for the most motor vehicle access to and through allotments, followed by alternative E. Both of these alternatives would result in an increase of the current level of vehicular access. Conversely, alternative D would be a reduction in the amount of motorized use and alternative C would result in the greatest reduction of motorized vehicle access. However, none of the alternatives, including A, B, and G, would have a significant enough impact to make the use of any existing allotment economically prohibitive.

Motorized winter recreation has no effect on livestock grazing, as no permitted grazing takes place during winter.

Effects from Disturbance Processes (fires and fuels management and insect and disease mortality): Fires and fuels management can have very differing short-term and long-term effects on livestock grazing. Effects depend upon the burning conditions and controlled burning versus a wildfire, because the results and timing of a wildfire are much less predictable.

In the case of prescribed fire, livestock are managed so that the area to be burned is not grazed in advance, to assure adequate fine fuels (residual grass) to carry a fire. Pastures are often rested or use deferred following the burn to allow for vegetative recovery. This “resting” requires that the permittee be flexible in management, and involved in considerable advance planning and coordination, especially if it requires livestock to use other allotments or forage sources. If the planned prescribed fire does not take place on schedule, arrangements need to be made again in successive attempts, and can accrue additional costs.

Grazing is often deferred for up to two growing seasons following a fire to allow vegetation to reestablish. Deferment time can be decreased or increased depending upon the amount and timing of precipitation events following the burn.

Recent fire effects studies (Perryman and Laycock 2000) indicate that the amount of deferment needed is dependent on the post-fire vegetation condition desired; for example, if more forbs are a component of the desired condition (for wildlife habitat needs, for example), then grazing immediately after green-up will increase the amount of forbs by reducing competition with grasses (versus two years of rest, which would reduce the forb component in the plant community).

By managing sagebrush density and structure on rangelands, prescribed burning often results in an increase in forage production (grass/forb) and availability, and a shrub community more compatible with a variety of wildlife species. A reduction in brush density can accelerate the recycling of nutrients, and result in making water more available across the landscape, in springs, seeps, and intermittent streams. This can have the effect of simplifying livestock management, improving livestock or wildlife distribution, and increasing available AUMs. A significant effect often results from under-burns in conifers or other types of burns that can increase forage production and accessibility. Alternatives using more prescribed fire would result in increases in the impacts described above.

A wildfire can have similar effects as prescribed fire, but is likely to have unplanned effects as well. It may result in entire pastures or allotment being burned. Livestock may have to be completely removed from an allotment or pasture (sometimes even to avoid being caught in the fire). Fences and stockwater pipelines may be destroyed. A permittee may be forced to alter planned grazing management of other lands in their operation (private, state, and BLM). If fences are burned, grazing systems must be modified until the fences can be replaced, which can add expense to the grazing permittee, as well as the Forest Service.

Wildfire may remove sagebrush and remnant grasses and forbs; it can recycle nutrients, and may result in many of the same benefits that prescribed fire provides. Since timing, location, and burn conditions are not in the control of management; however, these benefits are less likely to be realized. Wildfire may remove trees and open the understory of timber types to a flush of grass and forb production for many years. Similar to prescribed fire in sagebrush types, this can have the effect of recycling nutrients and improving the quality and quantity of forage for livestock and wildlife.

Based on the estimated acres of wildfire, the effects of alternatives B through E and G would be similar to those in the existing plan (alternative A). Alternative F would have a reduced occurrence of wildfire due to a reduction in wildfire acres and an increased emphasis on suppressing fires outside of wilderness to meet protection objectives.

In many ways, timber stands, heavily impacted from insect and disease, have the same effect on livestock forage availability as fire. As trees succumb to infestation and die, the understory receives additional sunlight and precipitation, greatly increasing forage production. This additional forage is available until seedlings mature enough to shade out the understory and/or dead trees fall, preventing access. There is also an increase in nutrient cycling from the dead trees, only at a much slower rate than through fire.

Effects from Big Game Grazing: Big game grazing and browsing is generally compatible with livestock grazing and browsing. There is a large dietary overlap (40 to 80 percent) between elk and cattle (Kufeld 1973) and a similar though smaller dietary overlap between sheep and deer (Kufeld 1973, Wallmo et al. 1973). Elk grazing patterns have been shown to be strongly influenced by livestock grazing, as they seek areas of forage regrowth following grazing by livestock (Crane et al. 2001).

Forage demands of big game can exceed the capability of the land and can cause detrimental impacts to vegetative and soil resources, particularly where elk numbers exceed herd unit population objectives. Conflicts over the allocation of forage resources will occur and increase as certain big game populations continue to expand, and forage on grazing allotments that is allocated to permitted cattle or sheep can be removed by wildlife when this occurs. In certain cases, limitations may be placed on forage use by permitted livestock to assure adequate forage for the wild ungulate populations, particularly on crucial winter range.

The planned management or improvement of rangelands can be complicated by heavy utilization from wild ungulates, and heavy browsing of willows by deer, elk, and moose can restrict plant community development. Barking of aspen by moose and elk can be detrimental to a stand, and browsing of young aspen can limit attempts at stand regeneration. Effects from big game management are the same for alternatives A, B, D, and G. Alternative C does not permit commercial livestock grazing on crucial big game winter range. Alternatives E and F do not allocate forage for crucial big game winter range, allowing more forage for commercial livestock.

Effects from Recreation: Recreation management can alter livestock grazing in several ways. One common effect from recreation use occurs when Forest visitors open gates along system roads and trails to pass through and then do not close them. This frequent occurrence allows livestock to drift into pastures, allotments, roadways, or other areas where they are not intended to be, which often results in unplanned livestock use and disruption of planned management. Grazing permits require that stockmen keep livestock in designated areas. To comply, and to minimize the task of gathering and returning livestock, a rapid response is necessary, and can incur considerable expense. In some cases, cattleguards can replace gates, but materials, installation, and maintenance are costly. Recreation can add expense to livestock operators who, in springtime, must repair fences that are cut or otherwise damaged by wintertime snow-goers or horseback riders that do not want to detour their route to a gate.

Achieving reasonably uniform livestock distribution across a landscape is one objective of livestock management, since it allows the optimal use of available forage resources. Areas with campers, pet dogs, all-terrain vehicles, and other concentrated human activity are generally avoided by livestock. Concentrated or frequent recreation use along roads and near popular areas can cause livestock to avoid grazing or passing through an area, and work directly against a permittee's attempts to distribute livestock evenly. Cattle trailing along roadways can cause traffic congestion and a hazard to motorists and livestock. This congestion may be caused by the physical barrier of the livestock or motorists stopping to photograph the cowboys herding the cattle. Cattle are occasionally shot by mistake or otherwise during hunting seasons, or struck and injured or killed by vehicles, resulting in a direct economic loss. Summer-home and property inholding owners sometimes become concerned with livestock in and around their cabin permit areas and private land. This is also true of people using camping and picnic sites on the Forest.

Fences are a common solution, but require installation and maintenance that can be costly. Fencing of roadways may result in a safer travelway for motorists and livestock, but also a loss of forage available to permitted livestock. Right-of-way fence can either disrupt planned grazing management or it can increase the management flexibility by creating additional pastures. Some ranchers use guard dogs to protect livestock, particularly sheep. The recreating public can distract dogs away from their sheep, resulting in reduced effectiveness in protecting sheep and time lost to the task of locating a guard dog. The dogs can also intimidate recreationists, and may contribute to conflicts between recreation and livestock grazing. Use of the Forest for recreation is likely to continue to increase over time. Higher levels of summer recreation create increased levels of potential conflicts with livestock use. Those alternatives that allow more areas of motorized and dispersed recreation are likely to impact livestock grazing the greatest.

Alternative F would account for the most motorized recreational activity, as it allows for the most motor vehicle access to and through allotments, followed by alternative E. Both of these alternatives would result in an increase of the current level of motorized recreation. Conversely, alternative D would be a reduction in the amount of motorized recreational use and alternative C would result in the greatest reduction. Alternatives A, B, and G would fall between E and D. None of the alternatives would have a significant enough impact to make the use of any existing allotment economically prohibitive to use.

Winter recreation does not affect livestock grazing, as no permitted grazing takes place during the winter.

Effects from Noxious and Invasive Species: Infestations of noxious weeds can significantly impact livestock grazing if they are extensive enough to reduce the amount of available forage. Once established, noxious weeds and other invasive plant species have the ability to out-compete native vegetation for nutrients and precipitation. In addition to being undesirable from a forage standpoint, single specie plant communities are usually less dense with more bare soil exposed and a higher erosion potential. Over time, less water is stored, soil erosion occurs and re-establishment of a native plant community becomes more difficult and expensive to accomplish. Any ground-disturbing activity has the potential to expose a site to noxious and invasive plant introduction, particularly when motor vehicles are involved. Likewise, established motorized access can make noxious and invasive plant treatment much easier and cost effective.

Alternatives E and F would have the greatest potential to introduce new infestations of noxious weeds and impact livestock grazing. The other alternatives would be similar to no change from the present level.

Effects from Mineral and Energy Development and Oil and Gas Development: Increased mineral development can add to road systems, increase travel, and increase potential for the introduction of noxious weeds. Increased oil and gas development can add to road systems, increase travel, and increase potential for the introduction of noxious weeds; which could result in localized forage effects on livestock grazing.

Alternatives A, B, E, F, and G have the same area available for locatable minerals exploration and have the greatest risk of adverse effects. Alternatives C and D have lower amounts of land available because recommended wilderness areas may eventually have minerals withdrawn from development. These alternatives would have lower risk of adverse effects from this activity than the other alternatives. Given the low likelihood of development, there are no effects predicted on livestock grazing.

The possibility of oil and gas development in the planning period is low or very low under all alternatives. The amount of development is likely similar among the alternatives, though some alternatives such A, F, E, and B allow oil and gas development with surface occupancy on more acres than alternatives C, D, and G. Given the low likelihood of development, there are no effects predicted on livestock grazing.

Effects from Riparian and Wetland Management: Management and protection of riparian and wetland resources are emphasized under all alternatives. The objectives and standards for protecting riparian and wetland resources have some of the greatest influence relative to the forest grazing program achieving desired conditions. Over the last 10 to 15 years, many changes have been made in grazing management and practices to protect riparian and wetland resources, which are reflected in current resource conditions. Effects of riparian and wetland management would be similar across all alternatives.

Effects from Wildlife Habitat Management: These effects would be similar as those discussed in the Disturbance Processes section above.

Effects from Soil and Watershed Management: Management and protection of soil and water are emphasized under all alternatives. The objectives and standards for protecting soil and water resources have some of the greatest influence relative to the forest grazing program achieving desired conditions. Over the last 10 to 15 years, many changes have been made in grazing management and practices to protect soil and water resources. Effects of soil and watershed management would be similar across all alternatives.

Effects from Heritage Management: Livestock can contribute to the deterioration of heritage resources through physical contact (e.g., hoof action, rubbing on structures) or by contributing organic matter to a site. They can remove or alter vegetation that serves to protect sites from erosion and make heritage resources more visible for unauthorized collection. In cases where the level of impact is determined to be unacceptable, the impacts can be mitigated with fencing, which can be costly, or with changes in management (intensity or timing). If livestock are excluded from a site or forage use levels are reduced, total available forage (AUMs) on an allotment is reduced. Federal law requires that effects of livestock grazing be evaluated and mitigated Forest-wide. This takes place during site-specific analysis (allotment level) and is implemented through the allotment management plan. Effects of heritage management are identical across all alternatives.

Wilderness Recommendation: Livestock grazing "and activities and the necessary facilities to support a livestock grazing program, will be permitted to continue in National Forest wilderness areas, when such grazing was established prior to classification of an area as wilderness" in accordance with Congressional Grazing Guidelines (WO Amendment 2300-90- 2, FSM 2323.2, pp. 19-26). There is to be "no curtailment of grazing permits or privileges in an area simply because it is designated wilderness...Wilderness designation should not prevent the maintenance of existing fences or other livestock improvements, nor the construction and maintenance of new fences or improvements which are consistent with allotment management plans and/or which are necessary for the protection of the range."

Management of permitted livestock in these areas can be made more difficult and costly than in other areas of the Shoshone due to (1) restricted motorized travel for access, (2) restricted use of motorized equipment such as chainsaws, and (3) restrictions on other management activities such as design of new range improvements. The restriction of travel for access, however, can also be viewed as a benefit. Since areas without motorized use contain a lesser diversity of uses (i.e., only non-motorized recreation), fewer conflicts between users with different expectations of their recreation experience are likely to occur. Indirect effects from wilderness management include (1) an increased expectation of no livestock presence by forest visitors and associated complaints, (2) a need to manage around a recreational "wilderness" experience to minimize conflicts, with a potential increase in people and horse use (and associated conflicts) over levels prior to this designation, (3) a need to manage for wilderness character and plant communities, and (4) a potential loss of opportunity for issuance of off-road travel permits for construction and maintenance of range improvements.

Taking all these impacts into account, on average, the greater the amount of wilderness acreage within an allotment, the greater the cost and increased difficulty of managing livestock. As such, alternative C would have the most impact, followed by alternative D. Alternatives A, B, E, F, and G would have no change from the existing condition. See table 100.

Table 100. Affected existing commercial livestock allotments and acreage from wilderness, by alternative

Allotment name	Status	Allotment acres	Alternatives A, B, E, F, and G		Alternative C		Alternative D	
			Acres	%	Acres	%	Acres	%
Aspen	Active	2,100	0	0%	0	0%	0	0%
Atlantic	Vacant S&G	19,510	0	0%	7,820	40%	0	0%
Atlantic City	Active	970	0	0%	0	0%	0	0%
Bald Ridge	Active	24,610	3,190	13%	5,170	21%	3,190	13%
Basin	Active	69,300	10,700	15%	54,300	78%	10,700	15%
Bayer Mountain	Active	5,630	0	0%	0	0%	0	0%
Bear Creek	Active	34,900	12,700	37%	25,100	72%	12,700	37%
Beartooth & Face of the Mtn.	Active	38,600	0	0%	32,600	84%	0	0%
Beaver Creek	Active	1,030	0	0%	0	0%	0	0%
Belknap	Active	10,900	0	0%	10	0%	0	0%
Bench	Active	28,400	0	0%	24,100	85%	0	0%
Big Creek	Active	18,700	12,400	66%	16,500	88%	16,300	87%
Bobcat	Active	6,520	0	0%	3,760	58%	0	0%
Bull Creek	Active	400	0	0%	0	0%	0	0%
Burnt Mountain	Vacant S&G	4,190	0	0%	2,960	71%	0	0%
Carter Creek	Active	160	0	0%	0	0%	0	0%
Community	Active	15,000	0	0%	12.000	80%	0	0%
Cottonwood	Forage Reserve	6,690	0	0%	5,220	78%	5,220	78%
Crandall	Active	28,700	10,500	37%	14,000	49%	10,500	37%
Deer Creek	Active	4,420	0	0%	3,750	85%	3,420	77%
Dick Creek	Active	10,600	0	0%	6,690	63%	2,820	27%
Dickinson Park	active/ vacant	22,140	7,940	36%	17,500	79%	7,940	36%
Doby Cliff	Active	800	0	0%	0	0%	0	0%
Dunoir	Active	53,200	4,250	8%	38,800	73%	38,800	73%
Ed Young Basin	Active	11,300	0	0%	0	0%	0	0%
Fish Lake	Active	12,700	0	0%	0	0%	0	0%
Francs Peak	Vacant S&G	14,100	0	0%	14,000	100%	14,000	100%
Frye Lake	Active	21,700	1,100	5%	7,870	36%	1,100	5%
Ghost Creek	Active	10,700	0	0%	4,130	38%	0	0%
Gooseberry	Forage Reserve	10,730	0	0%	8,770	82%	4,890	46%
Greybull	Active	34,600	11,700	34%	30,600	88%	30,500	88%
Guard Station	Active	13,200	0	0%	12,500	94%	11,000	83%
Hardpan/Table Mtn.	Active	32,100	6,500	20%	13,700	43%	13,700	43%
Hays Park	Active	8,670	8,670	100%	8,670	100%	8,670	100%
Horse Creek	Active	28,240	18,500	65%	18,500	65%	18,500	65%
Hunter Creek	Active	1,600	670	42%	670	42%	670	42%

Table 100. Affected existing commercial livestock allotments and acreage from wilderness, by alternative

Allotment name	Status	Allotment acres	Alternatives A, B, E, F, and G		Alternative C		Alternative D	
			Acres	%	Acres	%	Acres	%
Ishawooa Hills	Active	1,130	280	25%	2,880	255%	280	25%
Kirwin and Wood River	Active	21,640	0	0%	17,260	80%	14,747	68%
Lake Creek	Forage Reserve	18,900	7,490	40%	7,490	40%	7,490	40%
Little Rock	Active	4,900	0	0%	3,310	67%	0	0%
Maxon Basin	Active	3,790	0	0%	0	0%	0	0%
Meadow Creek	Active	1,350	1,350	100%	1,350	100%	1,350	100%
Meeteetse	Active	5,820	0	0%	0	0%	0	0%
Middle Fork	Active	26,500	12,900	49%	20,800	79%	12,900	49%
North Fork Winter Range	Forage Reserve	4,530	0	0%	4,530	100%	4,530	100%
Parque Creek	Active	13,400	4,110	31%	5,250	39%	5,250	39%
Peat Beds	Vacant S&G	5,830	0	0%	5,100	88%	0	0%
Pickett Creek	Active	14,300	0	0%	12,700	89%	0	0%
Pine/Willow	Active S&G	18,300	0	0%	14,200	77%	0	0%
Piney	Active	13,700	13,700	100%	13,700	100%	13,700	100%
Ramshorn	Active	16,200	3,420	21%	8,290	51%	9,450	58%
Rand Creek	Active	1,580	1,100	69%	4,220	266%	1,100	69%
Rennerberg	Active	1,350	0	0%	1,060	79%	0	0%
Robbers Roost	Active	50,600	3,660	7%	26,200	52%	33,800	67%
Sage Creek	Active	920	0	0%	0	0%	0	0%
Salt Creek	Active	8,260	0	0%	0	0%	0	0%
Sawmill Creek	Active	9,400	0	0%	0	0%	0	0%
Slate Creek	Active	8,700	0	0%	900	10%	0	0%
South Pass	Active	4,830	0	0%	0	0%	0	0%
Squaw Creek	Active	6,300	0	0%	2,930	46%	0	0%
Sugarloaf & East Fork	Active	20,000	10,200	51%	20,000	100%	20,000	100%
Table Mountain	Resource Protection Non-Use	13,800	0	0%	13,600	99%	0	0%
Timber Creek	Active	10,000	0	0%	7,360	74%	6,290	63%
Twin Peaks S&G	Vacant S&G	4,700	4,700	100%	4,700	100%	4,700	100%
Union Pass	Active	39,800	2,870	7%	9,100	23%	2,870	7%
Valley-Boulder	Active	3,380	2,460	73%	2,460	73%	2,460	73%
Warm Springs & Wind River	Active	62,200	0	0%	3,750	6%	3,160	5%
Washakie Needles	Active	7,760	7,780	100%	7,780	100%	7,780	100%
Whiskey Mountain	Active	12,400	12,000	97%	12,000	97%	12,000	97%
Wiggins Fork	Active	44,600	5,990	13%	23,800	53%	5,990	13%

Table 100. Affected existing commercial livestock allotments and acreage from wilderness, by alternative

Allotment name	Status	Allotment acres	Alternatives A, B, E, F, and G		Alternative C		Alternative D	
			Acres	%	Acres	%	Acres	%
Yellow/Steer	Vacant S&G	19,299	14,100	74%	19,200	100%	19,200	100%
Forest-wide Summary		1,107,000	217,000	20%	665,600	60%	403,900	36%

Effects from potential research natural area or special interest area: Designation generally precludes commercial livestock grazing, although incidental use may occur. None of the potential research natural area or special interest areas contain significant acreage of suitable livestock range within any active commercial allotment. Table 101 displays the allotments and suitable acres impacted for each potential research natural area or special interest area by alternative.

Table 101. Research natural area/special interest area (RNA/SIA) acres in active allotments

Allotment name	Allotment acres in RNA/SIA	RNA/SIA name	Alternative	Suitable allotment acres in RNA/SIA	Stocking rate	AUMs impacted by RNA/SIA
Beartooth and Face of the Mtn.[a]	1,090	Line Creek RNA	ALL	380	8.6	22
Crandall I & II[b]	30	Swamp Lake SIA	ALL	30	6.3	2.5
Bench	1,900	Bald Ridge RNA	C	1	6.9	0
Basin	1,570	Pat O'Hara RNA	C	5	13.1	0
Bald Ridge	410	Bald Ridge RNA	C	93	3.2	17
Bald Ridge	1,800	Pat O'Hara RNA	C	72	3.2	12
Robber Roost[b]	1,690	Pat O'Hara RNA	C	670	4.9	70
Kirwin and Wood River[c]	480	Kirwin SIA	B, C, D & E	120	7.7	8
Maxson Basin	420	Little Popo Agie Moraine SIA	B, C & D	6	4.3	1
Ghost Creek[b]	550	Swamp Lake	ALL	220	3.1	36
TOTALS	9,890			1,600		169

[a] High elevation that presently receives only incidental livestock use.

[b] Area of standing water, high water table or soft ground that livestock avoid except during persistent drought.

[c] Due to limited access livestock do not typically use this part of the allotment.

Establishment of potential research natural areas or special interest areas would have no significant effect on existing livestock operations across all alternatives.

Summary of Effects to Resource

Alternative C would eliminate term permits for commercial livestock grazing on elk and big horn sheep crucial winter ranges that occur on active allotments. This alternative has the greatest potential adverse impact on livestock grazing. Alternatives A, B, D, and G are similar, and would essentially maintain the existing level of use. Alternative E would remove the allowable forage utilization restriction on big game crucial winter range, and in addition to that, alternative F would add any suitable and capable areas outside wilderness areas. Alternative F would provide the most opportunities for livestock grazing.

Cumulative Effects

This discussion considers effects to commercial livestock grazing since it began on the Shoshone, through the next planning period. It considers effects to the Shoshone and the adjoining counties. The impacts from historic livestock use of the Shoshone continue to be evident, and to a certain degree, influence livestock management today. For example, some areas are continuing to recover from the impacts of heavy or improperly managed livestock grazing in the early 1900s. Riparian areas altered by both commercial and recreational livestock use and/or tie hacking activities also continue to recover. Livestock management in these areas has been tailored to enhance and continue recovery. Fire suppression activities in the past have resulted in conifer encroachment in areas, which, in turn, can limit forage production and availability today, and affect livestock use and distribution patterns. More recently, large areas of beetle-killed timber have reversed some of these impacts and increased the acreage of transitory range.

Based on increased use by the public over the past 10 years, it is expected that the impact of recreational uses on the Shoshone will increase as the population of local communities increases, and as more people nationwide continue to seek places to recreate. All-terrain vehicle use, in particular, has seen a dramatic increase recently that is expected to continue, although the rate of growth is not likely to be as dramatic as it has been in the recent past. Vegetation management and the use of prescribed fire will likely increase in coming years to address vegetative health, fuel loads, and public safety. This can result in short-term expenses and long-term benefits to livestock grazing.

Commercial livestock grazing on the Shoshone today is influenced by the litany of effects described in the section above that include the allocation of forage resources between livestock and wildlife; limitations introduced by wilderness and research natural area or special interest area designation; predation and disease transmission; management adjustments to protect heritage resources; fisheries; threatened, endangered, and sensitive plants and animals; and water quality; considerations necessary due to wildfire and prescribed fire management, and recreation activities that result in gates being left open, livestock harassed, or impacts to resources being inaccurately attributed to livestock. All of these factors add to the complexity and expense for the ranching operations that are permitted to graze livestock on the Forest (Rimbey and Torell 2011). Despite all these factors, continued demand and the need for livestock grazing is likely to remain fairly consistent with current levels. Livestock management is generally considered more difficult on NFS lands than on private lands for the reasons described above. In addition, the business of livestock management is subject to factors most often not under the control of livestock operators, such as tourism, land values, and potential subdivision of base ranches, labor prices and availability, foreign markets and lamb/calf prices, USDA budgets and farm programs, fuel prices, predator control, social values, and Federal policy.

Because of, and in many cases despite of, the effects described above, livestock grazing is expected to continue on the Shoshone at or near the currently permitted level through this next planning period. Management of livestock grazing to deal with cumulative effects will be consistent across all alternatives.

Monitoring

Two types of monitoring are most applicable to commercial livestock grazing and the rangeland resource.

Implementation Monitoring: Determines whether standards and management practices are implemented as detailed in the forest plan and allotment management plan. The question asked with this type of monitoring is: “Did we do what we said we were going to do?” Implementation monitoring is short-term and includes allotment inspections and utilization estimates. Examples of implementation monitoring specified in the forest plan are allowable forage utilization levels for livestock grazing, residual forage requirements for big game winter range or streambank stability, and livestock counts to validate permitted stocking.

Effectiveness Monitoring: Determines whether management practices are effective in moving the resource toward the desired condition as described in the forest plan and allotment management plan objective. The question asked is: “Did the management practices do what we wanted them to do; did they meet the objectives?” An example of effectiveness monitoring is trend studies that determine whether vegetation is moving toward the desired condition and plant community. Effectiveness monitoring is long-term monitoring. Examples of effectiveness monitoring relative to the forest plan are vegetative composition transects to determine plant community or ecological site description, photo point transects to determine site changes toward or away from the desired condition.

In summary, implementation monitoring will tell if we are meeting the standards and guidelines, and effectiveness monitoring will reveal if management within the standards and guidelines is achieving the desired resource condition.

Forest Products

Timber Resources

Introduction

The Shoshone contains valuable timber resources. They are important for providing habitat for plants and animals and products that are in demand by the American public. These products include, but are not limited to lumber, house logs, posts and poles, and firewood. Because of the value of the timber resource, commercial timber harvest is used to move vegetation toward their desired conditions, improve watershed condition, improve wildlife habitat, and reduce wildfire risk through reduced fuel loads. Timber harvest also provides jobs and income in logging and manufacturing of wood products.

Legal and Administrative Framework

Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act of 1976 – these acts set forth the requirements for land and resource management plans for the National Forest System. 36 CFR 219 regulations require the Forest Service to identify areas suitable and available for timber harvest and the allowable sale quantity (ASQ) from those lands. In addition, regulations require us to analyze the supply and demand for resource commodities.

Multiple-Use Sustained Yield Act of 1960 – "It is the policy of the Congress that the national forests are established and shall be administered for outdoor recreation, range, timber, watershed and wildlife and fish purposes…The Secretary of Agriculture is authorized and directed to develop and administer the renewable surface resources of the National Forests for multiple-use and sustained yield of several products and services obtained there from…the achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the national forests without impairment of the productivity of the land."

Organic Administration Act of 1897 – Forests are established "to improve and protect the forest within the boundaries, or for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States."

Regulation and Policies

1982 Planning Rule Procedures: The procedures of the 1982 NFS Land and Resource Management Planning Rule require the identification of areas suitable for timber production and the allowable sale quantity from those lands. In addition, the procedures require the analysis of the supply and demand situation for resource commodities.

Key Indicators

- Number of suitable acres available for timber production;
- Associated allowable sale quantity;
- Acres of predicted harvest; and
- Long-term sustained yield capacity.

Methodology and Analysis Process

Timber suitability was determined using various resource data and GIS to apply criteria and identify lands suitable for timber production. Criteria for suitability are defined in the 1982 Planning Rule procedures at 36 CFR 219.14. Data were developed using the latest data sources and requirements to match the criteria defined by resource specialists.

Timber harvest was modeled using Spectrum, a software modeling system designed to assist decision makers in exploring and evaluating multiple resource management choices and objectives. Models constructed with Spectrum apply management actions to landscapes through a time horizon and display resulting outcomes. Management actions are selected to achieve desired goals while complying with all identified management objectives. One of the goals for all action alternatives was the objective to move vegetation toward desired condition. Other goals that were applied for some alternatives included maximizing timber output and present net value. The Spectrum model was used to determine allowable sale quantity, predicted timber volume sold, and acres treated by decade for each alternative.

Analysis Area

The analysis area for timber suitability is composed of the NFS lands administered by the Shoshone. The analysis area for timber demand consists of three counties comprising the timber impact zone. The analysis area for timber production is the lands suitable for timber production.

Affected Environment

The 1986 Forest Plan as amended set an average annual allowable sale quantity volume[28] of 22,400 hundred cubic feet (Ccf). The Forest Plan set this amount as the maximum allowable harvest of timber from the suitable timber land base of approximately 86,000 acres. In the early 1990s, monitoring indicated that timber data and assumptions used in the Forest Plan analysis had overestimated the amount of timber the Shoshone could produce. This, combined with the 1988 fires that burned over 9,000 acres of suitable timber land, resulted in the need to amend the forest plan. The 1986 Forest Plan as amended was amended in August 1994, with a recalculated allowable sale quantity (USDA Forest Service 1994). The amendment changed the annual average volume to 9,000 Ccf of sawtimber and products other than logs. The 9,000 Ccf includes 2,000 Ccf of standing dead trees that are cut for personal use firewood from suitable lands. Volume in addition to the allowable sale quantity is obtained from the unsuited base; including approximately 2,000 Ccf of personal use firewood and 2,000 Ccf of volume cut for other vegetation management purposes. Other reasons include wildlife habitat improvement, enhancement of scenic views, hazard tree removal, or other ecosystem management reasons. The amendment directed that all salvage volumes offered for sale would count toward allowable sale quantity.

Total average annual volume harvested fell steadily through the1990s, until an increase in 2004. The volume of products other than logs sold since 1986 has averaged slightly over 6,000 Ccf per year. Volume for products other than logs remained relatively stable during that period. Sawtimber volume sold has fluctuated greatly since 1986. Sawtimber volume sold has averaged 11,000 Ccf since 1986. Since 1997, sawtimber volume sold has averaged 8,400 Ccf. During the late 1990s and early 2000s, sawtimber volume sold was as low as 200 Ccf (see table 102).

[28] Per NFMA the allowable sale quantity (ASQ) is a per decade number. For the 1986 plan the ASQ would have been 22,400 thousand cubic feet (Mcf) in the first decade. The numbers are displayed here as average annual volumes for discussion purposes.

The large fluctuations in total sawtimber volumes were driven by salvage sales in response to large disturbance events such as the 1988 wildfires and the recent insect epidemic.

Table 102. Volume sold and harvested, by product, in hundred cubic feet (Ccf)

Fiscal year	Sawtimber sold	Products other than logs sold	Total		Sawtimber harvested	Products other than logs harvested	Total
1981	15,800	2,430	18,200		21,300	3,150	24,500
1982	16,900	5,770	22,700		7,250	4,830	12,100
1983	18,200	8,350	26,500		10,700	3,500	14,200
1984	13,950	8,840	22,800		13,000	8,100	21,100
1985	9,940	10,200	20,100		23,100	8,690	31,800
1986	9,490	7,610	17,100		17,600	8,720	26,300
1987	30,800	6,520	37,300		29,300	9,650	39,000
1988	24,100	4,540	28,600		24,700	7,180	32,000
1989	27,200	4,210	31,500		12,000	4,220	16,000
1990	21,000	4,870	25,900		29,400	4,720	34,000
1991	14,200	6,580	20,800		20,100	4,980	25,100
1992	2,650	6,340	8,990		13,900	6,600	20,500
1993	5,460	6,880	12,300		8,400	5,950	15,000
1994	4,510	10,400	14,900		7,900	7,580	15,500
1995	570	6,840	7,410		2,280	7,590	9,870
1996	5,700	7,570	13,300		4,470	7,250	11,700
1997	4,480	5,940	10,400		3,460	7,950	11,400
1998	4,630	6,720	11,400		770	10,400	11,200
1999	2,320	8,500	10,800		2,580	8,180	10,800
2000	800	4,400	5,200		4,040	3,220	7,260
2001	220	5,850	6,070		2,140	5,790	7,930
2002	8	4,930	4,940		1,260	5,240	6,500
2003	2,820	4,920	7,740		2,090	5,180	7,270
2004	42,700	5,080	47,800		11,500	4,930	16,400
2005	8,740	5,190	13,900		23,900	5,460	29,400
2006	6,700	5,180	11,900		15,800	5,830	21,600
2007	21,400	4,290	25,700		7,450	4,540	12,000
2008	8,350	4,650	13,000		13,100	3,950	17,100
2009	12,000	7,500	19,500		15,000	5,730	20,700
2010	1,390	4,680	6,070		9,380	5,480	14,900
2011	24,530	5,110	29,600		6,300	4,960	11,300

Timber growth and mortality was assessed by Menlove (2008) using Forest Inventory and Analsysis data (FIA). Net annual growth is the difference between gross annual growth and losses due to mortality. Gross annual growth of live trees on all forest land on the Shoshone National Forest was estimated to be 40 million cubic feet, and net annual growth was 3.4 million cubic feet (Menlove 2008). Most of this data are from before the current insect epidemic. It is highly likely that during the height of the insect epidemic mortality exceeded growth. It is anticipated that with the waning of the epidemic and the regeneration of a new age class of trees that growth will again exceed mortality going forward.

Clearcutting is the one treatment that garners the most attention from some visitors or local residents. Clearcutting is not a significant component of the treatments on the Shoshone (table 103).

Table 103. Clearcut acres on the Shoshone National Forest, 1986 to 2012

Fiscal Year	Acres
1986	0
1987	26
1988	2
1989	0
1990	0
1991	0
1992	56
1993	0
1994	0
1995	0
1996	9
1997	22
1998	35
1999	34
2000	9
2001	9
2002	5
2003	0
2004	72
2005	2
2006	44
2007	0
2008	0
2009	72
2010	60
2011	137
2012	57

Economics

The following economic information is from *An Economic Profile of the Shoshone National Forest* (Taylor et al. 2012). It is included in the Plan Set of Documents. Additional information on the timber industry in Wyoming is found in *The Dynamic Wyoming Timber Economy* (Rideout 2003).

The lumber and wood products industry in the three-county area has declined. After peaking in 1978, labor earnings from lumber and wood products declined steadily from $14.3 million to $2.0 million in 2000. With the closure of Cody Lumber Sawmill in Cody, labor earnings from lumber and wood products in the region may have declined further. Most of the decline in labor earnings for the lumber and wood products sector in the three-county region occurred in Fremont County when a major sawmill closed in Dubois. In Fremont County, labor earnings from the lumber and wood products sector peaked at $13.4 million in 1978, and had declined to less than $1 million in 2000. As of 2001, county-level information specifically for lumber and the wood products industry was no longer available. An IMPLAN (input/output model) done in 2011 estimated the economic impacts of harvesting 4.5 million board feet (MMBF) of timber in the three-county region. The IMPLAN model estimated labor earnings of $1.9 million (2009 dollars) for harvesting 4.5 MMBF of timber and 2.5 MMBF of wood products other than lumber (University of Montana, IMPLAN Model of three-county region, Bureau of Labor Statistics, 2008, Taylor et. al. 2012).

The 1986 Forest Plan as amended as amended established an allowable sale quantity of 9,000 Ccf of timber. The volumes have fluctuated greatly since 1986 and have recently been increasing; the average for that period is near the 1986 Forest Plan as amended allowable sale quantity amount. For purposes of an average economic projection, calculations were based on a sawtimber harvest of 9,000 Ccf and products other than logs harvest of 5,000 Ccf. This is slightly above the amounts in the allowable sale quantity amendment, but in line with recent harvest levels.

Because there is no major timber processor in the three-county region, the majority of sawtimber harvest on the Shoshone is exported outside the area for processing. As a result, the major economic impact to the region’s economy from the harvest of sawtimber on the Shoshone is logging. For the three-county region, the economic impact of the combined timber harvest is estimated (per IMPLAN model) at 9,083 jobs and $21.9 million in labor earnings, including direct logging jobs and additional jobs that are generated as a result of the direct jobs(Taylor et al. 2012).

Evaluation

Due to the bark beetle insect epidemic, harvest levels have been temporarily higher than average until the epidemic subsides, fuel levels are reduced, and the volume of damaged timber is salvaged. The increased harvest levels should continue until areas of wildland-urban interface can be protected and as long as there is some value in standing dead timber. It is anticipated the demand for products other than logs will continue at or above the current levels of 5,000 Ccf. Once the salvage effort is completed, it is anticipated the Shoshone will return to a harvest level near 9,000 Ccf of sawtimber and 5,000 Ccf of products other than logs. In the near term, the slightly higher volumes will result in proportionally higher economic benefits to the three-county region. In the long term, these levels of harvest may be difficult to maintain since 26 percent of the suitable base falls with inventoried roadless areas where timber cutting is restricted.

Desired Condition

The removal of wood products (sawtimber, small-diameter roundwood, chips, pulp, firewood, etc.) and other forest products (mushrooms, Christmas trees, pine cones, plants, greenery, etc.) contributes to ecological, social, and/or economic sustainability (including local communities) and associated desired conditions. A sustainable mix of timber products responsive to market demand, including that of local industry, is provided.

Provide a reliable supply of forest products over time that (1) is consistent with achieving desired conditions on NFS lands, and (2) helps maintain or create processing capacity and infrastructure in local communities.

Suitable timber lands are managed to produce a sustainable supply of commercial timber products.

Environmental Consequences

Lands generally suitable for timber production vary slightly across the alternatives. These are lands that are physically capable and have not been administratively withdrawn (such as wilderness) for timber harvest. Analysis identified a range of 86,300 acres in alternative A to 251,200 acres in alternative F as generally suitable, see table 104 and maps 27–32.

Table 104. Suitability acres for timber harvest and production by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Lands generally not suited for timber harvest							
Wilderness, Dunoir, High Lakes, wild river, RNA	1,419,000	1,430,000	2,001,000	1,598,000	1,417,000	1,417,000	1,430,000
Rock, steep slopes, Restocking not assured	339,900	339,000	78,600	245,400	346,300	346,300	339,000
Total lands generally not suited for timber harvest	1,759,000	1,769,000	2,080,000	1,844,000	1,764,000	1,764,000	1,769,000
Lands generally not suited for timber production							
Grass, shrub, noncommercial species, soil type	312,000	399,500	162,000	282,400	324,200	324,200	399,500
Management area direction	281,000	220,900	73,500	187,500	170,400	98,800	220,900
Total lands generally not suited for timber production	593,100	542,300	235,500	469,900	494,600	423,000	542,300
Lands generally suitable for timber production							
Total lands generally suitable for timber production	86,300	127,000	122,100	124,500	179,700	251,200	127,000
Total Forest Acres	2,438,000	2,438,000	2,438,000	2,438,000	2,438,000	2,438,000	2,438,000

Timber suitability is also affected by management area allocations. Lands in management areas 5.1, 5.2, and 5.4 are suitable for timber production. All other management areas preclude timber production as an objective. Timber harvest may be allowed in other management areas (2.2A, 2.3, 3.1B, 3.3A, 3.3B, 3.3C, 3.6, 4.2, 4.3, 4.5A, 8.1, 8.2, and 8.6), but only to meet other resource objectives. These acres are not suitable for timber production.

Alternative A is the current forest plan as amended and implemented. Timber suitability has been updated to reflect forest plan amendments and current conditions. Acres suitable for timber production are lower in this alternative than found in the action alternatives.

As the revised Forest Plan is implemented on the ground, timber suitability may change based on site-specific analysis. Broad-scale information is used in determining lands suitable for timber production in the revised Forest Plan. As a result, changes may occur at the project-scale level using site-specific data. Changes to timber suitability will be monitored during implementation of the revised Forest Plan.

Allowable Sale Quantity and Predicted Volume Sold

The allowable sale quantity for each alternative was formulated by considering the lands suitable for timber production, vegetation desired condition, other multiple-use objectives, and the management requirements set forth in NFMA. To develop a predicted volume sold, a budget constraint reflecting current budgets was included for each alternative.

The allowable sale quantity is considered a ceiling for harvest from the lands suitable for timber production, and certain conditions may arise where standards and guidelines may limit what volume is actually available during site-specific project implementation. Examples are water quality guidelines or wildlife and heritage resources protection measures. Where possible, the effect of these standards and guidelines has been taken into account in the calculation of the allowable sale quantity. See appendix B for a description of modeling analysis.

Products in the allowable sale quantity volume include traditional sawlogs and products other than logs (POL) harvested from lands identified as suited for timber production. POL includes posts, poles, chips, firewood, etc. POL does contribute toward the allowable sale quantity if removed from suited lands.

Timber harvest levels for the alternatives were calculated using Spectrum (see appendix B). The alternatives included constraints to distribute activities across the forest and among timber types to mimic feasible harvest patterns. Within these constraints, an objective function was applied to produce timber products from suitable timber lands. All solutions were finally run with an objective to maximize present net value to ensure economic efficiency in vegetation treatments.

Table 105 and table 106 display the predicted volume sold and allowable sale quantity for each alternative. The allowable sale quantity is a decadal number.

Table 105. Predicted volume sold for each alternative

Timber volume (Ccf)	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Saw timber	14,600	14,200	12,500	13,600	18,800	25,800	14,200
POL	800	760	720	740	1,030	1,400	760
Salvage	1,560	1,580	1,630	450	2,330	3,260	1,580
Total	17,000	16,550	14,900	15,900	22,100	30,500	16,550

Table 106. Allowable sale quantity for each alternative (per decade)

Timber volume (Mcf)	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Allowable sale quantity	19,800	22,800	21,900	22,400	32,800	46,600	22,800

Other factors including budgets and changes in executive and congressional direction or natural events like wind, wildfires, insects, and disease could cause actual harvest levels to be different than projected. For example, the Shoshone has not been budgeted recently at levels to fully implement harvest levels to keep ahead of the current bark beetle epidemic. The experienced budget level limits the amount of timber that can be prepared and offered.

Timber harvest may be allowed on unsuited lands and in other management area prescriptions but only to meet the resource objectives compatible with that management area. An example of this could be fuel reduction treatments within management area 4.5A Potential Kirwin Historical Area. Harvest in these areas is called other vegetation management (OVM) and would not contribute toward the allowable sale quantity. Historically, other vegetation management volume is fairly minor. Table 107 displays the acres by alternative harvesting from allowable sale quantity versus other vegetation management ground.

Table 107. Harvesting acres by alternative from allowable sale quantity versus other vegetation management ground (per decade)

ASQ/OVM Acres	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
ASQ	5,350	5,220	5,400	5,210	7,560	11,000	5,220
OVM	1,720	1,660	630	1,390	1,480	1,190	1,660
Total acres	7,080	6,880	6,030	6,600	9,040	12,200	6,880

Total sale program quantity includes all the volume expected to be offered from the Shoshone, given experienced budget levels for timber sale offerings from lands suitable for timber production that contributes toward allowable sale quantity and from other vegetation management on unsuited lands. Total sale program quantity includes volume from sawtimber, POL, personal use firewood, and post and poles from all sales and permits. The allowable sale quantity portion is calculated based on experience budget levels and the other vegetation management portion was based on estimates of anticipated acres of treatment prorated at the average volume per acre for suited lands. Personal use firewood is based on past recent history. No attempt was made to estimate the amount or type of salvage that may occur from natural events such as wildfire, blowdown, insects, and disease.

Table 108 displays the revenue by product and alternative, and table 109 displays the road costs by alternative to implement the allowable sale quantity.

Table 108. Revenue by product and alternative (per decade)

Timber revenue (M$)	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Saw timber	4,670	4,530	4,000	4,330	5,990	8,250	4,530
POL	60	57	54	55	77	110	57
Salvage	270	270	280	270	400	560	270
Total	5,000	4,860	4,330	4,650	6,460	8,900	4,860
Total timber cost (M$)	7,170	6,950	6,650	6,650	9,170	12,580	6,950

Table 109. Road costs to implement the allowable sale quantity by alternative (per decade)

Roads	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Reconstruction miles	28	28	24	26	36	49	28
Construction miles	2	2	2	2	2	3	2
Temporary roads miles	22	21	19	20	28	38	21
Road costs (M$)	640	620	550	590	820	1,110	620

Reforestation

Reforestation is the re-establishment of forest cover either naturally (by natural seeding, coppice, or root suckers) or artificially (by direct seeding or planting) (Helms 1998). The implementing regulations for the National Forest Management Act (NFMA) state:

"When trees are cut to achieve timber production objectives, the cutting shall be made in such a way as to assure that the technology and knowledge exists to adequately restock the lands within five years after final harvest. Research and experience shall be the basis for determining whether the harvest and regeneration practices planned can be expected to result in adequate restocking." Further, "Five years after final harvest means five years after clearcutting, five years after overstory removal cut in seed tree cutting, or five years after selection cutting" (36 CFR 219.27)

Generally, harvests from suitable timber lands, described above, are used to achieve timber production objectives. Harvests from lands not suitable for timber production are not addressed above; however, they are generally restocked except where permanent openings are created for wildlife, habitat improvement, vistas, recreation uses and similar practices (36 CFR 219.27). Natural disturbances, such as wildfire or blowdown may also create a reforestation need; however, decisions to artificially reforest these areas are made on a site-specific basis. The Shoshone relies primarily on natural regeneration. Final harvest cuts on the Shoshone are generally successful using natural regeneration following harvest. Where regeneration is not expected to occur naturally, planting has been the preferred method for artificial regeneration.

Table 110 displays the expected acres that will need to be planted by alternative and the associated costs.

Table 110. Acres expected to be planted and associated costs by alternative (per decade)

Timber regeneration	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Planting acres	2,320	2,280	1,930	2,200	2,920	3,790	2,280
Planting costs ($M)	510	510	360	490	610	780	510

Timber Stand Improvement

Timber stand improvement is generally non-commercial or precommercial thinning of trees to meet density-level objectives for stand health, growth, vigor, and other resource objectives such as wildlife hiding cover.

There are some tradeoffs between thinning conifer stands that provide habitat for Canada lynx prey species (snowshoe hare) and thinning stands to produce more timber volume. The action alternatives include 2,130 acres of precommercial thinning in lynx habitat during the planning period. This thinning allows the opportunity to manage for timber in lynx habitat while limiting the number of acres of lynx habitat that will be impacted. The effects of this small amount of thinning are not expected to adversely affect Canada lynx.

The precommercial thinning acres will remain the same, approximately 450 acres a year across all alternatives for the next 10 years. The alternatives with higher suitable acres—E and F—will have higher numbers of acres to thin, about 15 years out. Thus, alternatives with less suitable acres—A and C—will have fewer precommercial thinning acres about 10 years out.

The cost of thinning on the Shoshone in recent years has been $450 per acre.

Direct and Indirect Effects

Effects from Fire and Fuels: Fire and fuels management includes mechanical and prescribed fire treatments, and generally has a positive effect on timber management. The objectives for fuel reduction are consistent with commercial timber harvest. Timber harvest is often the tool for reducing fire risk through a reduction in fuel loading. Timber harvest also moves vegetation toward desired conditions that are more resilient and less fire-prone. Alternative F would include the most fire treatments with 41,200 acres and result in the most positive impact on timber harvest. Alternatives A through D include from 36,100 to 35,000 acres of fire treatment and would result in similar positive impacts on timber harvest. Effects for alternative E with 37,400 acres of fire treatment would fall between alternative F and the balance of the alternatives.

Effects from Aquatic Habitat, Riparian, Watershed, and Wildlife: Design criteria to protect aquatic habitat, riparian areas, watersheds, and wildlife can impact the timing and extent of timber harvested in a given area and at a given time. These measures can increase the costs associated with harvesting timber in some cases. None of these design criteria impacts will change the annual amount of timber that is being harvested on the Shoshone. The only effect is on the particular timing and location of some harvest. These impacts are similar across all alternatives and do not affect the timber output projections presented for the alternatives.

Effects from Insects and Wildfire: Insects, disease, and wildfire can affect the production of timber by killing and damaging trees. This reduces the value of the timber and lowers that value to the point where it is no longer economical to harvest the timber for commercial products. This can also lower the amount of timber that is available during a particular time period; though as long as stands are regenerated, this will not have a long-term impact on available timber volume. Acres of suitable timber that are projected to be impacted by wildfire range from 8,151 in alternative C to 16,630 in alternative F. This increase across the alternatives is a function of the fact that the acres of suitable timber increase across the alternatives. Total projections of wildfire acres on the Forest actually decrease as the acres of suitable timber land increases, because of the emphasis on suppressing fire on suitable timber lands.

Under all alternatives, there exists potential for salvage/sanitation cuts to harvest dead and damaged timber and to attempt to slow or impede insect infestations from spreading or to salvage the value of timber killed by wildfire. The degree to which these harvests are undertaken will largely depend upon the risks associated with wildfire potential, insect infestation spread into healthy stands, public safety, the presence of high value resources, access to the timber, and the plan management direction of the area and adjoining areas.

Acres of salvage/sanitation harvest will continue to be a portion of total timber harvested. Differences across the alternatives will be similar to the differences shown for total harvest. Given the direction for management of suitable land is similar across the alternatives, the portion of salvage/sanitation harvest from those lands would generally be similar across the alternatives. There is some chance that the more extreme alternatives will have some differences. There could be less salvage in alternative F, where there are more managed lands and less wildfire, and more salvage harvest in alternative C, where there are less managed lands and more wildfire. The relative differences between the other alternatives are unlikely to show any significant differences in the proportion that salvage harvest is of the total harvest on the forest.

Cumulative Effects

Many factors influence and affect timber harvest. The demand for timber products, supply from other sources, laws, and regulations all affect the amount of timber that may be harvested from the Shoshone. Budgets and court decisions also impact timber supply potential. Following is a brief description of some items that are changing or may change in the future, adding to the effects on timber harvest from the alternatives. Through the life of this revised Forest Plan, climate change is not expected to impact the amount of timber harvest.

Demand and Future Timber Products

The demand for timber products is a driver in the amount of wood fiber supplied from the Shoshone. Diversification of wood product manufacturing has historically allowed Montana mills to be more resilient in changing markets (Montana DNRC 2010). This diversification leads to new products and new processing techniques, and affects the demand for wood fiber. If markets improve and demand for wood products increases, there will be the desire for more wood fiber from the Shoshone. If demand decreases and mills close, there may be less desire for wood fiber from the Shoshone. A decrease in demand may reduce the amount of timber sold from the Shoshone under all alternatives.

Alternative Sources for Wood Fiber

The supply of wood fiber from private and State lands and adjacent national forests impacts Shoshone demand. If wood fiber supplies decrease from private and State lands and adjacent national forests, there will be an increasing demand for wood fiber from the Shoshone. If supplies increase from private and State lands and adjacent national forests, there may be a decrease in demand for wood fiber from the Shoshone. A decrease in demand may reduce the amount of timber sold from the Shoshone under all alternatives.

Special Forest Products

Introduction

Special forest products are mainly plant and fungal material that are gathered from forested lands or rangelands for personal use, for barter, for commercial resale, or for sale as a craft product. They can generally be categorized under five general areas: residential comfort and use, food, herbs and medicinal, decorative, and specialty items. Special forest products can play a role in sustainable development and are thought to provide links to sustaining rural economies and contributing to economic diversification. As demand for these special products increases and new markets are created, harvest pressure may increase, but has remained fairly constant over the years.

Legal and Administrative Framework

Sustained Yield Forest Management Act of 1944 and the Multiple Use Sustained Yield Act of 1960: Allow for the production of multiple quality goods and resources at sustained levels over time, including forest products.

36 CFR 223.1: Trees, portions of trees, and other forest products on NFS lands may be sold for the purpose of achieving the policies set forth in the Multiple-Use Sustained Yield Act as amended and the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended and the Program there under.

36 CFR 261.6(a): Cutting or otherwise damaging a forest product except as authorized by a permit or Federal law.

36 CFR 261.6(e): Loading, removing, or hauling a forest product acquired under any permit unless such product is identified as required in such permit.

36 CFR 261.10(c): Selling or offering for sale any merchandise or conducting any kind of work activity or service unless authorized by a Federal law, regulation, or permit.

36 CFR 261.10(l): Violating any condition or term of a permit.

FSM 2467: Sales of special forest products

FSM 2467.01: Authority: Forest officers may sell other forest products under provisions set out at 36 CFR 223.1.

FSM 2467.02: Objective: To sell other forest products where it would serve local needs and meet land management objectives.

FSM 2467.03: Policy: Use management measures that perpetuate or increase the production of miscellaneous forest products within applicable objectives, standards, and guidelines of the Shoshone National Forest land and resource management plan. Recover the fair market value of such products when it is practical to do so.

FSM 2467.04: Responsibility: See FSM 2404.2 for delegations of authority and assignments of responsibility to agency officials by organizational level. Regional Foresters shall develop appraisal and sale procedures, including defining the conditions of sale for forest products.

FSM 2467.1: Conditions of Use for Miscellaneous Forest Products: Conditions for use of miscellaneous forest products are set forth in FSH 2409.18, section 87.

FSM R2 Supplement No. 2400-96-2: 2431.3: Minimum and Standard Rates.

2431.31a: Standard Rates. “Standard rates may be used for sale of all nonconvertible products and Special Forest Products. Forest Supervisors may establish higher standard rates when supported by an appraisal specialized for that product. Limit standard rates for convertible products to less than 4,000 CCF.”

Permits are generally required for harvest of special forest product resources, as well as for research collections. The permit regulates the manner in which forest product resources are harvested and provides information for monitoring the amount harvested. Collections that qualify as non-commercial research, educational use, or incidental personal use can be authorized through an administrative use permit or a free use permit.

Methodology

The analysis included a review of rules and regulations for special forest and botanical products and effects based on management area allocation for each alternative. Management areas with more access allow for increased availability of special forest products.

Affected Environment

Special forest and botanical products are plant and fungal material that may be collected from NFS lands. Special forest and botanical products include, but are not limited to, mosses, fungi (including mushrooms), bryophytes, liverworts, roots, bulbs, berries, seeds, wildflowers, forbs, sedges, grasses, nuts, ferns, tree sap, boughs, bark, cones, burls, transplants, pine straw, Christmas trees, firewood, posts and poles, shingle and shake bolts, mine props, rails, vigas, bow staves, and fence material. These products are available through commercial harvest, personal use, and through free use. Historically, the Shoshone has granted commercial and or free use of special forest and botanical products to individuals and tribes with treaty and other reserved rights.

Special forest and botanical products may be collected Forest-wide, unless an area has been closed for a specific reason. Existing uses are often tied to historical knowledge and patterns of use. The most popular special forest and botanical products on the Shoshone include firewood, Christmas trees, transplants, teepee poles, and boughs. Mushroom picking can be a popular activity following wildfires. In recent years, requests from the general public for commercial and free use collection of special forest and botanical products have remained about the same.

Special forest and botanical products have importance to the tribes as traditional and cultural uses. As per current handbook direction (2409.18, section 87.13), the Shoshone considers “treaty rights, customary and traditional uses (including subsistence and other historical uses of plant material by Tribes), the Federal trust responsibility to Tribes, and competitive market demands in determining which products would be excluded from or allowed for sale to commercial harvesters. When there is a shortage of any particular special forest product for tribal use, commercial permits will be issued only to the extent that the tribal use can be accommodated.”

The Shoshone consults and coordinates with tribal governments prior to issuing any permits, contracts, or other authorized instrument when there is a possible impact to tribal treaty and other rights and interests in the permitted or contracted area (handbook direction 2409.18, section 87.18). The Shoshone honors the unique legal relationship, including the trust relationship, between the Federal Government and Indian Tribal governments.

In addition, the Forest Service has the responsibility to honor Indian Tribes' reserved rights (handbook direction 2409.18, section 87.2). The gathering of forest products by the 11 recognized tribes is a reserved right on the Shoshone. The 11 recognized tribes may remove special forest and botanical products without charge or permit (36 CFR 223.239(e)).

The supply of desired products is dependent on ecological conditions and existing distributions of potential habitat (see table 111). Forest management can increase the supply of certain products. Thinning and regeneration harvest can also increase production of Christmas trees. Firewood is often a by-product of a commercial timber harvest. With the recent bark beetle epidemics within the forest, there is no shortage of firewood, although accessibility may become an issue in areas closer to the population centers around the Shoshone.

Table 111. Association of special forest product with cover types

Special forest product	Cover type
Christmas trees	Lodgepole pine, spruce/fir, Douglas-fir
Moss	Montane riparian within lodgepole pine, spruce/fir
Burls	Lodgepole pine, spruce/fir
Cones	Lodgepole pine, spruce/fir, Douglas-fir
Mushrooms	Lodgepole pine, spruce/fir
Boughs	Douglas-fir, lodgepole pine, spruce/fir
Wildflowers and seed	All cover types
Cuttings	Willow and cottonwood
Transplants	Lodgepole pine, spruce/fir, aspen, Douglas-fir
Firewood	All forest cover types
Posts and poles	Lodgepole pine, spruce/fir

Permits for collection will generally be required. Care has to be taken to assure that native and desired non-native plant populations are not adversely affected due to over-harvesting and that conflicts with other uses are minimized.

Environmental Consequences

Special forest and botanical products may be collected for personal use Forest-wide except in some special areas (botanical and historical special areas) and research natural areas. Commercial use of special forest and botanical products is not allowed in designated wilderness; recommended wilderness; wilderness study area; wild, scenic, and recreational rivers; special areas; or research natural areas.

Table 112 displays the acres by management area where commercial use of special forest and botanical products is not allowed. Alternatives C and D have the most acres and alternatives A, B, E, F, and G have the least acres where commercial use of these products is not allowed. Acres not allowed for personal use remain constant for all action alternatives.

Table 112. Acres of management areas where commercial use of special forest and botanical products is not allowed, by alternative

Management area		Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
MA 1.1	Wilderness	1,359,000	1,359,000	1,359,000	1,359,000	1,359,000	1,359,000	1,359,000
MA 1.1A	Wilderness Glacier addition	6,560	6,560	6,560	6,560	6,560	6,560	6,560
MA 1.2, 1.2A, 1.2B	Recommended wilderness			628,800	194,500			
MA 1.6A	Wilderness study areas	15,200	15,200		15,200	15,200	15,200	15,200
MA 1.5A	Wild and scenic rivers	6,920	6,920	3,350	6,920	6,920	6,920	6,920
MA 3.1A, 3.1B, 3.1C	Botanical, geological (1)	580	2,940	2,940	2,940	580	580	2,700
MA 8.1, 8.2, 8.6	Administrative sites, developed recreational sites, recreation resident sites, ski resort (1) (2)	1,145	1,145	1,145	1,145	1,145	1,145	1,145

Requests for and use of special forest and botanical products are expected to slowly increase over the life of this revised Forest Plan; regardless of the alternative, the allowable collection of them, access to them, and how habitat conditions may vary. Alternative F provides the most areas with allowable use, the most access, and the most management activities to improve habitat conditions for special forest and botanical products.

Effects from Access: The opportunity for collecting special forest and botanical products is affected by the amount of motorized access to the Shoshone. Areas with no motorized access limit opportunities and reduce the ability to collect products. Alternative C has the most non-motorized access; thus, reduced opportunities for use. Alternative F has the most motorized access; thus, the best opportunities for use.

Direct and Indirect Effects

Effects from Roads and Trails Management: The existence of road access has the potential to impact the accessibility and viability of collection of forest products. This is undoubtedly true for firewood and may be true for other products. Alternative C decreases the miles of roads open to the public. Collection of special forest products under alternatives A through G would be similar, with more motorized access than alternative C.

Effects from Disturbance Processes (fires/fuels management): Wildfire and prescribed fire activities have the potential to increase populations of some fungi. Alternatives F and E allow more fire and fuels management activities and could increase the collection of some special forest products. Alternatives A, B, C, D, and G would allow for the most acres to be managed by wildfire and or prescribed fire activities; therefore, the potential for increased populations of fungi is higher. Alternatives E and F have more acres that can be managed, but other criteria limit the use of wildfire within the managed acres.

Effects from Timber Harvest: Timber harvest increases the potential availability of some special forest products, such as firewood. Harvest operations improve access and in some cases consolidate the firewood to piles, making gathering easier. The amount of timber harvest is the highest under alternative F, providing for more firewood cutting. Collection of special forest products under all other alternatives would be similar.

Cumulative Effects

The West has been the fastest growing region in the country, and this trend is expected to continue for the next 20 years (U.S. Census 2000 data and projections). With this increased growth rate comes an increased use of special forest and botanical resources. The sustainable use of these resources may become increasingly vulnerable, requiring permitting and limitation of use.

The specific effects that climate change will have on special forest products, particularly those that are botanical, are unknown. It is likely that many of the effects on overall vegetation will impact individual species in some way. The potential effects (and uncertainties) that climate change may have on forest vegetation on the Shoshone are summarized in *Climate Change on the Shoshone National Forest, Wyoming* (USDA Forest Service 2012). See the Vegetation Cumulative Effects discussion for further information.

Land (Special Uses)

Introduction

This section addresses those aspects of Forest Service management relating to land ownership adjustment (purchases, exchanges, sales, and rights-of-way acquisition) and non-recreation special uses (e.g., communication sites, utility corridors, and right-of-way authorizations). The type and number of these types of uses do not change through the alternatives.

Demand for the use and occupancy of the Shoshone continues to grow, with accompanying challenges. If it is determined to be in the public interest, land special use permits may be issued that authorize use and occupancy.

Legal and Administrative Framework

Laws

Lands Adjustments

Weeks Act of March 1, 1911 (16 U.S.C. 515). This act, as amended, authorizes the Secretary of Agriculture to purchase lands within the watersheds of navigable streams to promote regulation of the flow of navigable streams or for timber production. It also allows for the exchange of NFS land with acquired land status.

General Exchange Act of March 20, 1922 (16 U.S.C. 485, et seq.). This act authorizes the exchange of land or timber that was reserved from the public domain for National Forest System purposes.

Act of March 3, 1925 (16 U.S.C. 555). This act authorizes the Secretary of Agriculture to purchase land for national forest headquarters, ranger stations, dwellings, or other sites required for the effective performance of the authorized activities of the Forest Service.

Clarke-McNary Act (Act of June 7, 1924) (16 U.S.C. 569). This act authorizes the acceptance of donations of land that is chiefly valuable for growing timber crops. Tracts wholly or largely composed of arable or rangelands, barren, permanent brush or shrub types, or lands characterized as urban or developed are not acceptable under the act.

Department of Agriculture Organic Act of August 3, 1956 (7 U.S.C. 428a). This act provides that the Department of Agriculture can purchase land or interests therein, as necessary, to carry out its authorized work. However, there can be no purchases under this authority, unless provision is made therefore in the applicable appropriation or other law. The act serves as the primary authority for administrative-site acquisitions and Land and Water Conservation Fund purchases where the Weeks Law or specific authorities do not apply. The act may also be used to accept donations under its terms.

Act of September 21, 1944 (16 U.S.C. 526). This act authorizes appropriation for the purchase of lands where such action is necessary or beneficial for administration and public use of the national forests. The act is general legislation, and an appropriation is necessary to make it effective.

Forest Service Omnibus Act of October 23, 1962 (16 U.S.C. 555a). This act authorizes the exchange of NFS lands having acquired status when no other exchange authority applies to the disposal of those specific lands.

Wilderness Act of September 3, 1964 (16 U.S.C. 1134). This act authorizes acquisition by purchase, exchange, gift or bequest, of lands within the perimeter of any area designated as wilderness.

Land and Water Conservation Fund Act of September 3, 1964 (16 U.S.C. 460l-9). This act is primarily a funding authority for land acquisition. Purchases using funds appropriated under this act must be primarily of value for outdoor recreation purposes or to conserve habitat for fish, wildlife, and plants, including those listed as endangered or threatened species.

National Forest Roads and Trails Act of October 13, 1964 (16 U.S.C. 532-538). This act authorizes the Secretary of Agriculture to acquire, construct, and maintain forest development roads and to obtain and grant easements under a cooperative program.

Wild and Scenic Rivers Act of October 2, 1968 (16 U.S.C. 1277). This act authorizes the acquisition of lands within the authorized boundaries of any component of the National Wild and Scenic Rivers System by purchase, exchange, gift, or bequest.

National Trails System Act of October 2, 1968 (16 U.S.C. 1246). This act authorizes the acquisition of lands or interests in lands by written cooperative agreement, donation, purchase, and exchange, where applicable, within the exterior boundaries of areas designated under the act.

Endangered Species Act of December 28, 1973 (16 U.S.C. 1534). This act directs the Secretary of Agriculture to establish and implement a program under the National Forest System to conserve fish, wildlife, and plants, including those listed as endangered or threatened species. To carry out this program, the Secretary has the authority to acquire lands, waters, or interests therein by purchase, donation, or otherwise.

Federal Land Policy and Management Act of October 21, 1976 (43 U.S.C. 1701). This act is the primary authority for the Forest Service to acquire and grant easements. Section 205 of the act authorizes the Secretary of Agriculture to acquire access (lands or interest therein) over non-Federal lands to units of the National Forest System by purchase, exchange, donation, or eminent domain.

Acceptance of Gifts Act of October 10, 1978 (7 U.S.C. 2269). The act authorizes the Secretary of Agriculture, on behalf of the United States, to accept, receive, hold, utilize, and administer bequests or devises of real and personal property made for the benefit of the Department of Agriculture or for the accomplishment of any of its functions.

Small Tracts Act of January 12, 1983 (16 U.S.C. 521c-i). This act authorizes the sale, exchange, or interchange of certain limited categories of NFS lands.

Forest Service Facility Realignment and Enhancement Act of 2005 (16 U.S.C. 580d). This act provides for sale, lease, or exchange of administrative lands and facilities which are excess to the needs of the Forest Service.

Special Uses

Act of July 26, 1866, (30 U.S.C. 51) (Revised Statute (RS) 2477; 43 U.S.C. 932). This act granted rights-of-way for the construction of ditches and canals for water to be used for mining, agriculture, manufacturing, or other purposes. It also provided for the creation of rights-of-way for public highways and county roads constructed across public domain before the lands received national forest status. Although the act was repealed by the Federal Land Policy and

Management Act in 1976 (43 U.S.C. 1715), rights preexisting the establishment of the Shoshone National Forest, are preserved.

Organic Administration Act of June 4, 1897, (16 U.S.C. 477-482, 551). This act authorizes issuance of rules and regulations for the occupancy and use of the national forests. This is the basic authority for authorizing use of NFS lands for other than rights-of-way.

Preservation of American Antiquities Act of June 8, 1906, (16 U.S.C. 431 et seq.). This act authorizes permits for archeological and paleontological exploration involving excavation, removal, and storage of objects of antiquity or permits necessary for investigative work requiring site disturbance or sampling which results in the collection of such objects.

Act of March 4, 1915, as amended July 28, 1956, (16 U.S.C. 497). This act authorizes term permits for structures or facilities on NFS land, and sets maximum limits of 80 acres and 30 years.

Bankhead-Jones Farm Tenant Act of July 22, 1937, as amended (7 U.S.C. 1010-1012). This act authorizes the development of programs of land conservation and use to protect, improve, develop, and administer the land acquired and to construct structures thereon needed to adapt the land to beneficial use. Under the act, the Department of Agriculture may issue leases, licenses, permits, term permits, or easements for most uses, except rights-of-way.

Granger-Thye Act of April 24, 1950, (16 U.S.C. 490, 504, 504a, 555, 557, 571c, 572, 579a, 580c-5801, 581i-1). This act authorizes special-use permits not to exceed 30 years duration for the use of structures or improvements under the administrative control of the Forest Service and for the use of land in connection therewith, without acreage limitation.

Act of September 3, 1954, (68 Stat. 1146; 43 U.S.C. 931c, 931d). This act authorizes permits, term permits, leases, or easements at the fair market value, not to exceed 30-years duration, to states, counties, cities, municipalities, or other public agencies without acreage limitation for the construction and operation of public buildings or other public works, exclusive of rights-of-way.

Highway Act of August 27, 1958, (23 U.S.C. 317), supplemented by the Act of October 15, 1966 (49 U.S.C. 1651). This act authorizes the Federal Highway Administration to grant easements to states for highways that are part of the Federal-aid system or that are constructed under the provision of chapter 2 of the Highway Act. The Forest Service consents to the grant of these easements in a form agreed upon by the two agencies and upon the state highway agency's execution of stipulations.

Wilderness Act of September 3, 1964 (16 U.S.C. 1131-1136). This act establishes requirements for special-use authorizations in designated wilderness areas for temporary structures, commercial public services and access to valid mining claims and lands of other ownership. Under this act, presidential approval is necessary for establishing new water facilities, power projects, and transmission lines.

Land and Water Conservation Fund Act of September 3, 1964, as amended (16 U.S.C. 4601-6a(c)). Section 4(c) of this act authorizes permits for recreation, such as group activities, organized events, motorized recreational vehicle use, and other specialized recreation activities of limited duration.

National Forest Roads and Trails Act of October 13, 1964 (16 U.S.C. 532-38). This act authorizes the Secretary of Agriculture to grant temporary or permanent easements to land owners who join the Forest Service in providing a permanent road system that serves lands administered by the Forest Service and lands or resources of the land owner. It also authorizes the grant of easements to public road agencies for public roads that are not a part of the Federal-aid system.

Federal Land Policy and Management Act of October 21, 1976, (43 U.S.C. 1761-1771). This act authorizes the Secretary of Agriculture to issue permits, leases, or easements to occupy, use, or traverse NFS lands.

American Indian Religious Freedom Act of August 11, 1978 (42 U.S.C. 1996). This act states the policy of the United States to preserve and protect the rights of Native Americans to reasonable access and use of NFS lands for exercising their traditional cultural religious beliefs and practices. This act does not grant authority to issue authorizations.

Archeological Resources Protection Act of October 31, 1979, (16 U.S.C. 470aa). This act authorizes the Secretary of Agriculture to issue permits for archeological research, investigations, studies, and excavations.

Alaska National Interest Lands Conservation Act of 1980, (16 U.S.C 3210). Section 1323(a) of this act provides that, subject to terms and conditions established by the Secretary of Agriculture, the owners of non-Federal land within the National Forest System shall be provided adequate access to their land.

Federal Timber Contract Payment Modification Act of 1984, (16 U.S.C. 618). Section 3 of this act authorizes a waiver of all or part of a land use fee for an organizational camp operated by the Boy Scouts of America or other nonprofit organizations when they provide services the authorized officer determines are a valuable benefit to the public or programs of the Secretary of Agriculture.

National Forest Ski Area Permit Act of 1986, (16 U.S.C. 497b). This act authorizes use for up to 40 years and acreage size deemed appropriate by the authorized officer for nordic and alpine ski areas and facilities.

Omnibus Parks and Public Lands Management Act of 1996, (16 U.S.C. 497c). Section 701 of this act revises and amends the National Forest Ski Area Permit Act of 1986 regarding fee calculations, compliance with the National Environmental Policy Act, and mineral use.

Act of May 26, 2000, (16 U.S.C. 406l-6d). This act supplements the authority of the Secretary of Agriculture to regulate commercial filming and still photography on NFS lands. It also authorizes the Secretary to retain and spend land use fees collected for commercial filming and still photography without further appropriation, and provides for recovery of administrative and personnel costs in addition to the collection of the land use fee.

Cabin User Fee Fairness Act of 2000, (16 U.S.C. 6201-6213) as set out in title VI of the appropriations act for the Department of the Interior and Related Agencies for Fiscal Year 2001. This act establishes procedures for appraising recreation residence lots and determining fees for recreation residence lots located on NFS lands.

National Forest Organizational Camp Fee Improvement Act of 2003, (16 U.S.C. 6231 et seq.). This act establishes a land use fee system for organizational camps located on NFS lands and authorizes the Secretary of Agriculture to retain and spend these fees without further appropriation. The act also exempts certain ministerial actions from the provisions of the National Environmental Policy Act.

Executive Orders

Executive Order 11990. The intent of this order is to help avoid the long- and short-term adverse effects associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in the wetlands whenever there is a practicable alternative.

Executive Order 11988. The intent of this order is to help avoid the long- and short-term adverse impact associated with the occupancy and modification of floodplains and to avoid direct and indirect support of flood development whenever there is a practicable alternative.

Regulations and Policies

Regulations and policies have been passed in support of these laws and include the following:

USDA Departmental Regulation 9500-3. This regulation discourages the unwarranted conversion to other uses of prime and unique farmlands, farmlands of statewide or local importance, and prime rangelands; the unwarranted alteration of wetlands or flood plains; or the unwarranted expansion of the peripheral boundaries of existing settlements.

Forest Service Manual (FSM) 2700 (Special Uses Management), Chapters 2700-2790. Forest Service Handbook (FSH) 2709.11 (Special Uses Handbook), Chapters 00-90. FSH 2709.12 (Road Rights-of-Way Handbook), Chapters 00-70.

- These directives pertain to the management of the special uses program.

FSM 5400 (Land ownership), Chapters 5400-5480. FSH 5409.12 (Appraisal Handbook), Chapters 00-70. FSH 5409.13 (Land Acquisition Handbook), Chapters 00-70. FSH 5409.17 (Rights-of-Way Acquisition Handbook).

- These directives pertain to land purchases, donations, exchanges, land valuation, and right-of-way acquisition.

FSM 5500 (Landownership Title Management), Chapters 5500-5590. FSH 5509.11 (Title Claims, Sales, and Grants Handbook), Chapters 00-60.

- These directives pertain to trespass resolution and to land sales.

Spatial and Temporal Context for Effects Analysis

The area of consideration is the Shoshone National Forest and adjoining lands within the three-county area. The next 15 years was considered the time span for reasonably foreseeable future cumulative effects.

Affected Environment

Land Ownership Adjustments

Approximately 99.8 percent of all lands within the boundary of the Shoshone are federally owned and managed by the Forest Service. Where they occur, private inholdings tend to be relatively consolidated. For these reasons, land ownership adjustments are not as common as on other units of the National Forest System, where land ownership is more fractured. Nevertheless, land ownership adjustment through purchase, exchange, and sale is a useful tool for improving land management efficiency and meeting resource management objectives.

Exchanges and sales are pursued to consolidate ownership patterns (simplifying management), to resolve encroachments on NFS lands, and to eliminate unneeded administrative facilities. Most funding for future acquisitions would come from the Land and Water Conservation Fund. This is a competitive national fund and is not a reliable source for funding of purchases, so it is expected that most adjustments will be land exchanges.

The Shoshone uses the Small Tracts Act (P.L. 97-465) to resolve land disputes and management problems by conveying through sale, exchange, or interchange, three categories of tracts of land: parcels encroached upon, road rights-of-way, and mineral survey fractions. All applicants must qualify under the guidelines of the Small Tracts Act.

Road and trail right-of-way easements are acquired from willing parties. Because many easements have already been acquired, and given the high level of Federal land ownership within the Shoshone, the rights-of-way program is not as active as on other units of the National Forest System. In recent years, private land owners have been observed to be less willing to convey full public easements, offering instead only limited administrative easements.

Within the last 20 years, the most significant acquisition has been of a large number of mineral-entry inholdings on the Greybull Ranger District. This acquisition has returned virtually the entire historic Kirwin mining district to Federal ownership and serves to simplify achievement of resource management objectives. Acquisition of other inholdings is desired, but limited by other Shoshone priorities, the willingness of sellers, and the ability to obtain funding for acquiring high-priority parcels. (See table 113, table 114, and table 115.)

Table 113. Shoshone National Forest acreage for 1986, 1991, 2005, and 2009 to 2011

Year	Acres
1986	2,433,125
1991	2,432,990
2005	2,437,218
2009	2,437,217
2010	2,437,731
2011	2,437,731

Table 114. Acres of land acquired 1986 to 2011

Year	Transaction	Acres
1986	Wyoming Game and Fish Exchange	160
1991	Deer Creek Trailhead Purchase	1
1992	Kirwin Donation	3,843
1996	South Fork Exchange	103
1998	TE Ranch Exchange	365
2002	Dunrud Purchase	589
2010	Cross Donation	514
	Total	5,061

Table 115. Acres of land disposed of 1986 to 2011

Year	Transaction	Acres
1986	Wyoming Game and Fish Exchange	161
1988	Goodyear Small Tracts Act Sale	3
1989	Julien Small Tracts Act Sale	1
1991	Stuart Small Tracts Act Sale	3
1996	B4 Ranch Small Tracts Act Sale	1
1996	South Fork Exchange	157
1997	Les Terry Small Tracts Act Sale	< 1
1998	TE Ranch Exchange	55
2008	Meeteetse Administrative Site Sale	< 1
2009	Cody Dwelling Administrative Site Sale	< 1
2010	Estes Small Tracts Act Sale	< 1
	Total	382

Non-recreation Special Uses

The Forest Service issues special-use authorizations (permits, easements and leases) to allow private or government entities to occupy, traverse, or use NFS lands. Special-use authorizations are most often granted for specified periods, generally not exceeding 20 years, but often with provisions for renewal (for example, for facilities with substantial financial investment such as resorts). Shorter-term and one-time authorizations are also issued (for example, for scientific studies and recreation events that are anticipated to occur within a limited and clearly defined timeframe). Special-use authorizations fall into two broad categories—recreational special uses and non-recreational special uses. Non-recreational special uses include such uses as roads, ditches, pipelines, communication sites, and utility lines (see table 116). Non-recreational special-use authorizations have generally increased over time.

Table 116. Non-recreational special use authorizations in 2011

Special use type	Number of authorizations
Agriculture and range	10
Religious facilities	2
Sanitary systems	1
Service uses	3
Research	26
Industry camps and storage	12
Arts	17
Oil and gas development	1
Power lines	5
Aircraft facilities	2
Road rights-of-way	46
Telecommunications uses	41
Water and water transmission	91
Total	257

Utility Corridors

There are no existing utility corridors on the Shoshone. The 1992 *Western Regional Corridor Study* by the Western Utility Group describes two potential east/west utility corridors—one along U.S. Highway 14/16/20 and one along U.S. Highway 26/287. Development of these corridors, however, would prove challenging, as those routes are also scenic byways (respectively, the Buffalo Bill Cody Scenic Byway and the Wyoming Centennial Scenic Byway) and carry both National Forest System and Wyoming State scenic byway designations. In this regard, the corridors have corridor management plans, the visual resources components of which tend to limit the development of visually conspicuous utility corridors. Additionally, development of the proposed corridors would necessarily include construction along popular recreational corridors within Yellowstone and Grand Teton National Parks. For all of these reasons, development of the corridors appears unlikely. Development of utility corridors in other locations is also not expected because of the large areas of wilderness that block east-west corridors and rugged terrain on the Shoshone that make north-south corridors less attractive than lower-elevation public and private properties. Local distribution lines and smaller pipelines (power lines less than 69 kilovolts and pipelines less than 10 inches in diameter) have not been identified as corridors and are normally located in conjunction with an existing road system or other previously disturbed area.

Designated Communication Sites

Designated special-use communication sites are identified in table 117. Any additional sites require site-specific environmental analysis, amendment of the forest plan, and a site management plan approved by the regional forester.

Table 117. Special use communication sites in 2011

Site name	Site location
Dead Indian Hill Communications Site	T. 55 N., R. 104 S., secs. 10, 15
Togwotee Pass Communications Site	T. 44 N., R. 110 S., sec. 28
Lava Mountain Communications Site	T. 43 N., R. 110 S., sec. 23
Windy Ridge Communications Site	T. 41 N., R. 107 S., sec. 22
Sheep Ridge Communications Site	T. 41 N., R. 107 S., sec. 26
Limestone Mountain Communications Site	T. 30 N., R. 99 S., secs. 7, 18
South Pass Communications Site	T. 30 N., R. 101 S., sec. 25
Roundtop Mountain Communications Site	T. 30 N., R. 99 S., secs. 30, 31

Desired Condition

The land ownership pattern of the Shoshone provides for efficient and effective resource management within the proclaimed boundaries of the Shoshone. Rights-of-way are pursued where there is a high-priority identified need and a willing land owner. Non-recreational special-use authorizations are issued for those uses that are determined to be in the public interest. Communication uses are accommodated where possible within existing communication sites, with designation of new sites as an option of last resort.

Environmental Consequences

Across all alternatives, the issuance and administration of lands special-use authorizations will continue to provide authorization for use and occupancy of NFS lands where in the public interest.

Direct and Indirect Effects

Land Ownership Adjustments

There are approximately 29,180 acres of lands of other ownership located within the boundary of the Shoshone. The Shoshone's land exchange program is very limited and will not change across the alternatives. All alternatives emphasize cooperation with land owners and improving land ownership patterns. Opportunities for right-of-way acquisition also do not change across alternatives. Most readily available rights-of-way have already been acquired. Remaining rights-of-way considered are not anticipated to be acquired in the planning period of 10 to 15 years. The amount and potential opportunity for land adjustments are limited and do not vary across alternatives. Land ownership adjustments are discretionary and are not generally pursued where they may have net negative environmental consequences. No change in effects is anticipated and the revised Forest Plan is not anticipated to have direct or indirect effects on these uses. No cumulative effects are anticipated.

Special Uses Generally

The number of special-use authorizations since 2006[29] is depicted in figure 28 and table 118.

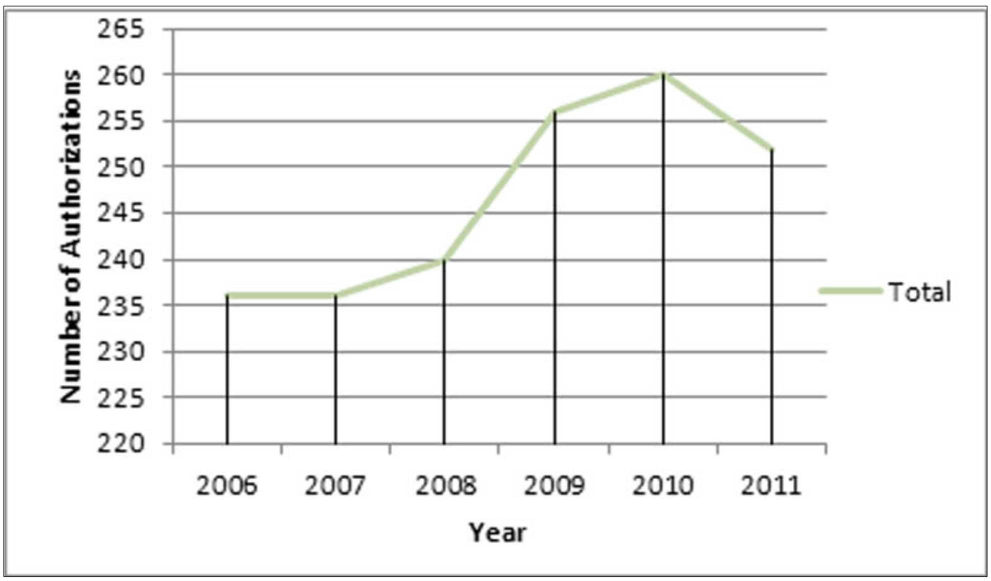


Figure 28. Number of special-use authorizations issued since 2006

[29] Detailed special use information is available in the Natural Resource Manager database from 2006 forward.

Table 118. Special-use authorizations by type, 2006 to 2011

	2006	2007	2008	2009	2010	2011
Water development and transmission	90	90	90	91	91	90
Road rights-of-way	40	39	43	44	47	46
Telecommunications	38	38	38	39	40	40
Research	14	13	18	24	28	26
Arts	12	16	9	18	11	16
Industrial camps and storage	13	13	13	12	12	12
Agriculture and range	11	11	11	10	10	9
Power lines	5	5	5	5	5	5
Religious facilities	2	2	2	2	2	2
Service uses	3	2	3	2	3	2
Aircraft facilities	2	2	2	2	2	2
Sanitary systems	1	1	1	1	1	1
Oil and gas development	1	1	1	1	1	1
Non-commercial group use	4	3	4	5	7	0
Grand Total	236	236	240	256	260	252

Authorization rates among uses involving long-lasting improvements (i.e., water development and transmission, roads, telecommunications infrastructure, industrial camps and storage, agriculture and range, power lines, religious facilities, service uses, aircraft facilities, sanitary systems, and oil and gas development) has been relatively static over time, with a very gradual increase. The uses themselves are also relatively static (e.g., a telephone line, once constructed, tends to change very little from year to year). These uses are not expected to vary across alternatives. No change in effects is anticipated and the revised Forest Plan is not anticipated to have direct or indirect effects on these uses. No cumulative effects are anticipated.

Authorization rates among uses not involving such improvements (i.e., research, arts, and noncommercial group use) are relatively variable. These uses tend to be short-term with minimal or no measurable impact on natural resources. These uses are not expected to vary across alternatives. No change in effects is anticipated and the revised Forest Plan is not anticipated to have direct or indirect effects on these uses. No cumulative effects are anticipated

Utility Corridors

Utility corridors are not expected to vary by alternative. There are no existing or reasonably foreseeable utility corridors on the Shoshone, so there are no direct or indirect effects on these resources. No cumulative effects are anticipated.

Communication Sites

The number and location of communication sites does not vary by alternative, so there are no direct or indirect effects on these resources. No cumulative effects are anticipated.

Monitoring

Monitoring will include tracking the number and types of land use authorizations annually.

Effects from Management Area Prescriptions: Some management area (MA) allocations, such as NFS lands which have not been statutorily designated for a specific use (e.g., MA 1.2–Recommended Wilderness, 2.3 Potential Research Natural Areas, etc.) or lands that have been administratively designated for a specific use (e.g., MA 3.1A – Swamp Lake Special Interest Area, MA 2.2A – Line Creek Research Natural Area, etc.) are less likely to be considered for disposal or exchange. Based on management area allocations, alternative C would have the fewest acres likely to be considered for disposal or exchange, followed by alternatives D, G and B, and A. Alternatives E and F are similar and would have more acres available and likely to be considered for disposal or exchange.

Cumulative Effects

Past land ownership adjustments and non-recreational special use are discussed under the affected environment and provide the existing condition for this analysis. Non-recreational special uses listed in table 116 include access roads, ditches, pipelines, communication sites, and utility lines. These uses are anticipated to remain, and non-recreational special use authorizations have generally increased over time. Applications are received and processed on a site-specific basis.

Minerals

Introduction

The Forest Service manages mineral-related activities consistent with multiple-use management principles. The agency integrates the exploration, development, and production of mineral and energy resources with the use, conservation, and protection of other resources

In the Mining and Minerals Policy Act of 1970, Congress declared that it is the continuing policy of the Federal Government, in the national interest, to foster and encourage private enterprise in (among other goals) the development of domestic mineral resources and the reclamation of mined land. This Federal policy applies to National Forest System (NFS) lands.

The Forest Service recognizes the importance of NFS mineral resources to the well-being of the Nation, and encourages bona-fide mineral exploration and development. But, it also recognizes its responsibility to protect the surface resources of the lands under its care. Thus, the Forest Service is faced with a double task: to make minerals from NFS lands available to the national economy; and, at the same time, minimize the adverse impacts of mining activities on other resources.

Individuals operating under United States mining laws have a statutory right to enter NFS lands to locate and develop mineral resources. Mineral resource activity on the Shoshone National Forest has occurred, but sporadically. Mineral activity is presently limited to a few scattered areas. Activity has fluctuated with demand, and current low prices for many minerals make exploration and development uneconomical.

Minerals management on NFS lands requires interagency coordination and cooperation. Although the Forest Service is responsible for managing surface resources of NFS lands, the Bureau of Land Management (BLM) in the U.S. Department of Interior (USDI) is primarily responsible for managing government-owned minerals. Since it is not possible to separate mineral operations from surface management, the agencies have developed cooperative procedures to accommodate their respective responsibilities.

Lands currently available for oil and gas leasing under 36 CFR 228.102(d) were identified in the *Shoshone Oil and Gas Leasing Record of Decision* (USDA Forest Service 1995). The decision that will be made in connection with this FEIS will not change the current leasing decision. A future leasing decision may need to be made to address any consistency issues that arise with the suitability decisions made in the Plan.

Legal and Administrative Framework

Organic Administration Act of June 4, 1897 (30 Stat. 11, as amended; 16 U.S.C. § 473 et seq.): This act provides the Secretary of Agriculture the authority to regulate the occupancy and use of NFS lands. It provides for the continuing right to conduct mining activities under the general mining laws if the rules and regulations covering NFS lands are complied with. This act recognizes the rights of miners and prospectors to access NFS lands for all proper and lawful purposes, including prospecting for, locating, and developing mineral resources.

Multiple-Use Sustained-Yield Act of June 12, 1960 (P.L. 86-517, 74 Stat. 215; 16 U.S.C. 528 et seq.): This act requires that NFS lands be administered in a manner that considers the values of the various resources when making management decisions and specifically provides that nothing in the act be construed to affect the use or administration of the mineral resources on NFS lands.

U.S. Mining Laws Act of May 10, 1872 (17 Stat. 91, as amended, 30 U.S.C. § 22 et seq.): This act (often referred to as the General Mining Act of 1872) sets forth the principles of discovery, right of possession, assessment work, and patent for hard-rock minerals on lands reserved from the public domain. The law applies to lode, placer, mill-site claims, and tunnel sites. Except as otherwise provided, all valuable mineral deposits, and the lands in which they are found, are free and open to exploration, occupation, and purchase under regulations prescribed by law.

Mineral Leasing Act of February 25, 1920 (P.L. 66-146, 41 Stat. 437 as amended, 30 U.S.C. § 181 et seq.): This act authorizes the Secretary of the Interior to issue leases for the disposal of certain minerals (coal, phosphate, sodium, potassium, oil, oil shale, gilsonite, and gas). The act applies to NFS lands reserved from the public domain, including lands received in exchange for timber or other public domain lands, and lands with minerals reserved under special authority.

Mineral Materials Act of July 31, 1947 (P.L. 80-291, 61 Stat. 681, as amended, 30 U.S.C. § 601 et seq.): This act provides for the disposal of mineral materials on the public lands through bidding, negotiated contracts, and free use.

Mineral Leasing Act for Acquired Lands of August 7, 1947 (P.L. 80-382, 61 Stat. 913, as amended, 30 U.S.C. § 351 et seq.): This act extends the provisions of the mineral leasing laws to federally owned mineral deposits on acquired NFS lands and requires the consent of the Secretary of Agriculture prior to leasing.

Multiple Use Mining Act of July 23, 1955 (P.L. 84-167, 69 Stat. 368, as amended, 30 U.S.C § 601 et seq.): This act requires the disposal of common varieties of sand, stone, gravel, pumice, pumicite, and cinders under the provisions of the Materials Act of July 31, 1947, and gives to the Secretary of Agriculture the authority to dispose of these materials. It also provides that rights under any mining claim located under the mining laws are subject to the right of the United States to manage and dispose of surface resources.

Mining and Minerals Policy Act of December 31, 1970 (P.L. 91-631, 84 Stat.1876, 30 U.S.C. § 21a): This act states that the continuing policy of the Federal Government is to foster and encourage private enterprise in the development of economically sound and stable domestic mining and minerals industries and the orderly and economic development of domestic mineral resources.

Federal Coal Leasing Amendments Act of August 4, 1976 (90 Stat. 1083; 30 U.S.C. § 201 et seq.): This act amended the Mineral Lands Leasing Act of February 25, 1920 (para. 3) by specifying that coal leases on NFS lands may be issued only after the consent of the Secretary of Agriculture and adherence to conditions the Secretary may prescribe. The act also provides that no lease shall be issued unless the lands involved in the lease have been included in a comprehensive forest land and resource management plan and the sale is compatible with the revised Forest Plan. The act authorizes the issuance of a license to conduct exploration for coal.

Federal Land Policy and Management Act of October 21, 1976 (P.L. 94-579, 90 Stat. 2713, 43 U.S.C. § 1701 et seq., 7 U.S.C. § 1212a, 16 U.S.C. § 478a, 1338a): This act defines procedures for the withdrawal of lands from mineral entry. It reserves to the United States the rights to prospect for, mine, and remove the minerals in lands conveyed to others and requires the recordation of claims with the BLM.

Surface Mining Control and Reclamation Act of August 3, 1977 (P.L. 95-87, 91 Stat. 445, 30 U.S.C. § 1201-1328): This act provides for cooperation between the Secretary of the Interior and states in the regulation of surface coal mining. It also restricts or prohibits surface coal mining operations on NFS lands, subject to valid existing rights and compatibility determinations.

Energy Security Act of June 30, 1980 (P.L. 96-294, 94 Stat. 611, 42 U.S.C. § 8855): This act directs the Secretary of Agriculture to process applications for leases and permits to explore, drill, and develop resources on NFS lands, notwithstanding the current status of the forest land and resource management plan.

National Materials and Minerals Policy, Research and Development Act of October 2, 1980 (94 Stat. 2305; 30 U.S.C. §1601-1605): This act restates congressional intent to promote policies that provide for an adequate and stable supply of materials while considering long-term needs, a healthy environment, and natural resource conservation. The act also requires the Secretary of the Interior to improve the availability and analysis of mineral data in Federal land use decision making.

Omnibus Parks and Public Lands Management Act of 1996 (P.L. 104-333, 110 Stat. 4093, 16 U.S.C. § 497c): This act automatically withdraws from all forms of appropriation under the mining laws and from disposition under all laws pertaining to mineral and geothermal leasing all lands located within the boundaries of ski area permits.

Federal Onshore Oil and Gas Leasing Reform Act of 1987 (30 U.S.C. § 181 et seq.): This act expands the authority of the Secretary of Agriculture in the management of oil and gas resources on NFS lands. The BLM cannot issue leases for oil and gas on NFS lands over the objection of the Forest Service. The Forest Service must approve all surface-disturbing activities on NFS lands before operations commence.

Federal Cave Resources Protection Act of 1988 (102 Stat. 4546; 16 U.S.C. § 4301-4309): Provides for protection and preservation of caves on Federal lands.

Energy Policy Act of 2005 (PL 109-58): Directs Federal agencies to undertake efforts to ensure energy efficiency, and the production of secure, affordable, and reliable domestic energy.

Executive Orders

Executive Order 13212 issued May 18, 2001: This executive order titled “Actions to Expedite Energy-Related Projects” requires Federal agencies to take actions, to the extent consistent with applicable law, to expedite projects that will increase the production, transmission, or conservation of energy.

Resource Protection Measures

For locatable minerals, **36 CFR 228** requires a claimant to file an operating plan or notice of intent for proposed mining activities. The plan must include the name and address of operators, a sketch or map of the location, descriptions of operations, access timing, operating period, and environmental protection measures. The Shoshone coordinates with the claimant to assure that standards and guidelines outlined in the revised Forest Plan are met. The operating plan requires an environmental analysis and decision before it is approved.

For minerals that are leased and mineral materials that are sold, there are Forest-wide and management area prescription standards and guidelines that apply. All alternatives provide for protecting forest resources including soil and water resources.

In addition, appropriate leasing stipulations are applied to all oil and gas leases to protect forest resources.

Methodology

Lands which are legally unavailable for leasing are:

- Lands withdrawn from mineral leasing by an act of Congress or by an order of the Secretary of the Interior;
- Lands recommended for wilderness allocation by the Secretary of Agriculture;
- Lands designated by statute as wilderness study areas, unless oil and gas leasing is specifically allowed by the statute designating the study area

The following terms are used for classifying oil and gas (occurrence) potential (USDI Bureau of Land Management 2009, 2010):

- HIGH: Inclusion in an oil and gas play as defined by the [United States Geological Survey] national assessment, or, in the absence of play designation by the [United States Geological Survey], the demonstrated existence of: source rock, thermal maturation, and reservoir strata possessing permeability and/or porosity, and traps. Demonstrated existence is defined by physical evidence or documentation in the literature.
- MEDIUM: Geophysical or geological indications that the following may be present: source rock, thermal maturation, and reservoir strata possessing permeability and/or porosity, and traps. Geologic indication is defined by geological inference based on indirect evidence.
- LOW: Specific indications that one or more of the following may not be present: source rock, thermal maturation, reservoir strata possessing permeability and/or porosity, and traps.
- NONE: Demonstrated absence of (1) source rock, (2) thermal maturation, or (3) reservoir rock that precludes the occurrence of oil and/or gas. Demonstrated absence is defined by physical evidence or documentation in the literature."

Oil and gas development potential is based on the following categories:

- High potential for hydrocarbon development indicates areas where the average well density is anticipated to be more than 100 wells per township.
- Moderate potential for hydrocarbon development indicates areas where the average well density is anticipated to be between 20 and 100 wells per township.
- Low potential for hydrocarbon development indicates areas where the average well density is anticipated to be 2 to fewer than 20 wells per township.
- Very low potential for hydrocarbon development indicates areas where the average well density is anticipated to be fewer than 2 wells per township.
- No potential for hydrocarbon development indicates areas where no wells are anticipated.

Directional drilling viability and offset distance varies with the target formation, the top depth of the target formation, and formation productivity. Directional drilling distances of 0.25 mile are assumed to be standard practice in most formations with current technology.

In the DEIS analysis there was an effort to evaluate the number of acres of land that was not suitable for surface development but could be accessed from lands suitable for surface development using directional drilling. In that analysis, it was assumed that directional drilling could access lands up to 1 mile away. In reality the actual distance over which resources could be recovered would be dependent on the formation being accessed and the technology being used and could be far less than 1 mile. Public comment on the analysis indicated that it was confusing and made it difficult to compare the alternatives. For the FEIS, it was decided to drop that portion of the analysis and only focus on the impacts to the surface resources on the acres available for surface development. Areas outside of the areas suitable for surface development can still be accessed through directional drilling.

Spatial and Temporal Context for Effects Analysis

The affected area for direct and indirect effects to minerals is the lands administered by the Shoshone. This area represents the NFS lands where mineral activity may occur under direction of the forest plan.

The affected area for cumulative effects to minerals includes the lands administered by the Shoshone, as well as the lands of other ownership both within and adjacent to the Shoshone boundaries.

The timeframe addressed is the 15 years for the anticipated life of the plan.

Incomplete and Unavailable Information

The full extent of the existence and availability of mineral resources on the Shoshone is unknown. The best information available based upon past exploration and future projections is used in the analysis.

Affected Environment

Mineral resources on federally owned lands are separated into three categories—locatable, leasable, and mineral materials—by statutory and regulatory direction. Currently, 58 percent of the Shoshone (wilderness, wild river, High Lakes Wilderness Study Area, and Dunoir Special Management Unit) is legally withdrawn from mineral development.

Locatable minerals

Locatable minerals[30] such as gold, silver, copper, and other uncommon varieties are subject to the 1872 General Mining Law, as amended. The Mining Law grants a statutory right to explore for and develop these minerals unless the land has been formally withdrawn from mineral entry. Locatable mineral extraction is a process that starts with notices of intent to operate, plans of operations, and bonding. On NFS lands, locatable mineral activities that reach a level of significant surface resource disturbance require a plan of operation that is used to determine adverse impacts to the environment and surface resources (36 CFR 228.4).

[30] Hardrock minerals that are found on lands acquired by the Forest Service (as opposed to public domain lands) are leasable and not locatable.

The Forest Service manages impacts to other resources related to the exploration, development, and production of locatable minerals on its land via regulations at 36 CFR 228, Subpart A. The Forest Service may not deny proposed operations or make them impossible by imposing unreasonably restrictive management requirements or conditions. The Forest Service may require mitigation and requirements to minimize adverse effects. Forest Service regulations state that mining operations should minimize adverse environmental impacts to surface resources.

The Shoshone has a history of locatable hardrock minerals activity. Geology is favorable for the occurrence of mineral deposits. Within the northern half of the Shoshone, there are numerous mineralized intrusives. The larger complexes at Stinkingwater, Kirwin, and Meadow Creek are "…characterized by a central copper-molybdenum zone surround by a halo of silver, gold, lead, zinc, and mercury in peripherals veins" (Fisher 1981 cited in Dersch 1982).

Mining has waned since the late 1800s; none of the historic sites operates today.

Small-scale panning and dredging for gold have increased in the past several years. Most of these activities do not require an operating plan because of the lack of significant impacts.

Leasable minerals

Leasable minerals are federally owned fossil fuels (oil, gas, coal, oil shale, etc.), geothermal resources, sulfur, phosphates, and uranium that are subject to exploration and development under leases, permits, or licenses issued by the Secretary of the Interior, with Forest Service input. The Bureau of Land Management is the agency responsible for issuing the leases. The 1920 Mineral Leasing Act, as amended, together with the 1989 Federal Onshore Oil and Gas Leasing Reform Act, provide the authority and management direction for leasable minerals on Federal lands. In 1970, the Geothermal Steam Act added steam to the list of minerals that could be leased on NFS lands.

Coal potential exists on the Shoshone, but is limited to a subbituminous variety with impurities such as shale (Dersch 1982). There has been no demand for leases. Geothermal is similar to coal; there is some potential, but little interest in leasing. Potential is limited to two areas west of Dubois near Warm Spring Creek and Little Warm Spring Creek (Decker 1976 cited in Dersch 1982). The energy potential of the springs is limited. Phosphate deposits are found along the east flank of the Wind River Range in Baldwin Creek, Burroughs Creek, and Beaver Creek (Hausel and Holden 1978 cited in Dersch 1982). At this time, only oil and gas resources are being leased on the Shoshone.

The Shoshone borders on oil- and gas-producing basins in Wyoming (see map 33). Twenty-five percent of those lands (255,000 acres) have a high potential for oil and gas occurrence (USDI Bureau of Land Management 2009, 2010). The remaining acres have a low potential for oil and gas occurrence. Though there is potential for oil and gas in high potential areas, that does not mean it will be developed. Factors such as accessibility of the formations, demand, prices, and quality influence future development (see map 34). Lands on the Shoshone generally have a low or very low potential for oil and gas development (USDI Bureau of Land Management 2009, 2010).

Between 1956 and 1986, 20 oil and gas fields were discovered within 10 miles of the Shoshone's boundary. Exploratory drilling is occurring off the Shoshone and seismic activity was conducted on the Shoshone near Clark, Wyoming, in 2006. Of the 34 wells drilled on the Shoshone in the past, 31 have not produced and three have been plugged due to low production. In the last three years, there were two applications to drill exploratory wells on the Shoshone, one in the Line

Creek area and the other north of Dubois. Drilling of the Line Creek well is no longer being pursued.

Lands currently available for oil and gas leasing under 36 CFR 228.102(d) were identified in the *Oil and Gas Leasing Record of Decision* (USDA Forest Service 1995). That decision may need to be amended or replaced depending on the decision made in the revised Plan. Currently, 8,570 acres of the Shoshone are leased for oil and gas (see table 119 and map 80). Other acres are in the process of being evaluated for possible leasing.

In March 2006, the Governor of Wyoming, Under Secretary of Agriculture, and regional foresters from the Rocky Mountain and Intermountain Regions signed a memorandum of understanding on oil and gas leasing in inventoried roadless areas on the Shoshone and Bridger-Teton National Forests. The parties agreed that new oil and gas leases would not be issued in inventoried roadless areas until new leasing availability decisions are completed. The memorandum of understanding applies to the roadless inventory that was in effect at the time of the agreement. For the Shoshone, that is the inventoried roadless areas established by the 2001 Roadless Area Conservation Rule.

Table 119. Acres of oil and gas leased on the Shoshone National Forest per year, 1970, 1973 through 2003, 2005, and 2007

Year	Acres leased	Year	Acres leased	Year	Acres leased
1970	6,720	1981	111,400	1990	2,120
1973	33,900	1982	129,600	1998	2,780
1974	6,380	1983	94,100	1999	0
1975	5,170	1984	37,000	2000	1,950
1976	16,610	1985	6,330	2000–2003	0
1977	11,300	1986	27,700	2005	8,800
1978	6,860	1987	28,000	2006	8,600
1979	3,090	1988	70,900	2007	8,570
1980	34,900	1989	56,500	No change since 2007	

Mineral materials

Mineral materials are common materials such as stone, sand, gravel, clay cinders, and decorative rock. Disposal is authorized under the Materials Act of 1947. This act provides for disposing of mineral materials on public lands through bidding, negotiated contracts, or free use.

The Forest Service may sell these mineral materials or issue free-use permits to state and county governments for public projects such as highway construction or maintenance. All contracts contain requirements for reclaiming sites to pre-mining conditions as much as possible. The Forest Service uses mineral materials from its lands for building and surfacing system roads.

The Forest Service has full authority to make decisions about disposing of mineral materials on lands where the surface is federally owned.

Sites throughout the Shoshone range from gravel pits to areas where material is gathered for decorative rock or landscaping boulders. Small sales for decorative rock, boulders, or aggregate occur in small numbers, but mainly on the south half of the Shoshone. Typically, sites are small.

Most are near or next to roads. Use of gravel pits is sporadic and usually associated with road work on or near the Shoshone.

Desired Condition

Mineral resources provide commodities for current and future generations commensurate with the need to protect other resources. Mineral materials are available to support resource management, e.g., road surfacing; personal use, e.g., landscape rock; and some commercial uses.

Environmental Consequences

Direct and Indirect Effects

Under all alternatives, management that allows mineral activity, allows activity with constraints, or prohibits activity would respectively allow, limit, or prohibit exploration and development in certain areas. This management would result in direct impacts to mineral development. The extent of these impacts would vary by alternative, based on amount of acreage and associated development potential. Protective measures for other resources, including limiting or prohibiting access and development or controlling the timing or nature of development, would result in impacts to development. Under all alternatives, operators must use best management practices in the exploration, development, production, and abandonment of mineral resources.

Under all alternatives, areas administratively open to oil and gas leasing would be open to geophysical exploration. Requiring geophysical exploration to be performed within the constraints necessary to protect other resources may impact oil and gas exploration, but could benefit other resources. Impacts to exploration would include increased costs to the operator from the use of more expensive, but less surface-disturbing techniques (e.g., small, portable foot- or helicopter-transported surveying equipment in areas with surface use restrictions). If surface-use restrictions prevent an operator from effectively surveying/exploring oil and gas resources, development could be sited based on incomplete information, affecting the potential success of a future well. This also could result in increased costs to the operator and in nonproductive disturbances to land and surface resources.

Special designations (e.g., recommended wilderness, proposed research natural areas) and other management areas (e.g., back country non-motorized areas, big game areas) may limit oil and gas exploration and development, depending on their location in relation to oil and gas development potential. These lands may be subject to a variety of restrictions related to oil and gas exploration or development, or require certain best management practices or mitigation to preserve resource and management objectives in these areas. In general, constraints on exploration, development, production, and abandonment of oil and gas resources would increase project timeframes and costs, and may limit the number of well pads and amount of surface disturbance on a lease. However, such constraints may result in beneficial impacts to other resources in a given area.

Under all alternatives, the extent of impacts to oil and gas development from constraints and limitations on exploration and development relates directly to oil and gas development potential in an area. Management action that constrains development of oil and gas areas with a high-potential for oil and gas occurrence generally would result in more impacts to development than similar management action that constrains development in areas with a low potential for oil and gas occurrence.

Locatable minerals

All alternatives have similar effects on individual mineral activities, in that they all include standards and guidelines that operating plans must incorporate. Specific effects will be related to the actual location of the mineral activity in relationship to management area designations. None of the restrictions will prevent the activity from taking place, but they could result in restrictions on timing and location of activities. In general, the alternatives with more area open to vegetation management and motorized activity will have more area where the restrictions will be less impacting on mineral development. Alternatives listed in order of greatest area with less restrictions to greatest area with more restrictions are F, E, A, B, G, D, and C.

Under the 1872 mining law, the Forest Service is required to provide for locatable mineral exploration and development, unless the area has been withdrawn from mineral development. Some alternatives make management area designations that recommend or propose designations that may lead to withdrawal from mineral development. These withdrawals would reduce the area available for mineral activities. This effect is greatest in alternatives C and D, which recommend 584,700 and 165,600 acres, respectively, for wilderness designation on lands that are not currently withdrawn from mineral development. Other allocations that could lead to withdrawal are those for potential research natural areas and special interest areas. These designations add an additional 6,490 and 18,000 acres to alternatives C and D in addition to the recommended wilderness that may be withdrawn. For the remaining alternatives, management area allocations that may lead to a mineral withdrawal in order of most to least are G (20,560 acres), B (14,970 acres), A (1,870 acres), E (480 acres), and F (0 acres).

Other management area designations that may result in mineral withdrawal are those for developed recreation areas (8.1), ski-based resorts (8.2), and administrative sites (8.6). Those allocations are the same in all alternatives.

Mineral materials

All operations would have to meet standards and guidelines. Standards and guidelines could restrict the location and timing of mineral activity. In some situations, standards and guidelines could prevent mineral development. In general, the alternatives with more area open to vegetation management and motorized activity will have more area where the restrictions will be less impacting on mineral development. Alternatives listed in order of greatest area with less restrictions to greatest area with more restrictions are F, E, A, B, G, D, and C.

The availability of mineral materials would vary by alternative in that some management area designations are not suitable with the development of mineral materials. The acreages impacted are the same as those described under locatable minerals above and the reduction in area available would be the same. The one difference is that the areas would not have to be formally withdrawn. The areas will be unavailable strictly upon forest plan direction for each management area.

Leasable minerals

The acres available for oil and gas leasing on the Shoshone are set by the Oil and Gas Leasing Record of Decision (USDA Forest Service 1995). The alternatives do not make changes to the acres available for leasing. The alternatives do identify areas where surface occupancy for oil and gas development is not compatible with management area desired conditions.

Table 120 identifies acres that are suitable for oil and gas development based upon allocation. Lands where allocations allow surface occupancy for oil and gas development are displayed on maps 35–40 and 75.

Alternative A represents the direction in the current leasing decision. Alternatives B through F assigned acres of surface development suitability based upon the compatibility between oil and gas development and management area desired conditions. Generally management areas that were outside of special areas and travel corridors that allow summer motorized recreation where considered compatible with oil and gas development. An additional criterion was included in alternatives B, D, and E to address grizzly bear. In those alternatives, any land within the primary conservation area for the grizzly bear was identified as not suitable for surface development. This criterion was designed to maintain the acres of secure habitat within the primary conservation area. This criterion was not used in alternative C, because all primary conservation area acres were assigned to management areas that we designated as not suitable for surface development.

In an effort to respond to public comment, a different tact was taken in alternative G for identifying lands suitable for surface development for oil and gas. Three criteria were used to screen for areas that would not allow for oil and gas surface development. The first was to remove the primary conservation area for the grizzly bear. The second was to remove the most critical crucial big game winter range as identified by Wyoming Game and Fish Department. And the third was to look at allocations made on adjoining BLM lands. In looking at what areas to focus on that allow surface development in alternative G, we used three interrelated criteria to identify areas. The three criteria are (1) areas with a high potential for occurrence of oil and gas resources; (2) areas with some potential for development of those resources; and (3) areas with existing oil and gas leases. We combined these two sets of criteria to develop a final allocation showing what areas are suitable for surface oil and gas development in alternative G.

In addition to the allocation criteria considered in the alternatives, acres may not be suitable for surface occupancy because they are too steep or are riparian acres. The acres of steep slopes and riparian do not change by alternative. These acres are displayed in table 120. Steep slopes and riparian acres do not generally result in oil and gas resources being unavailable for development, because they are generally not contiguous and there will be nearby areas that allow surface occupancy that can be used to access oil and gas resources. The following discussion does not consider acres that are steep or within riparian areas.

Table 120. Oil and gas surface occupancy suitability by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Legally withdrawn	1,416,000	1,416,00	1,416,000	1,416,000	1,416,000	1,416,000	1,416,000
Administratively withdrawn	52,600						
Allocation does not allow surface occupancy	171,100	619,000	858,250	796,400	544,400	313,800	892,800
Allocation allows surface occupancy	798,100	402,800	163,600	225,400	477,500	708,000	129,100

Table 121. Acres open to oil and gas surface occupancy where suitability is restricted by steep slopes and riparian areas by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Allocation allows surface occupancy (see table 120)	798,100	402,800	163,600	225,400	477,500	708,000	129,100
Steep slopes and riparian do not allow surface occupancy	270,800	89,200	23,700	35,100	115,100	199,000	32,900
Areas allowing surface occupancy once steep slopes and riparian are removed.	527,300	313,500	139,900	190,400	362,400	509,000	96,200

The extent of impact alternative allocations will have on oil and gas development is based upon the allocation and how it is associated with potential occurrence of oil and gas resources and the likelihood for future development. In response to public comment and the issues, we conducted additional analysis focusing on those lands with a high potential for oil and gas occurrence. Outside of the area legally withdrawn from mineral development there are 255,000 acres with a high potential for oil and gas occurrence. Table 122 displays by alternative the percentage of the 255,000 acres that allow surface occupancy.

Table 122. Percentage of acres with high potential for oil and gas occurrence that would allow surface development by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Percentage of high potential lands with an allocation that allows surface occupancy	91	71	32	47	74	87	38

On the lands with high potential for oil and gas occurrence, alternatives A and F provide the greatest percentage of acres that allow surface occupancy for development. Alternative C provides the lowest percentage, alternative G provides the next lowest amount, and alternative E, B, and D provide similar amounts.

Any direct impact on oil and gas development would be dependent upon the actual discovery and development of an oil and gas field. The reasonably foreseeable development projections for the 255,000 acres with high potential for oil and gas occurrence identify 17,400 acres with a low potential for development and 190,200 with a very low potential for development. Table 123 displays by alternative the percentage of the acres that have some potential for development that allow surface occupancy.

Table 123. Percentage of acres with high potential for oil and gas occurrence and some potential for development that would allow surface development by alternative

	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Percentage of high potential lands with some potential for development where allocation allows surface occupancy	89	67	31	45	69	86	46

Similar to the comparisons above, alternatives A and F provide the greatest percentage of acres that allow surface development where there is some potential for surface development and high potential of occurrence. Unlike the previous comparisons, alternative G provides more lands than alternatives C and D. This is reflective of the design emphasis used in creating alternative G that tried to feature lands with high occurrence potential, some potential for development, and current lease activity while still excluding big game crucial winter range. The remaining alternatives of B and E rank similar to the previous comparisons.

The overall estimates for low development on the Shoshone are similar to those made 25 years ago (USDA Forest Service 1992). Given these projections and the lack of activity in the last 25 years, the potential for any oil and gas development in the planning period is very low and the same for all alternatives. Despite the difference in the acres available for surface development, it is unlikely that any of the alternatives will impact oil and gas development.

Effects from Riparian and Wetland Management: Surface occupancy associated with leasable minerals and mineral materials would not be allowed in riparian or wetland areas and would be restricted for locatable mineral activity. Unless there is no other option for location, activity would not be affected by this direction. This limitation on surface occupancy for leasable and mineral material activity does not vary among alternatives since riparian and wetland areas do not vary among alternatives. Because of the low development potential, there is likely to be little to no effect to leasable minerals. Because of the likely ability in most cases to access mineral resources from outside the riparian and wetland areas, there would be little effect to mineral materials or locatable mineral activities.

Effects from Scenic Resource Management: Surface occupancy associated with minerals activity would be restricted in visually sensitive areas. Unless there is no other option for location or mitigation, mineral activity would not be affected by this direction. Restrictions are tied to sensitive visual areas which vary little among alternatives. There is likely to be little to no effect on mineral activity during the planning period.

Effects from Wildlife Habitat Management: Habitat security requirements for grizzly bear can be expected to affect locatable mineral exploration and development. Where roads, and the access they provide, are necessary, limitations on road construction and operating seasons can be expected to have the effect of prolonging exploration or development work.

Habitat security requirements for grizzly bear can be expected to affect mineral material development. Where roads, and the access they provide, are necessary, limitations on road construction and operating seasons can be expected to have the effect of impacting development work.

Habitat security requirements for grizzly bear can be expected to affect leasable mineral exploration and development. Where roads, and the access they provide, are necessary, limitations on road construction and operating seasons can be expected to have the effect of prolonging exploration or development work. In alternatives B, C, D, E, and G, direction does not allow surface occupancy for oil and gas development within the grizzly bear primary conservation area. This has no effect on oil and gas in alternative C, because the acres assigned to no surface occupancy are already excluded based upon management area suitability. For alternatives B, D, E, and G, the additional acres excluded from development are 41,700, 24,700, 57,700, and 32,100, respectively. In alternatives A and F, surface occupancy is allowed within the primary conservation area, but the direction on development within the primary conservation area still needs to be met. In those alternatives, oil and gas would be limited by access and operating season restrictions. The acres affected are 135,100 in alternative A and 153,900 in alternative F.

Despite the limitations in these alternatives, grizzly bear primary conservation area restrictions are likely to have little effect on oil and gas development, because of the low likelihood of oil and gas development and the fact that very little of the lands with a high potential for oil and gas occurrence fall within the primary conservation area.

Mineral and energy exploration and development is likely to be affected in lynx analysis units in occupied habitat. Guidelines give direction that winter access should be limited to designated routes or designated over-the-snow routes. The direction will create some timing and location restrictions on development. The effect would be the same in all alternatives.

Crucial winter range places timing restrictions on mineral activity. This is likely to increase oil and gas development time and costs to apply the restrictions. The effect is the same in all alternatives, except alternatives C and G. In alternative C, direction was applied that does not allow surface occupancy within crucial winter range. This resulted in an additional 58,000 acres of no surface occupancy in alternative C, beyond what was excluded as the result of management area allocations. In alternative G, some of the crucial winter range was excluded from surface occupancy, resulting in an additional 60,000 acres of no surface occupancy.

Effects from Soil and Watershed Management: Surface occupancy associated with leasable minerals would not be allowed on steep slopes, restricting locatable mineral and mineral materials activity. Unless there is no other option for location, activity would not be affected by this direction. This limitation on surface occupancy for leasable activity does not vary among alternatives since steep slopes do not vary among alternatives. Because of the low development potential, there is likely to be little to no effect to leasable minerals. Because of the likely ability in most cases to access mineral resources from outside the steep areas, there would be little effect to mineral material or locatable mineral activities.

Effects from Heritage Management: Surface occupancy associated with minerals activity would be restricted in areas with heritage resources. Unless there is no other option for location or mitigation, mineral activity would not be affected by this direction. This restriction on mineral activity does not vary among alternatives since heritage resources do not vary among alternatives. There is likely to be little to no effect on mineral activity during the planning period.

Summary of Effects to Resource

All alternatives would allow mineral activity in some areas with constraints to protect other resources. These constraints would include limiting or prohibiting access and development or controlling the timing or nature of development. All alternatives also have some areas where mineral activity would be prohibited. For mineral materials and locatable minerals, alternatives ordered such that the ones providing the most area open and the least restrictions in open areas to those with the least area open and most restriction in open areas are: F, A, E, B, G, D, and C. This basically illustrates how the alternatives impact the opportunity for mineral materials and locatable mineral development. For oil and gas surface development, alternative G is different. From an overall acres available standpoint, alternative G has the fewest acres available of all the alternatives. If the focus is on the acres with the highest potential of oil and gas occurrence, alternative G ranks between alternatives B and D.

The actual effects on mineral development are tied to the demand associated with leases, claims, and materials, and are based on whether that activity is impacted by plan direction. Based on the last 20 years of activity, the demand for minerals, oil, and gas on the Shoshone is low. That could change in the future as demand and technology change, but for the near term, there is no evidence of a change in demand for mineral resources on the Shoshone. Based on the prospect of low demand, the impact on mineral development during the planning period is low and is similar for all alternatives.

Cumulative Effects

Cumulative effects evaluate the potential impacts to mineral resources from the proposed action when combined with past, present, and reasonably foreseeable actions. The lands within the Shoshone boundary form the geographic scope for cumulative effects since this is the scope for the revised Forest Plan. The temporal bound would be the life of the revised Forest Plan, which is estimated to be a 10- to 15-year time span.

To integrate the contribution of past actions to the cumulative effects of the proposed action and alternatives, existing conditions are used as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior actions that have affected access and might contribute to cumulative effects.

There currently are no mineral operations for locatable minerals on the Shoshone, and there are no known plans for such operations. Some small-scale gold panning and dredging is occurring on a sporadic basis, but it has not lead to any sustained operations or interest.

There is currently one drilling application on the Shoshone north of Dubois. If that drilling results in a find that encourages further exploration, the development of a full field on the Shoshone is possible. The area would be associated with areas off the Shoshone, so it is likely that only part of the development would occur on NFS lands. In past analysis done for the Shoshone, a full field development was projected at 500 acres (USDA Forest Service 1992, appendix A). The drilling application is in an area where development potential has been classified as very low. Any development would be accompanied by a project-specific environmental analysis.

Mineral material use can be expected to continue for in-service needs (e.g., road maintenance and watershed improvement activities) and as a salable commodity, and would result in the further depletion of that non-renewable mineral resource from NFS lands.

Roads

Introduction

National Forest System roads (referred to as system roads) provide motorized access to and through the Shoshone. They provide access and a means of transport for activities such as commercial uses, a wide range of recreation uses, resource protection, and administration of NFS lands.

System roads serve an identified purpose or need, whether it is for resource management, recreational use, or administration. These roads range from paved to aggregate-surfaced to native-surfaced, from single-lane to double-lane, from free-flowing to congested, from smooth to rough. They may be managed for passenger car use or for use by high-clearance vehicles.

There are four designated Scenic Byways and three Forest Highways on the Shoshone. The Scenic Byways are Beartooth National Scenic Highway (US 212), Chief Joseph Scenic Byway (WY 296), Buffalo Bill Scenic Byway (US 14/16/20), and Wyoming Centennial Scenic Byway (US 26/287). These routes are paved highways under the jurisdiction of other agencies. They are integral to enjoying the scenic quality of the Shoshone and they provide primary access through the Forest on major travel corridors. The Forest Highways are Beartooth Highway (U.S. 212), Chief Joseph Highway (WY 296) and Louis Lake Road (NFS Road 300). They are primary routes accessing large portions of the Shoshone. Part of Louis Lake Road is under Forest Service jurisdiction. The remainder is under the jurisdiction of other agencies.

Unauthorized, or non-system, routes are present. They may be routes that have developed over time by off-road use or through use of temporary roads that were inadequately closed or re-opened by a user, or they may be system roads that were closed or decommissioned and reopened by casual use. Though this document will not make travel management recommendations or decisions, it is relevant to note that non-system routes exist on the Shoshone. This section discusses effects to the current road system in response to actions by management area allocation and alternative. Decommissioning or other actions that restrict use or access are not addressed. Unauthorized routes will be addressed in a separate travel management planning effort.

Legal and Administrative Framework

Laws

National Forest Roads and Trails Act of October 13, 1964 (P.L. 88-657, 78 Stat. 1089, as amended): This act declared that an adequate system of roads and trails be constructed and maintained to meet the increasing demand for recreation and other uses. The act authorizes road and trail systems for the national forests. It also authorizes granting of easements across NFS lands, construction and financing of maximum economy roads (FSM 7705), and imposition of requirements on road users for maintaining and reconstructing roads, including cooperative deposits for that work.

Multiple-Use Sustained-Yield Act of June 12, 1960 (P.L.86-517, 74 Stat.215): This act directs that access and recreation opportunities to NFS lands be provided.

Highway Safety Act of September 9, 1966 (P.L. 89-564, 80 Stat. 731, as amended): This act authorizes state and local governments and participating Federal agencies to identify and survey accident locations; to design, construct, and maintain roads in accordance with safety standards; to apply sound traffic control principles and standards; and to promote pedestrian safety.

Federal Aid Highway Act of 1968, as amended (23 U.S.C. 109(a) and (h), 144, 151, 319, and 351): Establishes the National Bridge Inspection Standards **(23 CFR Part 650, Subpart C**) and the requirement that each state have a current inventory of bridges on all public roads, including system roads open to public travel (FSM 1535.11).

Forest and Rangeland Renewable Resources Planning Act of August 17, 1974 (P.L. 93-378, 88 Stat. 476, as amended): This act declares (per Sec. 10) that "…the installation of a proper system of transportation to service the NFS ….shall be carried forward in time to meet anticipated needs on an economical and environmentally sound basis…"

Federal Land Policy and Management Act of October 21, 1976 (P.L. 94-579, 90 Stat. 2742, as amended): This act declares (per Sec. 102) that "…the public lands be managed in a manner that…will provide for outdoor recreation and human occupancy and use."

Surface Transportation Assistance Act of 1978 (P.L. 95-599, as amended). Supersedes the Forest Highway Act of 1958: Authorizes appropriations for forest highways and public lands highways. Establishes criteria for forest highways; defines forest roads, forest development roads and forest development trails (referred to as "system roads" and "system trails" in Forest Service regulations and directives); and limits the size of projects performed by Forest Service employees on forest roads. Establishes the Federal Lands Highway Program.

36 CFR Part 212, Subparts A and B Travel Management Rule

36 CFR Part 212.51 Travel analysis as a part of all planning activities.

Title 23 United States Code – Addresses highways.

Executive Orders

Executive Order 11644 (as amended): Establishes policy and procedure "…that will ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of those lands, to promote the safety of all users of those lands, and to minimize conflicts among the various uses of those lands."

Regulation and Policies

- Forest Service Manual (FSM) 7700 Travel Management (all chapters).
- Forest Service Handbooks (FSH) 7709.55, 7709.56 and 7709.59 state policy and direction regarding travel planning, road preconstruction, and transportation system operations.

Agreements

Memorandum of Understanding between the Wyoming Department of Transportation, the Federal Highway Administration and the USDA, Forest Service Rocky Mountain and Intermountain Regions, signed 2010—for the development of highway projects on NFS lands.

Cooperative Forest Road Agreement between the Wyoming Department of Transportation and the U.S. Forest Service Rocky Mountain and Intermountain Regions, signed 2010—to permit the Wyoming Department of Transportation to work on system roads.

Memorandum of Understanding between the United States Department of Agriculture, Forest Service, and the United States Department of Transportation, Federal Highway Administration, signed 1998—for transfers of easement for highway purposes

Resource Protection Measures

The Forest Service Regional and National BMP Directives contain standards and design criteria including best management practices, designed to protect, maintain, and enhance the integrity of soil and aquatic ecosystems. There are Forest-wide and management area standards and guidelines that apply to roads, including stream crossings. Road design, maintenance, and management criteria are referenced under a guideline in the 1986 Forest Plan and referenced in the revised Plan under management approach.

Methodology

Analysis is based on the current road system. Infrastructure (INFRA) and geographic information system (GIS) databases were used for this analysis.

Effects of the alternatives on roads are compared based upon acres of land available for roads and for road construction.

Spatial and Temporal Context for Effects Analysis

The affected area for direct and indirect effects to system roads includes the lands administered by the Shoshone and roads outside of the Shoshone boundaries that may be under Forest Service jurisdiction due to transfer of easement or otherwise identified as important to management and administration of the Forest.

The affected area for cumulative effects to the system roads includes lands administered by the Shoshone, as well as lands of other ownership within and adjacent to the Shoshone's boundaries. This analysis reflects the anticipated life of the Plan (15 years).

Incomplete and Unavailable Information

Comprehensive travel management has not been completed. Additionally, travel analysis was not completed for the revised Plan as no road- or trail-specific decisions are being made. Travel analysis, per FSM 7712.2, is planned to be completed during comprehensive travel management planning following forest plan revision. It will be used to inform decisions related to identification of the minimum road system, as required by 36 CFR 212.5(b)(1).

Field verification of all system road constructed features and physical elements is ongoing. Some road lengths have not been physically verified.

Affected Environment

System roads are an infrastructure capital investment necessary for support of long-term management, administration, and use of the Shoshone. There are currently approximately 1,130 miles of system roads under Forest Service jurisdiction. Additional roads cross the Shoshone that are managed and administered by other jurisdictions, such as State, county, or private.

Roads provide access for a wide range of activities and uses on the Shoshone. Timber harvest has been the primary driver of road construction throughout the history of the Forest, including during the tie-hack era and the timber production boom of the post-World War II years. By the 1990s, most of the Shoshone's roads had been constructed and were being managed. The advent of all-terrain-type vehicles, increased availability of four-wheel drive vehicles, a change in demographics, and a trend upward in population helped to increase use of the Shoshone for motorized recreational activities.

Roads are characterized in a variety of categories, two of which are most prominent—operational maintenance level and functional class.

Operational maintenance level is a description of the current maintenance level of a road considering today’s needs, road condition, budget constraints, and environmental concerns. It defines the level to which a road is being maintained. Operational maintenance levels are described as follows:

Level 5 —Roads that provide a high degree of user comfort and convenience.

Level 4 — Roads that provide a moderate degree of user comfort and convenience at moderate travel speeds.

Level 3 — Roads that are open and maintained for travel by a prudent driver in a standard passenger car.

Level 2 — Roads that are open for use by high-clearance vehicles.

Level 1 —Roads that have been placed in storage (for longer than one year) between intermittent uses. Basic custodial maintenance is performed. Road is closed to vehicular traffic.

Table 124 shows miles of system road by operational maintenance level.

Table 124. Summary of Shoshone roads by operational maintenance level

Operational maintenance level	Miles
Level 5	3
Level 4	6
Level 3	193
Level 2	748
Level 1	182
Total	1,132

Generally, the higher the maintenance level, the more often a road receives maintenance and the better the condition of the road. The majority of the NFS road mileage on the Shoshone is in maintenance level 2. Roads meeting identified long-term, single-purpose needs but not constant need or use may be placed in the maintenance level 1 category. Level 1 roads are physically closed and not open for motor vehicle use until needed for management activity.

System roads are categorized into one of three functional classes—arterial, collector, or local. Functional class describes the way a road services land and resource management needs and the character of service it provides. The branching system of arterial, collector, and local roads is the network that provides access to NFS lands.

Arterials are the main travel corridors across the Shoshone. They provide access to large land areas, usually connect with other arterials or public highways, and are the primary travel corridors for goods, services and access to and from the Forest. They connect main highways to collector and local roads, tend to be the longest in length, receive the highest traffic volumes, and are generally aggregate-surfaced. Arterials may be in maintenance level 3, 4, or 5. They are designed and maintained for passenger car use.

Collectors serve smaller land areas than arterials and usually connect arterials to local roads or terminal facilities. They tend to be moderate to long in length and receive moderate traffic volumes. Collectors may be aggregate-surfaced or native-surfaced. Collectors are generally in maintenance level 3 or 4, but may be in maintenance level 2.

Local roads provide access to specific locations and tend to be the shortest in length. They generally connect terminal facilities to collectors, arterials, or public roads. They often serve as access to specific points of use, such as timber harvest units, campgrounds, trailheads, physical features, etc. They may serve a single purpose or they may serve multiple uses. Local roads may be paved, aggregate-surfaced or native-surfaced. They generally serve lower volumes of traffic. Local roads may be in any of the maintenance levels.

There is no direct correlation between functional class and maintenance level. Table 125 shows road miles by functional class.

Table 125. Summary of Shoshone roads by functional class

Functional class	Miles
Arterial	48
Collector	207
Local	877
Total	1,132

Timber harvest continues to involve road maintenance, frequent road reconstruction, and occasional construction. The need to maintain and improve the road system for motorized recreation opportunities and other uses continues. It is anticipated that the trend for construction will remain low. Expectations are that increases in traffic volume related to higher levels of and demand for motorized activity will result in an upward trend in the need for road maintenance and reconstruction. Miles of reconstruction and maintenance accomplishment generally fluctuate on an annual basis, based upon prioritization of available funding and urgency and magnitude of need. Reconstruction and maintenance may occur on local, collector, and arterial roads, and on roads in all maintenance levels.

Open system road miles may fluctuate over time due to changes in resource management activities, wildlife habitat needs, resource damage, changing demands for access, and availability of funds for maintenance and improvement.

In the last decade, new construction averaged less than 0.5 mile per year. Timber harvest activity created the primary need for new road construction. New construction has occurred almost exclusively on local, maintenance level 1 or 2, roads in this time period.

In the last decade, road reconstruction averaged approximately 18 miles per year. Timber harvest and recreational use generated the need for most reconstruction on the Forest. Reconstruction is road-specific and has included activities, such as replacement of bridge and culvert structures, repair of flood damage, aggregate placement, road relocation, and restoration of road templates.

Reconstruction has occurred on roads in nearly every maintenance level. Road reconstruction will continue to be necessary for managing and protecting resources, providing for increasing traffic volumes and recreational uses, and resolving safety concerns.

The term “decommission” encompasses varying types of activities meant to eliminate motorized use. Decommissioning activities may include: complete obliteration and rehabilitation; physically blocking, restoring natural drainage and revegetating; or scarification and seeding to return to natural production. A decommissioned route is not a system road. Much of the decommissioning that has been done has been related to watershed protection and improvement, changes in traffic patterns on highway reconstruction projects, elimination of multiple or braided tracks to the same area, and removal of user-created routes. In the last decade, decommissioning of system roads averaged approximately 1 mile per year. In that same timeframe, decommissioning of non-system routes averaged 3 miles per year.

Road maintenance is accomplished by the Forest Service on an annual basis and through authorizations, permits, and cooperative agreements with other agencies, commercial operators, and private parties. Road maintenance is not static in location or amount of investment. Maintenance of roads is dependent upon a number of factors, including:

- Total miles of open roads;
- Allocated funding for road maintenance;
- Miles of road maintained through commercial activities, such as timber sale contracts, and by cooperators or other parties;
- Funding allocated for reconstruction and improvement projects to support emergency repairs, mitigation of safety concerns, and other management activities;
- Funding needed for large projects, such as bridge replacement;
- Resource protection needs;
- Assigned operational maintenance levels; and
- Traffic use levels and season of use.

Road maintenance budgets fluctuate from year to year. Traffic volumes on the Shoshone’s open road system have risen. Commercial user contributions are variable in location. Costs for equipment and materials increase over time. Repair of road damage caused by natural events such as flash flooding or intense storm and runoff events occurs. Occasional needs for high financial investment, such as bridge and major culvert replacement and aggregate placement, divert available maintenance funds. These factors affect the amount of road maintenance that is accomplished on an annual basis.

Funding is well below that needed to annually maintain the entire road system at operational maintenance level standards. On average, the Shoshone physically maintains approximately 20 percent of the open road system on an annual basis. Generally, this includes surface blading most of the maintenance level 3, 4, and 5 roads, which receive the most use, once a year. As a result, roads are maintained on a priority basis, which includes user safety, resource protection, and resource management and administrative needs.

Road program funding is anticipated to remain static or decrease in the short term. Although not every road requires annual physical maintenance, roads in maintenance levels 3, 4, and 5 generally receive a higher level of attention as they are the primary access routes through the Shoshone and receive higher volumes of traffic. The trend for the majority of the Shoshone’s roads is toward declining condition and service level due to the reduction in overall funding and increases in traffic volume and use.

Motor vehicle use maps have been created, per 36 CFR 212.51, which identify roads, trails, and areas that are open to wheeled motor vehicle use. The maps enforce the prohibition at 36 CFR 261.13. Wheeled motor vehicle use on other than those roads, trails, and areas shown on the motor vehicle use maps is prohibited. Motor vehicle use maps are subject to annual review and re-issuance. All roads allow non-motorized use.

It is anticipated that demand for roads and access would remain high to meet the needs for administration of the public lands, management of resources, and public use. Public use is anticipated to increase. Use of roads for vegetation and hazardous fuels treatments is expected to increase, at least in the short term. Funding needed to maintain and reconstruct/construct roads to meet the demand for road uses would increase. Conversely, road program allocations are expected to remain stable or decrease in the short term. Competition for road funds is anticipated to remain high. Vegetation treatment activities would continue to support road work necessary for those activities to occur.

Changes in climate anticipated include warmer average temperatures, receiving more precipitation as rain rather than snow, and projections for increased severity of thunderstorm events (Rice et al. 2012) may increase the impacts of runoff on roads. Increased severity of rain events may trigger more intense debris flow and erosion capabilities, which affect roads by creating slumps and slides, depositing roadway materials and surfacing outside of the road template or into ditches or waterways, and exceeding capacity of drainage structures.

Desired Condition

System roads provide legal and reasonable access for a variety of recreation opportunities, resource management, authorized and permitted uses and administration. Resource impacts from roads are balanced with the benefits of having roads available for use. Many roads are open to motorized use, as identified on the motor vehicle use map. Some roads are closed except for administrative or authorized use or for intermittent, short-term resource management activities. Some roads are seasonally closed to motorized use. Temporary roads provide short-term access to areas of the Shoshone for meeting desired conditions and objectives for resource management. Unauthorized or unneeded routes are rehabilitated and returned to natural land settings.

System roads are of varying functional class, maintenance level, physical condition and features to provide a broad array of opportunities for wheeled motorized vehicle access.

The Beartooth All-American Road, Wyoming Centennial Scenic Byway, Chief Joseph Scenic Byway, and Buffalo Bill Cody Scenic Byway provide outstanding scenic, recreational, and educational opportunities. Forest travel corridors continue to provide access into the forest interior, and local roads provide access to terminal facilities. Coordination with the Federal Highway Administration strengthens services and improves conditions on forest highways. Coordination with other road agencies ensures continued access to and protection of national forest resources.

System roads needed for long-term access, management, and administration are maintained in a manner that provides for user safety and minimizes impacts to natural resources. All system roads are periodically assessed for condition, resource damage, and maintenance needs. Funds are planned and expended by prioritizing need based on factors such as safety, traffic volume, resource damage, and road condition.

Road management is directed by travel management decisions based on travel analysis and environmental analysis. Roaded access is enhanced through easement and right-of-way acquisition and transfer, and easements necessary for legal administrative and public access are acquired.

Environmental Consequences

System roads are part of the infrastructure of the Shoshone. The road infrastructure is a tool to help manage, administer, and use the lands and resources on the Shoshone. Infrastructure is different than the many natural resources present on the Forest. While roads are not a natural resource, the physical presence of roads is useful and necessary for managing and enjoying the national forest. Some resource management activities and uses affect roads and the road system, but most have little effect.

Direct and Indirect Effects

Alternatives with more acres allocated to management area category 5 provide increased opportunities for the motorized use of system roads. Alternative F, followed by E, allow for the greatest amount of road-related opportunities. Conversely, alternative C allows for the fewest road-related opportunities. Alternatives A, B, G, and D are similar, although alternatives B and G contain more acres in MA 5.1 (Managed Forests and Rangelands) than alternatives A or D. In general, alternatives with fewer stipulations or restrictions on roads and road construction and reconstruction provide greater opportunities for the presence of open roads.

Alternative F includes the most acres of management area category 5. The increased area available for vegetation management would increase costs for related road maintenance, reconstruction, and construction. Alternative C includes the fewest acres of management area category 5, and would result in decreased costs for reconstruction, maintenance, and road management. The other alternatives would result in similar effects on roads and road-related costs, which would be less than alternative F and greater than alternative C. Actions that may have the greatest effects on the Shoshone road system, and motorized uses of it, include road management decisions allowing, restricting, or prohibiting motorized access; natural events such as floods and landslides; and access needs for commodity production.

Effects from Timber Harvesting: Commercial timber harvest activities would generally result in reconstruction, maintenance, and continued use of existing system roads and in application of best management practices on roads. New road construction is likely to be limited. Temporary road construction would be used as a common method for short-term access needs. Increased traffic volumes where timber harvesting occurs may create areas of congestion, slower traffic, noise, dust, potential conflicts with other users, and additional maintenance of signs and road features. New local roads constructed for timber harvest may be controlled to restrict use to that necessary for timber harvest activities, depending on management and resource concerns and opportunities. System roads that have been in a status of closed to motorized vehicle use (maintenance level 1) may be re-opened and reconstructed or maintained to access harvest units. Timber harvest may result in additions to the forest road system.

Administrative use of maintenance level 1 roads may occur when management activities such as precommercial thinning, invasive weed treatments, or other non-commercial silvicultural treatments are authorized.

It is anticipated that all alternatives would require construction, reconstruction, and maintenance of system and temporary roads to implement timber harvest. Effects to roads vary by alternative and are estimated based on the number of acres allocated to management area (MA) 5.1 (Managed Forests and Rangelands), where most of the timber harvest activities would occur. System road construction is anticipated to occur on local roads only, while reconstruction and maintenance may occur on local, collector, or arterial roads. All alternatives have the potential to increase the number of miles of system roads open to motorized use, as determined during project planning. Temporary roads are planned to be obliterated following project completion.

Over the next decade, timber harvest activities may generate the need for approximately 2 miles of system road construction in alternatives A, B, C, D, and G; 3 miles of system road construction in alternative E; and 4 miles of system road construction in alternative F.

Alternative C allocates the fewest acres to management category 5 and is anticipated to result in the fewest acres of timber harvest, resulting in fewer miles of system road construction, reconstruction, and maintenance, temporary road construction, and associated costs compared to the other alternatives. Reduced traffic volumes for commercial and administrative use may be expected, compared to the other alternatives. Road maintenance activities performed in conjunction with commercial timber harvest would occur less often than in other alternatives, since this work is only required commensurate with the commercial use.

Alternative F allocates the most acres to management category 5. Miles of system road construction, reconstruction, maintenance, temporary road construction and associated costs related to timber harvest would be greater than all other alternatives. Effects to roads from timber harvesting is least in alternative C, and increases in the following order: alternatives D, B, G (alternatives B and G would be the same), A, E, and F. Overall effects of alternatives A, B, C , D, and G are similar.

Road development in undeveloped areas increases the potential for greater frequency and volume of use, where access has been previously limited, and for greater disturbance to natural resources. It is anticipated that alternative F would increase road maintenance and management costs, as roads are added to the system, and increase motorized opportunities, as reflected on the motor vehicle use map. Increased traffic volumes and local congestion would be expected. Road maintenance activities done in conjunction with commercial use would occur more often, as commercial use would be more frequent and wider ranging. Providing access into more challenging terrain to reach significantly more acres for timber harvest might create the need for additional structures, such as bridges, and greater attention to increased frequency of maintenance to reduce soil and water concerns.

Short-term effects of each timber harvest project generally include: increased construction, reconstruction, and maintenance; traffic restrictions as required by project travel management decisions; increased use of haul routes; noise from equipment use; presence on roads of harvest, haul, and construction/maintenance equipment; and visible management activity. It is not anticipated that timber harvest activities would be a deterrent to other motorized users, although non-motorized users might avoid these areas.

Long-term effects generally include: maintenance and management of system roads and constructed features; maintenance of closures and restrictions; and maintenance and management of internal property and information databases.

Effects from Disturbance Processes (fires/fuels management and insect/disease mortality): Roads provide access for fire and fuels management. Traffic in support of wildfire suppression activities is generally temporary in nature. There may be both long-term and short-term impacts to system roads from wildfire. Short-term impacts may include increased volume and frequency of traffic; traffic restrictions; potential for damage to road features; increased maintenance due to heavier traffic volumes; noise; dust; congestion; destruction of constructed features that are susceptible to fire; opening of closed roads to provide direct access to areas of a fire; and use of temporary access routes. Long-term effects from wildfire may include: increased erosion and sedimentation of roadbed materials due to runoff events such as floods; increased potential for mass movement of road cuts and fills on un-vegetated slopes; need for additional or larger drainage structures to handle flows from un-vegetated drainages; and increases in travel management costs.

Increases in traffic with respect to size, weight and volume, would result in the need for increased maintenance of the road surface and constructed features if damaged or overloaded during suppression activity. The need for access by suppression equipment sometimes creates user routes, such as bulldozer-created containment lines or cross-country travel by engines that may be perpetuated by other forest users following completion of suppression activity. This may create the need for greater attention to rehabilitation of these user-created routes.

Temporary gates or other closures may be installed on roads to protect the public and firefighters by reducing congestion and conflicts and keeping people out of active fire areas.

Road constructed features that may be damaged by fire and fire suppression activities include bridges, signs and posts, cattleguards, fences, ditches, and metal features that may be damaged by heat. Damage may occur when roads or features are used inappropriately, such as overloading a posted bridge, driving over the end of a culvert, or knocking down a ditch to improve ease of access to a destination. Damage from wildfire may also impact constructed features made of wood such as, signs, posts, and wooden bridges.

Prescribed fire activities generally use the existing road system. Usually, no impacts to the road system result from prescribed fire activities, although short-term authorizations for use of a closed road may be granted and temporary road closures may be necessary to mitigate smoke management and other safety concerns.

Impacts to the system roads occur indirectly from insects and disease. Insects and diseases kill trees, some of which are along system roads. Indirect impacts include the potential for dead trees to fall onto or across a system road, creating a safety hazard to users, and the potential need for additional road maintenance to clear trees before or after they fall. Additionally, disease-damaged trees may be harvested or treated to reduce further disease effects and threat from wildfire. Harvest or vegetation treatment activities resulting from the effects of insects or disease on trees may result in impacts similar to those for timber harvest.

In general, it is anticipated that alternatives with greater amount of areas available for active management and motorized use result in fewer impacts from large wildfires and insects and disease, but would receive more prescribed fire activity than those alternatives with less area available for active management. Effects from wildfire, insects, and disease on roads may then be greatest in alternative C, least in alternative F, and similar among the other alternatives.

Effects from livestock grazing: In areas of open range, livestock may be on or adjacent to roadways, which presents concerns for the safety of the traveling public. Management of allotments and pastures often creates the need for structures such as cattleguards and gates in roadways, requiring installation of required warning and safety signing and increased costs to maintain.

Effects from Recreation: Roads provide access to and through the Shoshone. Wheeled motorized vehicles are the predominant use on open roads. Non-motorized uses may occur on any road and in the general forest area. The Motor Vehicle Use Map identifies roads open to designated non-winter uses.

Direct effects to roads from recreation generally involve road maintenance related to the intensity and season of use. Reconstruction may occur in order to improve constructed features or roadway conditions for safety reasons and to accommodate recreation-related traffic, renovate developed recreation sites, provide parking areas, and repair resource damage. Seasonal closures may be used to protect roads during spring runoff when they are soft and saturated and most vulnerable to damage.

The more miles of road open to motorized uses, the greater the cost to maintain and manage them. It is not anticipated that new roads would be constructed for the single purpose of providing motorized recreation opportunities for highway-type vehicles. It is anticipated that roads constructed for other purposes, such as timber harvesting, may provide additional opportunities for those vehicles. New motorized trails and future travel management decisions may provide additional or different recreation opportunities for motorized recreational uses. Alternatives A, B, D, E, and G are similar in system miles and cost.

Alternative C has the greatest amount of non-motorized area, followed by alternative D. It is anticipated that management area changes from current management might result in decommissioning approximately 15 percent of the current maintenance level 1 and 2 roads in alternative C. Open system road miles and costs to manage and maintain the road system would be reduced.

Alternative F has the greatest amount of area available in management category 5 and the least potential non-motorized areas, followed by alternative E, which may increase the demand for additional system roads available for motorized uses and the cost for maintenance and management of them.

Effects from Oil and Gas Development and Minerals Development: The Shoshone road system provides general access for oil and gas development, and locatable, leasable, and mineral materials development on the Forest. Access and roads are often associated with oil and gas development. Site-specific analysis is required prior to approval of exploration or development activities. Additionally, oil and gas production requires separate analysis.

The potential for oil and gas development in the planning period is low or very low under all alternatives. The amount of development would likely be similar among the alternatives. It is anticipated that any new roads needed for development would be minimal in number and mileage. Location of any new road would adhere to surface-occupancy and other restrictions in the affected management area. New roads needed for these activities would meet management area prescriptions and might restrict public use. Increases in traffic volume and weight might require additional improvements to the surface, drainage features, and structures of roads. Short-term heavy use is anticipated during exploration and well development. Long-term effects might include additional and more frequent road and structure maintenance.

Road access necessary for activities associated with locatable and mineral materials is site-specific. It is possible that new roads would be needed to access locatable and mineral materials. New roads needed for these activities would be minimal in number, would be at the minimum standard necessary to manage the activity, and would meet management area prescriptions.

Roads needed for these site-specific activities could restrict public use to protect the material property and investment and reduce safety concerns related to equipment usage and activity generally associated with these sites. It is anticipated that effects on roads of all alternatives are similar.

Effects from Wildlife Habitat Management: Since wildlife management does not vary among alternatives, the effects to roads are similar. Wildlife habitat management may directly affect motorized opportunities. Restrictions that limit types of access and seasonal closures during sensitive periods may temporarily displace motorized uses to other areas. The Shoshone's Motor Vehicle Use Map(s) restrict wheeled motorized uses to designated routes year-round or seasonally, sometimes in response to wildlife habitat needs. Alternatives A, B, C, D, E, and G allow timing restrictions and opportunities for seasonal wildlife closures.

Effects from Land Use Authorizations: Easements and permits issued to other parties would continue to be analyzed on an individual and site-specific basis and authorized based upon identified need and allowable motorized uses per management area, ensuring that appropriate access is granted for the intended activity or purpose. It is anticipated that construction, reconstruction, and maintenance activities would be allowed as authorized by permit, grant or easement. It is not expected that roads would be added to the Shoshone road system from authorizations granted to other parties. However, roads may be added to the Shoshone road system should the Forest Service receive easements across other lands to gain access for the public or to more efficiently manage NFS lands. Effects to the road system from all alternatives are similar.

Effects from Travel Management: Comprehensive travel management planning to identify the minimum road system and a list of routes to be decommissioned is likely to affect the Shoshone road system. Direct effects may include a wide range of activities, such as decommissioning, annual closures (putting roads into the maintenance level 1 category), seasonal closures, additions to the system, conversion of roads to trails, changes in operational maintenance level, and changes in the physical characteristics of roads. Travel management decisions are reflected on the Motor Vehicle Use Maps and on the ground. Project-level environmental analysis documents travel management decisions for resource management activities. It is anticipated that travel management costs would increase where there are more travel restrictions. Alternative C proposes the most non-motorized areas, while alternative F allows potential for more system roads and more open roads than the other alternatives. Alternatives A, B, D, E, and G are similar in the miles of system road and open road. Travel management per alternative is compatible with general suitability determinations for each management area.

Summary of Effects to Resource

All alternatives impact roads to some degree. The greatest impacts to system road construction are associated with commercial uses, such as timber harvest and minerals extraction, which are highest in alternative F and lowest in alternative C. The greatest impacts to system roads in general are associated with activities that rely on motorized access, such as motorized recreation and commodity production, of which opportunities are highest in alternative F and lowest in alternative C, and those that rely on non-motorized activities and protection of resources, such as wilderness and wildlife habitat, of which opportunities are highest in alternative C and lowest in alternative F. Roads and motorized uses are also affected by travel management decisions.

Table 126 displays the miles of road by functional class by alternative. Opportunities to reduce system road mileage in general and open road mileage in particular are greatest in alternative C.

Opportunities to add system road mileage in general and open road mileage in particular are greatest in alternative F, yet also present, perhaps to a lesser degree, in alternatives A, B, D, E, and G.

Table 126. Roads by functional class in miles (based on management area allocation)

Functional class	Alternatives A, B, D, E,F, G	Alternative C
Arterial	49	49
Collector	204	200
Local	879	747
Total	1,132	995

Cumulative Effects

Unauthorized routes:

Unauthorized routes result in additional land disturbance. Often these routes are created on steep grades and in drainage areas, resulting in resource damage such as soil erosion, sedimentation in channels, rutting, compaction (impacts aquatic habitat and destroys vegetation), and causing disturbance to wildlife and non-motorized users. Effects of this use are costly to remedy. The presence of these routes directly affects personnel, time and funding available to maintain, reconstruct, and manage system roads and to manage resources, such as water and soils, for programs that reduce weeds and improve aquatic organism passage and habitat.

Highway and roads under other jurisdictions:

U.S. and State Highways crossing the Shoshone have been reconstructed over time. Highway maintenance and operations activities would continue. Occasional reconstruction to replace drainage structures, improve highway surfaces, or repair highway segments from slides, slumps, flooding or to eliminate safety concerns would occur. Effects of these activities on the Shoshone road system are generally minimal. Highway reconstruction projects offer opportunities to improve intersection access and signage for system roads and features and recreation opportunities. Highway segments not needed due to relocation and unauthorized or unneeded routes on NFS lands would be rehabilitated. Opportunities would be explored to improve user safety by limiting access points, consolidating parking areas, and discouraging unmanaged off-road use onto the general forest area. Potential changes to the designated forest highway system may include removal or addition of roads or road segments. Reconstruction of forest highways may occur on an occasional basis.

Some roads under county jurisdiction provide access to and cross NFS lands. They generally receive annual maintenance and may be reconstructed to improve alignment, grade, width, structures, surfacing, and eliminate safety concerns. The frequency of reconstruction is occasional. As more people move to areas near the Shoshone and on private lands within forest boundaries, it is anticipated that the service provided by county roads would increase. There may be additional roads created by the need for increased access near the Shoshone.

Effects of increasing population and additional roads on lands of other jurisdiction near or within the Shoshone boundaries may increase fragmentation of land, disturbance of wildlife species, and demand for recreational uses on the national forest. Activities on and uses of lands under jurisdiction other than the Forest Service are outside the administration of the Forest Service.

These activities and uses may result in a reduction in the location and density of system roads in those boundary areas in order to maintain wildlife habitat objectives.

Climate Change:

Reductions in wetlands that may occur over time as a result of climate change would increase their importance and increase the need for additional buffer space between roads and could affect placement of new roads on the landscape. Potential changes in vegetation might influence where on the landscape roads are needed for vegetation management. For example, as forested vegetation and grasslands expand upward in elevation, fewer roads are necessary for vegetation management. However, higher elevations are not as conducive to building roads as they tend to be more extreme in terrain, and it is anticipated that much of the land in the higher elevations would provide refuge for displaced species and habitats. Should winters be shorter and summers longer, potential exists for increased wheeled motorized vehicle recreation and longer seasons of summer motorized use. However, recreation pressure related to water activities on the Shoshone may be reduced if climate change caused less water to be available.

Climate change is not anticipated to have major effects on the road system, especially within the planning period. Long-term effects may include a reduction in use related to timber harvest and wheeled motorized recreation activities related to water, but longer summer seasons may result in increased wheeled motorized use for other outdoor recreation activities. The presence of roads and highways may exacerbate landscape fragmentation that occurs on the Shoshone and on other jurisdictional lands surrounding and within forest boundaries or that may occur as a result of climate change. An increasing population interested in wheeled motorized use may increase the demand for more of those types of opportunities, although the demand may be better met through motorized trail opportunities rather than increases in the road system (Rice et al. 2012).

Recreation

Introduction

This section examines the extent to which the no-action (alternative A) and the action alternatives (alternatives B through G) affect both access and recreation opportunities on the Shoshone National Forest. Large expanses of wilderness and back country characterize the Shoshone and provide opportunities for backpacking, hunting, fishing, and horseback riding and packing. Popular driving corridors provide infrastructure for sightseeing or for visitors traveling though the Shoshone on their way to other destinations. Within these corridors, visitors find opportunities for driving for pleasure, viewing scenery and wildlife, camping, picnicking, and hiking. The lands between the back country and travel corridors are transition areas where common opportunities include motorized access, off-road vehicle riding, snowmobiling, mountain biking, hiking, dispersed recreation, hunting, fishing, horseback riding and packing, and opportunities for gathering forest products. Expansive wilderness areas provide opportunities for people to experience solitude and adventure in a natural environment. Developed sites in highway corridors and in the front country complement the wilderness as part of the wide range of recreation opportunities.

Participation rates and values placed on outdoor recreation seem to be increasing on a national, state, and local level. In 2010, almost 50 percent of all Americans participated in some type of outdoor recreation activity (The Outdoor Foundation 2011). Within the State of Wyoming, 93.7 percent of Wyoming residents that completed a 2008 survey indicated that public parks and public recreation areas are “Very Important” in their daily lives (SCORP 2009). Recreation opportunities are an important service that the Shoshone provides. According to research completed by Clement and Cheng (2008), the second highest value placed on the Forest is recreation. Many people rely on and have come to expect the Shoshone to provide a diversity of experiences and opportunities. Others choose to reside near the Forest because of the available experiences and opportunities. According to the 2008 Wyoming Statewide Outdoor Recreation Plan (2009), 83 percent of respondents either strongly agreed or agreed that “Having recreation areas close to my home improves my quality of life.” Regardless of where they are visiting from, these people provide important contributions to local communities, both as visitors and residents.

Visitors enjoy the full range of recreational activities, including hiking, backpacking, hunting, fishing, horseback riding and packing, snowshoeing, off-road vehicle riding, snowmobiling, camping and picnicking, viewing scenery and wildlife, dog sledding, mountain biking, cross-country and downhill skiing, mountaineering, whitewater rafting, and ice and rock climbing. New types of recreational activities that did not exist 10 to 15 years ago are also increasing on the Forest. World-class ice climbing opportunities have been discovered on the Forest, making the Shoshone an internationally known destination for this type of recreational activity. The use of all-terrain vehicles has increased over the last 5 years. Goat packing (use of domestic goats for packing supplies into the back country) is also becoming more popular with organized groups promoting this type of recreation. The activity of horn hunting (seeking antler sheds from deer, elk, and moose) has seen a dramatic rise in participation. Finally, peak bagging (climbing to the top of high mountain peaks) has also been increasing in frequency by visitors to the Shoshone.

Recreational use trends on the Shoshone have been affected by the increasing population in adjacent communities and changes in technology related to recreational activities. According to an interagency report conducted by the Greater Yellowstone Coordinating Committee on the state of spring, summer, and fall recreation in this area, national forests that are part of this larger area “are more likely to see significant increases in recreation use, particularly in the fastest-growing counties of the Greater Yellowstone Area. In these places, 10 to 15 percent annual increases in recreation use are possible (Greater Yellowstone Coordinating Committee 2006). All of these trends are causing an increase in outdoor recreational demands on NFS lands

Legal and Administrative Framework

Laws

These acts, along with other land use laws, executive orders, and policies guide management of recreation resources on NFS lands. Other laws pertinent to recreation management of NFS lands can be found in the Forest Service Manual (FSM) 2300-Recreation, Wilderness, and Related Resource Management.

Term Permit Act of March 4, 1915 (P.L. 63-293, Ch. 144, 38 Stat. 1101, as amended; 16 U.S.C. 497): This act provides direction to the NFS lands to authorize occupancy for a wide variety of uses through permits not exceeding 30 years.

Rehabilitation Act of September 26, 1973 (P.L. 93-112, Title V, 87 Stat. 390, as amended; 29 U.S.C. 791, 793-794, 794a, 794b): This act requires that programs and activities conducted by Federal agencies and by entities that receive funding from, or operate under a permit from Federal agencies to provide an equal opportunity for individuals with disabilities to participate in an integrated setting, as independently as possible. The only exception to the requirement is when the program would be fundamentally altered if changes were made solely for the purpose of accessibility.

Multiple-Use Sustained-Yield Act of June 12, 1960 (P.L.86-517, 74 Stat.215): This act provides direction to the NFS lands to provide access and recreation opportunities. The act states, “The policy of Congress is that national forests are established and administered for outdoor recreation….”

L**and and Water Conservation Fund Act of 1965 (P.L. 88-578, 78 Stat. 897 as amended; 16 U.S.C. 460l-4(note); 460l-4 thru 6a, 460l-7 thru 460l-10, 460l-10a-d, 460l-11)**: “The purposes of this act are to assist in preserving, developing, and assuring accessibility to all citizens of the United States of America…such quality and quantity of outdoor recreation resources…providing funds for: 1. States for acquisition, planning, and development of recreation facilities and; 2. Federal acquisition and development of certain lands and other areas.”

Highway Safety Act of September 9, 1966 (P.L. 89-564, 80 Stat. 731, as amended): This act authorizes state and local governments and participating Federal agencies to identify and survey accident locations; to design, construct, and maintain roads in accordance with safety standards; to apply sound traffic control principles and standards; and to promote pedestrian safety.

Architectural Barriers Act of August 12, 1968 (P.L. 90-480, 82 Stat. 718 51 U.S.C. 4151-4154, 4154a, 4155-4157): This act establishes additional requirements to ensure that buildings, facilities, rail passenger cars, and vehicles are accessible to individuals with disabilities. It covers architecture and design, transportation, and communication elements of recreational site planning and development.

National Trails System Act of October 2, 1968 (P.L. 90-543, 82 Stat.919, as amended): This act establishes the National Trails System and authorizes planning, right-of-way acquisition, and construction of trails established by Congress or the Secretary of Agriculture.

Federal Land Policy and Management Act of October 21, 1976 (P.L. 94-579, 90 Stat. 2742, as amended): This act declares (per Sec. 102) that "…the public lands be managed in a manner that…will provide for outdoor recreation and human occupancy and use."

Surface Transportation Assistance Act of 1978 (P.L. 95-599, as amended). Supersedes the Forest Highway Act of 1958: Authorizes appropriations for forest highways and public lands highways. Establishes criteria for forest highways; defines forest roads, forest development roads and forest development trails (referred to as "system roads" and "system trails" in Forest Service regulations and directives); and limits the size of projects performed by Forest Service employees on forest roads. Establishes the Federal Lands Highway Program.

Federal Lands Recreation Enhancement Act of December 8, 2004 (P.L. 108-447, as amended): This act gives the Secretaries of Agriculture and Interior the authority to establish, modify, charge, and collect recreation fees at Federal recreational lands where a certain level of amenities have been developed.

Ski Fees, Omnibus Parks and Public Lands Management Act of November 12, 1996 (P.L. 104-333, div. I, Title VII, Sec. 701, 110 Stat. 4182; 16 U.S.C. 497c): Section 701 of this act:

- Establishes a system to calculate fees for ski area permits issued under the National Forest Ski Area Permit Act of 1986 (16 U.S.C. 497b);
- Provides for holders of ski area permits issued under other authorities to elect this permit fee system (FSH 2709.11, sec. 38.03a);
- Includes provisions concerning compliance with NEPA when issuing permits for existing ski areas (FSM 2721.61f and FSH 2709.11, sec. 41.61b); and
- Withdraws leasable and locatable minerals, subject to valid existing rights (FSH 2709.11, sec. 41.61c).

Ski Area Recreational Opportunity Enhancement Act of November 7, 2011 (H.R. 765 ENR)
The purpose of this act is to amend the National Forest Ski Area Permit Act of 1986 (16 U.S.C. 497b):

- (1) to enable snow sports (other than Nordic and alpine skiing) to be permitted on NFS land subject to ski area permits issued by the Secretary of Agriculture under section 3 of the National Forest Ski Area Permit Act of 1986 (16 U.S.C. 497b); and
- (2) to clarify the authority of the Secretary of Agriculture to permit appropriate additional seasonal or year-round recreational activities and facilities on National Forest System land subject to ski area permits issued by the Secretary of Agriculture under section 3 of the National Forest Ski Area Permit Act of 1986 (16 U.S.C. 497b)

Executive Orders

Executive Order 12862: Setting Customer Service Standards requires information about quantity and quality of recreation visits for national forest plans.

Executive Order 13195: Transportation Equity Act for the 21st Century (Public Law 105-178) aims to achieve the common goal of better establishing and operating America's national system of trails.

Regulation and Policies

Regulations and policies have been passed in support of these laws and require the following:

- Forest Service Handbook (FSH) 1909.15-Environmental Policy and Procedures Handbook
- Forest Service Manual (FSM) 2300-Recreation, Wilderness, and Related Resource Management
    - Continental Divide National Scenic Trail Comprehensive Plan
- Forest Service Handbook (FSH) 2709.11-Special Uses Handbook
- Shoshone National Forest supplement 2709.11 40 Special Uses Administration (Recreation Residence)
- Forest Service Manual (FSM) 7300-Buildings and Other Structures
- Forest Service Manual (FSM) 7700-Travel Management
- Rocky Mountain Regional supplements
    - 2300-93-6 (2330 Publically Managed Recreation Areas)
    - 2300-95-5 (2340 Privately Provided Recreation Opportunities
    - 2300-94-3 (2360.1-2361.32d Special Interest Areas)
    - 2300-94-4 (2361.4-2363.5 Special Interest Areas)
    - 2300-NO. 111(2370 Areas Designated Administratively)
    - 2300-90-1 (2390 Interpretive Services)

Assumptions and Limitations

- Access and travel management are a key aspect of providing recreational opportunities for the general public. Although the recreation analysis section discusses modes of travel and existing and potential areas for travel, forest plan revision is not intended to complete a formal travel management process nor designate specific routes for allowed travel. The designation of routes and trails for specific uses is not considered during plan revision, but will be addressed through subsequent travel management planning processes and decisions. The analysis in this document will consider effects of access and travel by management area.
- The Forest National Visitor Use Monitoring (NVUM) survey (2009), Clement and Cheng (2006) Study of Preferences and Values on the Shoshone National Forest and Wyoming Statewide Comprehensive Outdoor Recreation Plan (SCORP 2009) identifies the most popular recreation activities for this analysis.

Key Measurement Indicators

- Percent of the Shoshone and location of areas where roads and trails may be designated for wheeled motor vehicle use;
- Percent of the Shoshone and location of areas where over-snow vehicle use is allowed;
- Percent of the Shoshone and location of areas where mechanized use is allowed;
- Number of projected future miles of roads and motorized trails available for motor vehicle use;
- Percent of the Shoshone and location managed in the various recreation opportunity spectrum classes;

- Percent of total acres within 1-mile corridor of Continental Divide National Scenic Trail (CDNST) managed for recreational opportunity spectrum classes primitive and semi-primitive non-motorized;
- Percent of total acres within 1-mile corridor of CDNST managed for scenic integrity objectives high and very high; and
- Percent of total acres within 1-mile corridor of Nez Perce National Historic Trail (NPNHT) managed for scenic integrity objectives high and very high.

Methodology

For comparative purposes, each alternative is analyzed for the total number of acres, by management area allocation, where wheeled motor vehicle use may be designated, and over-snow vehicle use is allowed, or mechanized use is allowed.

Each management area is identified as to whether wheeled motor vehicle use, over-snow vehicle use, or mechanized use is allowed. Geographic information system information is then used to calculate the cumulative acres for that management area across the Shoshone. The cumulative acres for all of the management areas within each alternative are then calculated.

Likewise, each alternative is analyzed for the total number of acres and percentage of the Shoshone managed in various recreational opportunity spectrum classes and categories of scenic integrity objectives. Each management area includes direction for the recreational opportunity spectrum class and scenic integrity objectives that are most appropriate for managing that area of the Forest.

Projected future additional roads and motorized trails were estimated for each alternative. Comparative analysis of the differences in the total estimated miles is used to compare alternatives.

Unmapped management areas (MAs 3.2A and 3.2B) were created that are defined as 0.5 mile from the centerline of the Continental Divide National Scenic Trail and Nez Perce National Historic Trail. The direction for these management areas overrides other management area directions that overlap the corridors.

Effects to scenic and historic trails are calculated by identified management objectives related to recreational opportunity spectrum and scenic integrity objectives within a 1-mile-wide corridor.

Affected Environment

Transportation System

System roads and trails provide both motorized and non-motorized access to areas off roads into the back country and wilderness areas. The motor vehicle use map, updated annually, displays the system roads and trails and other areas on the Shoshone designed for motorized use (per 36 CFR 212.51). Motorized vehicles and operators are subject to State laws.

The current status for motorized access on system roads is summarized in table 127. This table displays the miles of road and whether they are designated for motorized use, yearlong or seasonally. The Shoshone currently has about 874 miles of system roads open to the public and designated for either yearlong or seasonal motor vehicle use. These roads are available for use by highway-legal vehicles that meet State legal requirements as well as all-terrain vehicles that have a State-issued sticker.

Table 127. Summary of Shoshone roads by travel management status

Total miles of roads open to the public	Miles of roads designated yearlong for motorized use	Miles of roads designated seasonally for motorized use
909	667	242

Trails

Table 128 displays the miles of trails by season of use (summer or winter) and whether the trail is managed for motorized or non-motorized use.

Table 128. Summary of Shoshone trails by season and managed use

Managed trails and roads (time of use and type)	Miles
Summer trails – Motorized use	32
Summer trails – Non-motorized use	1,652
Winter trails – Motorized use	276
Winter trails – Non-motorized use	48
*Roads enrolled in State Off-Highway Vehicle Program	874

*Although these routes are not classified as motorized trails; they are heavily used by all-terrain vehicles.

The Shoshone's trails system includes approximately 32 miles of motorized trails (managed for vehicles 50 inches or less in width), 1,652 miles of hiking and equestrian trails, 276 miles of snowmobile trails, and 48 miles of cross-country ski trails and 3 miles of single-track motorized (motorcycle) trails on the Forest. As mentioned in the introduction, one of the newest types of recreation taking place on the Shoshone is the use of all-terrain vehicles (sometimes called utility vehicles). Some of these vehicles are too wide for the existing motorized trails managed for vehicles 50 inches or less in width. Subsequently, many of the existing system level 2 and 3 roads are used by this type of vehicle. Some roads are almost exclusively used by all-terrain vehicles. Approximately 874 miles of roads and trails are enrolled in the State Off-Highway Vehicle Program and available for all-terrain vehicle and motorcycle use.

Trail Maintenance

Trail maintenance is accomplished by the Forest Service in cooperation with partners and volunteers. Federal funding for motorized trails is sometimes supplemented by funding from the state of Wyoming through their off-highway vehicle sticker registration and grant program.

The Shoshone's ability to maintain the trail system is dependent on a number of factors, including:

- Total miles of open trails;
- Allocated funding for trail maintenance;
- Allocated funding for trail projects to support nationally designated trails (Nez Perce and Continental Divide National Scenic Trails);
- Assigned operational maintenance levels;
- Resource protection needs;
- Use levels and season of use; and
- Outfitter and guide special use fees.

In general, trail maintenance budgets have historically decreased over the last 10 years. Similar to roads, funding for trails has been well below that needed to annually maintain the entire trail system at operational maintenance level standards. Annual accomplishment reports indicate that on average the Shoshone has been able to maintain, on an annual basis, approximately 42 percent of the open trails on the Forest (table 129). This does not include maintaining these trails to standard: rather performing one maintenance item on each trail. With decreased trails budgets, the Shoshone staff anticipates their ability to accomplish this level of maintenance will decline. Trails are maintained on a priority basis where user safety, visitor demands, and resource protection are all used to prioritize trail maintenance.

Table 129. Average annual trail maintenance accomplished

Miles of open trails (motorized and non-motorized)	*Average miles maintained	*Percent maintained
1,672	708	42

*Maintained is defined by completing at least one maintenance activity on each trail.

Continental Divide National Scenic Trail

The National Parks and Recreation Act of 1978 established the Continental Divide National Scenic Trail (CDNST) (Pub. L. No. 95-625, 92 Stat. 3467), which amended the National Trails System Act of 1968 (16 U.S.C. 1241-1251).The CDNST crosses Federal lands administered by the United States Department of Agriculture, Forest Service, and the United States Department of the Interior, Bureau of Land Management, and National Park Service. The Regional Forester of the Rocky Mountain Region is the lead Forest Service official for coordinating matters concerning the study, planning, and operation of the congressionally designated CDNST (Forest Service Manual 2353.04). The trail generally follows the corridor described in the Bureau of Outdoor Recreation’s 1976 Study Report and the 1977 Final Environmental Statement. A 50-mile corridor was identified on either side of the Continental Divide in which to locate the final route. The CDNST traverses portions of 25 national forests, 3 national parks, 4 Bureau of Land Management Districts, as well as various private lands in the states of Montana, Idaho, Wyoming, Colorado, and New Mexico. The total distance from the Canada-United States border on the north and the United States-Mexico border on the south is approximately 3,100 miles. Of this total distance, approximately 750 miles are located in Montana, 180 miles in Idaho, 610 miles in Wyoming, 770 miles in Colorado, and 790 miles in New Mexico.

The Shoshone National Forest has approximately 31 miles of the CDNST located in the southwest section of the Forest (see map 41). On the Shoshone, the original and current route was established in a 1998 Decision Notice and Finding of No Significant Impact. This decision recognized that the trail should be managed for pedestrian and horse traffic, but located some segments on existing roads to build as few new trails as possible and avoid sensitive wildlife habitat. Currently, the trail follows a mixture of non-motorized and motorized primitive roadways. Motorized use is allowed to the extent that occurred in 1998. As the trail location is refined, it is expected that the entire length of the trail will be located off roads. At the time of forest plan revision, there were two proposed re-routes that have had cultural resource and botanical surveys completed. Land and resource management plans provide for the development and management of the CDNST as an integrated part of the overall land and resource management direction for the land area through which the trail passes.

Projects that may affect the CDNST, including forest plan revision must consider the following direction:

FSM 2353.44b

- Use the Scenery Management System (FSM 2382.1; Landscape Aesthetics: A Handbook for Scenery Management, Agricultural Handbook 701, 1995, http://www.fs.fed.us/cdt) in developing CDNST unit plans and managing scenery along the CDNST. The one-half mile foreground viewed from either side of the CDNST travel route must be a primary consideration in delineating the boundary of a CDNST management area (para. 2b). The CDNST is a concern level 1 route (Landscape Aesthetics, page 4-8), with a scenic integrity objective of high or very high, depending on the trail segment (Landscape Aesthetics, page 2-4).

FSM 2353.42

- Manage the CDNST to provide high-quality scenic, primitive hiking and pack and saddle livestock opportunities. Backpacking, nature walking, day hiking, horseback riding, nature photography, mountain climbing, cross-country skiing, and snowshoeing are compatible with the nature and purposes of the CDNST (FSM 2353.42). Use the recreational opportunity spectrum and the Recreational Opportunity Spectrum Users Guide in delineating and integrating recreation opportunities in CDNST unit plans and managing the CDNST (FSM 2311.1). Where possible, locate the CDNST in primitive and semi-primitive non-motorized recreational opportunity spectrum classes, recognizing that the CDNST may have to traverse intermittently through more developed recreational opportunity spectrum classes to provide for continuous travel between the Montana-Canada and New Mexico-Mexico borders. Locate a CDNST segment on a road only where it is primitive and offers recreational opportunities comparable to those provided by a trail with a Designed Use of Pack and Saddle Stock, recognizing that the CDNST may have to be located on or across designated routes because of the inability to locate the trail elsewhere (FSM 2353.44b, para. 11).

The management area emphasis of each of the alternatives may have effects to scenery management system as well as the recreational opportunity spectrum class that may affect the CDNST. Alternatives will be analyzed by the scenery management system and recreation opportunity spectrum proposed by each alternative as they relate to the CDNST.

Nez Perce National Historic Trail

The Nez Perce (Nimíipuu or Nee-Me-Poo) National Historic Trail (NPNHT) was established by Congress through Public Law 99-445 in 1986, amending the National Trails Systems Act of 1968 to designate the NPNHT as a component of the National Trails System. The NPNHT was designated to commemorate the 1877 flight of the non-treaty Nez Perce from their homelands in eastern Oregon, Idaho, and Washington. Five Nez Perce bands, nearly 800 men, women, and children, struggled across almost 1,200 miles of rugged country. The course they chose on their epic journey has been memorialized in the NPNHT. In its entirety, the NPNHT covers 1,170 miles, of which, 319 miles are designated high potential route segments. The trail, including associated sites and auto tours, crosses a mix of local, county, State, Federal, and tribal jurisdictions and agencies in four Forest Service regions, across Oregon, Idaho, Wyoming, and Montana.

There are approximately 147 miles of the trail within the State of Wyoming, of which 36.7 miles are located on the Shoshone National Forest (see map 42). The trail's current alignment generally follows the route identified in the "Nez Perce (Nee-Me-Poo) Study Report" prepared by the Department of Agriculture in March 1982, and the Environmental Assessment and Decision

Notice signed by Assistant Secretary of Agriculture Peter C. Myers on July 1, 1985 (16 U.S.C.1244 (a)(14)). Motorized use is allowed where the NPNHT overlaps an existing road and along the auto tour route. Where the NPNHT follows National System trails, the NPNHT is non-motorized. In the forest plan revision process, an unmapped management area was created that includes the corridor within 0.5 mile of the centerline of the NPNHT location. This management area overlies other management areas that it crosses. At the time of the 1986 Forest Plan as amended revision, the Forest Service was completing a Comprehensive Management Plan Revision for the entire NPNHT. Therefore, guidance related to management of this historic trail comes from the 1990 Comprehensive Management Plan (CMP), which is currently under revision. When the new Comprehensive Management Plan is finished, its direction is incorporated by reference into the revised Forest Plan. In general, the 1990 Comprehensive Management Plan provides the following guidance related to planning processes: “Development and management of each segment of the trail shall be designed to harmonize with and complement any established multiple-use plans for that specific area in order to ensure continued maximum benefits from the land” (NPNHT CMP 1990).

To analyze differences in alternatives as they related to the NPNHT, measurement indicators of the scenic management system will be compared by alternative. The desired scenic integrity objective for the NPNHT is high or very high due to the management objectives aimed at preserving the original setting at the time this route was originally used.

Access and Travel Management

Access, using roads and trails, is associated with virtually every activity that takes place on the Shoshone. Roads and trails accommodate many purposes such as: outdoor recreation, fire suppression, wildlife management, transport of natural resources such as logs and minerals, firewood gathering, private in-holding access, electronic site and utility corridor maintenance, and managing and monitoring forest resources. Modes of vehicle travel on the Forest include: large commercial trucks, cars, pickups, four-wheel drive vehicles, over-snow vehicles, off-road vehicles (e.g., motorcycles, ATVs), mountain bikes, and wheelchairs. Non-vehicular travel modes include cross-country/back-country skiing, snowshoeing, dog sledding, horseback riding, and hiking. Roads and trails where wheeled motor vehicle use is currently allowed are identified on the Shoshone motor vehicle use map(s). A motor vehicle use map shows those roads, trails, and areas designated for motor vehicle use, under 36 CFR 212.51 for the purpose of enforcing the prohibition at 36 CFR 261.13. The motor vehicle use maps are subject to annual review and reissuance. Whether a road, trail, or an area is open to motorized use, and time of year when they are open, are important considerations regarding access on the Shoshone.

At this time, over-snow vehicle use is managed differently from wheeled motor vehicle use. There is no over-snow vehicle use map used to designate where and when over-snow vehicle use is allowed. Under the 1986 Forest Plan as amended, over-snow vehicle use (generally December 1 to April 30) is allowed anywhere it is not expressly prohibited with a legal order (36 CFR 261.50). Legal orders and management areas currently prohibit over-snow vehicle use on approximately 1,550,440 acres of NFS lands on the Shoshone. The areas where over-snow vehicle use is prohibited or restricted in some fashion are: designated wilderness, recommended wilderness, and other area closures for semi-primitive non-motorized recreation and big game crucial winter range. The Dunoir Management Area does not currently have a forest order prohibiting either snowmobile use or mechanized use.

At this time, mechanized use is managed the same as over-snow vehicle use. There is no mechanized use map used to designate where and when mechanized use is allowed. Under the

1986 Forest Plan as amended, mechanized use is allowed anywhere it is not expressly prohibited with a legal order (36 CFR 261.50). There are two management areas where mechanized use is prohibited. These include designated MA 1.1—Wilderness (e.g., Washakie Wilderness) and MA 1.2—Glacier Addition to Fitzpatrick Wilderness. In addition, one area currently restricts mechanized use to system roads and trails (2.2A Line Creek).

Motorized Use Trends

Off-road vehicle use continues to be a popular form of outdoor recreation on national forests nationwide. Close to "one in five Americans (19.2 percent) age 16 and older participated one or more times in off-highway vehicle recreation within the past year" (page 10, Cordell et al. 2008). Off-road vehicle users now account for 5 percent of the total number of visitors to national forests; on the Shoshone off-road vehicles are popularly defined as: (1) 4-wheel drive jeeps, automobiles, pickups, or sport utility vehicles; (2) motorcycles designed for cross-country use; (3) all-terrain vehicles, better known as ATVs; and (4) other specially designed or modified off-road motor vehicles (e.g., snowmobiles) used in a wide variety of ways (Cordell et al. 2008). Participation in off-road vehicle recreation steadily increased from 1999 to 2003 with a 37 percent increase over this time period (Cordell et al. 2008). This trend shifted from increasing to decreasing numbers of participation during the time period of 2003 to 2007 (Cordell et al. 2008). According to Cordell and others (2008), off-road vehicle participation decreased by 14 percent during this time period.

From a regional perspective, the West (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming) has the largest portion of off-road vehicle users and Wyoming has the highest participation rate (34 percent) of all states (Cordell et al. 2008). Available State of Wyoming off-road vehicle permit registration numbers mirror this trend. In 2002, the State instituted a mandatory off-road vehicle permit program. Since then, the number of permits sold has climbed from 6,767 to 55,060 in 2009, the last year data were available. Some of this 88 percent increase in permits sold is due to increased compliance since the mandatory program was initiated. Sales of permits in the Shoshone's three-county area ranged from 1,196 in 2002 to 6,970 in 2005. Counties with the highest permit sales are gateways to desirable public land recreation areas, such as Fremont County.

A 2006 University of Wyoming Department of Agriculture and Applied Economics survey and economic assessment of off-road vehicle use in Wyoming estimated that 150,000 off-road vehicles were owned by Wyoming residents and approximately 36 percent of residents used an off-road vehicle for recreational purposes in the preceding 12 months.

The 2009 Wyoming Statewide Comprehensive Outdoor Recreation Plan surveyed residents for their top three issues or concerns for outdoor recreation in Wyoming. The responses identified that motorized recreation will be the most challenging land management issue for the foreseeable future. The most common concern was too much motorized use and the second most common was support for motorized use and expanding motorized opportunities. These two opposing concerns highlight the difficulty in managing motorized recreation.

Recreation

The Shoshone finalized its Recreation Site Facility Analysis Report in May of 2006, and developed a Recreation Niche Statement with public involvement. The niche serves as the vision for the Forest's recreation program and to ensure unique attributes are maintained for future generations. The following is the Shoshone recreation niche:

All Paths Lead to Wildness

> The Shoshone, America's first National Forest, is rugged, remote and wild. Serving as a gateway to Yellowstone and Grand Teton National Parks, the Forest plays a key role in providing both locals and travelers an opportunity to connect with nature and experience wildlife. The rich western heritage has provided a trail-based infrastructure into and through the backcountry and continues to instill a sense of adventure and freedom. The Shoshone National Forest provides minimally developed facilities for overnight use and backcountry activities with the exception of facilities along travel corridors and/or near destination water sites, ranging from dispersed to highly developed sites.

Outdoor recreation is the fastest growing use within the national forests and grasslands, a use expected to increase in the future. As mentioned in the introduction, nearly 50 percent of all Americans participated in outdoor recreation in 2010 (The Outdoor Foundation 2011). Outdoor recreation encompasses a myriad of types of activities. Several studies have been conducted to analyze recreational participation rates on a national scale, but similar studies have been conducted at the State and Forest scale. The latest Wyoming Statewide Outdoor Recreation Plan (SCORP) analyzed user activities and found that the highest percentage (65 percent) of Wyoming residents participated in the activity described as “Driving for pleasure/sightseeing by auto” followed closely by “Viewing natural features such as scenery, flowers, etc.,” at 64 percent. The next two highest percentages of use, both at 61 percent, were for “Hiking or Walking” and “Viewing wildlife, birds, fish, etc.” (SCORP 2009). Table 130 lists the top six activities identified in the 2008 survey.

The latest National Visitor Use Monitoring (NVUM) Survey was completed in 2010 on the Shoshone (NVUM Summary Report May 2010). This monitoring program provides reliable information about recreation visitors to NFS-managed lands at the national, regional, and forest level. NVUM is a sampling system that provides statistics on recreation use.

Table 130. Total percentage of top six outdoor recreation activities in Wyoming*

Activity	Percentage of visitors who participated in this activity
Driving for pleasure/sightseeing by auto	65
Viewing natural features such as scenery, flowers, etc.	64
Hiking or walking	61
Viewing wildlife, birds, fish, etc.	61
General/other-relaxing, hanging out, escaping crowds, noise, etc.	60
Picnicking and family day gatherings	58

*2009 Wyoming Statewide Outdoor Recreation Plan (SCORP)

Visitation is estimated through surveys of exiting visitors and provides a snapshot of estimated use. According to the NVUM surveys completed in 2009, visitation estimates are between 529,156 and 763,044 per year across the Shoshone. About 66 percent of these visits were from people who lived within 100 miles of the Forest. Those visitors participated in the activities shown in table 131 during their visit, and indicated their primary activity.

Most of the visits to the Shoshone National Forest are day visits, yet the average visit to the Forest lasts about 13 hours. The vast majority of Shoshone visitors recreate at only one location. Only 8 percent of visitors recreate at more than one location on the Forest. About half of the visits are made by people who visit at most five times per year.

Nearly 54 percent of the visiting population participates in viewing the scenery in the Forest. Viewing natural features (23.9 percent) is the most common primary activity, followed by hiking/walking (15.5 percent) and snowmobiling (14 percent). Viewing natural features is an activity that is engaged in for more than half of all visits. Visitors participated in hiking and the two viewing activities in over 40 percent of visits. About one-third of the visits involved using a scenic byway while on the Shoshone (English 2010).

With increased use, recreationists are vying for quality recreation space, which may sometimes overlap in the same area at the same time. This can manifest itself in conflicts between recreationists that use non-motorized and those that use motorized modes of travel. Recreation conflicts occur when a user participating in one recreation activity negatively affects the recreation experience of another user.

Table 131. Activity participation on the Shoshone National Forest (FY 2009)[a]

Activity	Percentage of visitors who participated in this activity[b]	Percentage of visitors who said it was their primary activity[c]	Average hours spent in primary activity[d]
Viewing natural features	53.5	24.5	4.5
Hiking/walking	39.9	15.5	2.4
Snowmobiling	14.3	14	5.1
Hunting	9.1	8	6.1
Some other activity	7.6	6.6	4.3
Driving for pleasure	23.3	5.7	2.2
Fishing	10.4	4.8	6.3
Horseback riding	3.7	2.9	6.8
Cross-country skiing	3	2.9	2.1
Viewing wildlife	24	2.3	2.4
Relaxing	32.1	1.9	26.5
Developed camping	4.1	1.7	43.4
Off-road use	4.2	1.5	3.3
Picnicking	12.7	1.2	1.9
Primitive camping	4.7	1.1	29.9
Motorized trail activity	5.2	0.7	4.1
Backpacking	1.9	0.6	55.4
Resort use	3.9	0.5	39.1
Bicycling	1.2	0.5	2.9
Non-motorized water	1.1	0.5	3.9
Gathering forest products	2.6	0.4	3.8
Other non-motorized	0.7	0.2	4
Nature center activities	1	0	6
Nature study	5.6	0	
Visiting historic sites	3	0	
Motorized water activities	0.8	0	
Other motorized activity	0	0	5
Downhill skiing	0	0	
No activity reported	0	0	

[a] Participation data are from Forest National Visitor Use Monitoring results (2009).

[b] Survey respondents could select multiple activities so this column may total more than 100 percent.

[c] Respondents were asked to select one main activity; some selected more than one, so this column may total more than 100 percent.

[d] Computed only for those who indicated the activity was the main activity on their visit.

Although conflicts occur, overall satisfaction results showed that almost 76 percent of the people who visited the Shoshone were very satisfied with the overall quality of their experience (English 2010). Table 132 shows the Percent Satisfaction Index from the 2009 NVUM Survey.

Table 132. Percent Satisfaction Index* scores from recreation users

Items rated	Satisfied survey respondents (percentage)		
	Developed sites**	Undeveloped areas (GFAs***)	Wilderness
Developed facilities (includes restroom cleanliness and facility condition)	97.9	85.2	73.8
Access (includes parking availability, parking lot condition, road condition and trail condition)	80.9	92.8	76.1
Services (includes availability of information signage, employee helpfulness)	77.3	88	75.6
Perception of safety	97.1	98.7	85.6

* This is a composite rating. It is the proportion of satisfaction ratings scored by visitors as satisfied or very satisfied. It is computed as the percentage of all ratings for the elements within the grouping that are at or above the target level, and indicates the percent of all visits where the person was satisfied with agency performance.

** This category includes both day use and overnight use developed sites. Data from National Visitor Use Monitoring results (2009).

*** General Forest Areas, Data from National Visitor Use Monitoring results (2009).

Over half of visitors surveyed during the NVUM survey indicated they did not use special facilities and areas. Table 133 shows that the majority of visitors who did use special facilities and areas, used facilities designed for motorized travel. These include, scenic byways, forest roads, and motorized dual track trails.

Table 133. Visitors' self-reported use of selected facilities and areas, Shoshone National Forest (FY 2009)

Facility/area	Respondents who reported using this facility (percentage)
Developed swimming site	2.8
Scenic byway	30.0
Museum	3.4
Designated off-road vehicle area	13.3
Forest roads	26.9
Interpretive displays	2.4
Information sites	5.3
Developed fishing site	2.7
Motorized single-track trail	6.7
Motorized dual-track trail	17.5
None of these	48.2

Recreation Setting

The recreation opportunity spectrum (ROS) describes the setting in which recreation occurs. The Forest Service defines a recreation opportunity setting as the combination of physical, biological, social, and managerial conditions that give value to a place. Thus, an opportunity includes qualities provided by nature (vegetation, landscape, topography, scenery), qualities associated with recreational use (levels and types of use), and conditions provided by management (developments, roads, regulations). By combining variations of these qualities and conditions, management can provide a variety of opportunities for recreationists. The recreation opportunity spectrum was specifically developed to enable the integration of outdoor recreation principles and guidelines into multiple use management.

The Shoshone provides recreation activities that range from high adventure in the back country to driving scenic byways. Expansive wilderness areas provide opportunities for people to experience solitude and adventure in a natural environment. Developed sites in highway corridors and in the front country complement the wilderness as part of the range of recreation opportunities.

The 1986 Forest Plan as amended identified recreational opportunity spectrum settings and associated acres. Remapping of settings was completed in 2008, following the national protocols on how to identify appropriate recreation opportunity spectrum classes. The acres and percentages remapped in 2008 are shown in table 134.

Table 134. Recreation opportunity spectrum class and associated acreages of the Shoshone National Forest

ROS class	Acres in 2008	Percentage of the Shoshone
Rural	1,378	1
Roaded natural	207,615	8
Semi-primitive motorized	291,560	12
Semi-primitive non-motorized	572,312	23
Primitive	1,365,154	56

The recreation opportunity spectrum provides a framework for analyzing changes to recreation settings as a result of potential management activities under each alternative. The recreation opportunity spectrum can be used to estimate changes to recreation settings and opportunities resulting from potential development activities. The potential effects of possible management actions on recreation settings and experiences are represented in the estimated recreation opportunity spectrum inventory shifts under each alternative.

Developed Recreation Sites

Generally, developed recreation sites have kept pace with changing demands and expectations. Developed recreation facilities include a variety of distinctly defined areas, where facilities have been developed for concentrated public use either by the Forest Service or private parties. Redesign and reconstruction of developed sites has been ongoing with primary changes focused on updating campgrounds for recreational vehicle use and improving accessibility. Developed recreation facilities have been constructed to offer recreation experiences, protect resources, or otherwise manage concentrations of visitor use. These facilities range from a complete campground with water systems, toilets, and fully developed sites, to a simple bulletin board or parking barrier at a parking lot.

On the Forest, the majority of developed recreation facilities are in major travel corridors on or adjacent to the Buffalo Bill Scenic Highway, the Chief Joseph Scenic Highway, the Beartooth All-American Road, the Wyoming Centennial Scenic Byway, or other high use primary travel corridors that traverse the Forest.

Table 135 displays the number of developed recreation sites in 1986 and 2010.

Table 135. Developed recreation sites on the Shoshone, 1986 and 2010

Type of site	1986	2010	2010 Capacity PAOT*
Trailheads	20	28	1,956
Campgrounds	33	32	3,404
Picnic grounds	7	11	411
Observation sites	4	4	410
Boating sites	1	1	75
Fishing site	1	1	35
Interpretive sites	11	11	456

*Persons at one time (PAOT)

"Persons at one time" (PAOT) is a measure of the number of people that can occupy a developed recreation site, and is the basis for design of the site. The number of developed campgrounds has remained steady, yet the capacity at these sites has increased from 2,726 people at one time in 1986 to 3,404 in 2006. Recent (2010) campground occupancy numbers from facilities along the North Fork of the Shoshone River corridor, which is a major access route to the east entrance of Yellowstone National Park, does not show a widespread capacity issue. During the months of May through September, campgrounds along the North Fork average approximately 45 percent occupancy (table 136). This percentage is highest during July (59 percent). Campgrounds tend to range in the 80 to 90 percent occupancy rates during holidays and weekends and then drop off during mid-week.

Table 136. North Fork Corridor: 2010 campground occupancy rates

Campground	May	June	July	Aug/Sept	Total
Big Game	n/a	37.0%	43.4%	28.4%	36.3%
Clearwater	40.9%	34.0%	58.0%	39.0%	43.0%
Eagle Creek	51.7%	38.0%	75.6%	61.0%	56.6%
Elk Fork	36.4%	27.2%	35.0%	48.0%	36.7%
Rex Hale	n/a	34.0%	67.3%	36.0%	45.8%
Three Mile	55.0%	16.0%	62.7%	36.6%	42.6%
Wapiti	41.0%	42.9%	74.0%	55.0%	53.2%
Total	45.0%	32.7%	59.4%	43.4%	44.9%

Changes in visitor preferences have resulted in a shift from more traditional outfitted activities, such as multi-day back country horseback trips, to other activities such as climbing, mountain biking, rafting, fishing, and all-terrain vehicle and snowmobile riding to name a few.

Recreation Special Use Authorizations

National forests also offer recreational opportunities in partnership with commercial and non-commercial entities by granting special-use authorizations or entering into partnership agreements. These partnerships help provide recreational opportunities on national forests that the Forest Service does not directly provide. Recreational special uses include both commercial permits such as for lodges and outfitter and guides, and non-commercial activities such as the Forest's recreation residence program. In 1986, the Shoshone issued approximately 351 special-use permits. Of those, 229 (100 recreation residences, 110 outfitting and guiding permits and 19 for resorts, lodges and ski areas) were for recreation special uses. Today the Forest administers over 200 recreation special-use permits. Table 137 displays the different types of recreation special-use permits administered by the Shoshone.

Table 137. Recreation special uses on the Shoshone National Forest

Type of special-use permit	Number of permits or agreements
Groomed cross-country ski area	3
Groomed snowmobile area/shelter	2
Organization camp	3
Outfitter and guide	83
Recreation events (may vary from year to year)	6
Ski area	2
Target range	1
Non-commercial group use	4
Recreation residences	100
Resorts	17
TOTAL special-use permits	221

Scenic Byways

Scenic byways provide for the most popular recreation activity, “driving for pleasure/sightseeing by auto” on the Shoshone National Forest. As mentioned previously, 65 percent of people visiting the Forest participated in this activity, the highest participation rate among all respondents (SCORP 2009). Confirming this preference, the 2008 National Visitor Use Monitoring report found that the highest percentage of respondents that used forest facilities or areas used scenic byways (table 133).

There are three scenic byways and one All American Road crossing the Shoshone National Forest: Chief Joseph Scenic Byway (U.S. Highway 296), Buffalo Bill Scenic Byway (U.S. Highway 14-16-20), Wyoming Centennial Scenic Byway (U.S. Highway 26-287), and the Beartooth All-American Road (U.S. Highway 212) (see map 43). Each road provides a unique and different view of the Shoshone because they vary by viewshed, vegetation, geologic features, and historic uses. They provide opportunities for approximately 306 miles of scenic travel on the Shoshone and adjacent national forests. These roads provide forest access for the majority of tourists and local visitors.

Environmental Consequences

The environmental consequences for recreation resource opportunities are compared by alternative, based on key indicators of disturbance for each type of activity. In general, alternatives that contain management areas that allow for more acres available for motorized recreation (summer and winter) provide for increased quality and quantity of this type of recreation. Alternative F followed by E, allow for the largest amount of motorized recreation opportunities of all action alternatives. Conversely, alternative C followed by alternative D, provide for the least amount of motorized recreation. Alternatives that increase levels of non-motorized recreational opportunities will generally increase the quality and quantity of non-motorized recreation.

Direct and Indirect Effects

Motorized recreation

During the 1986 Forest Plan as amended development, approximately 23 percent of the entire Shoshone was open to summer motorized use and 36 percent was open to winter motorized use (table 138).

Table 138. Total acres allowable for motor vehicles use by alternative

Season and use allowed	Alternatives (acres/total percentage)						
	A (No action)	B	C	D	E	F	G
Over snow motor allowed	887,600 36%	481,200 20%	103,000 4%	323,800 13%	526,400 22%	825,200 34%	592,400 24%
Over snow motor not allowed	1,550,400 64%	1,956,800 80%	2,335,000 96%	2,114,300 87%	1,911,600 78%	1,613,000 66%	1,845,600 76%
Summer motor allowed	570,000 23%	570,200 23%	321,800 13%	350,000 14%	656,000 27%	823,300 34%	529,000 22%
Summer motor not allowed	1,868,000 77%	1,867,800 77%	2,116,200 87%	2,088,000 86%	1,782,200 73%	1,614,700 66%	1,909,000 78%

Table 138 also shows the total acres and percentage of Forest available for motorized use by season (summer and winter). Summer motorized acres were calculated using the total acres available for this type of use and were based on the following four criteria:

- Total management area acre allowance for summer motorized use by alternative;
- Slopes less than 40 percent;
- Acres available in the grizzly bear primary conservation area; and

Maps 44–49 and 76 display the allocations that allow summer motorized use by alternative.

Winter motorized acres were calculated using the total acres available for this type of use and were based on the following criteria:

- Total management area acre allowance for winter motorized use by alternative;
- Areas (acres) available in winter range with no restrictions
- Areas (acres) where new groomed trails are allowed
- Areas (acres) available in winter range where no new groomed trails are allowed

Maps 50–55 and 77 display the allocations that allow winter motorized use by alternative.

Cross-country Travel: Currently, the Shoshone does not allow cross-country wheeled motor vehicle use in any area. Wheeled motor vehicle use is only allowed on those roads and trails as designated on the Forest motor vehicle use maps. None of the seven alternatives allow cross-country wheeled motor vehicle use since there are no proposed changes to current management.

Cross-country Over-snow Vehicle Use: The 1986 Forest Plan as amended generally allowed over-snow motorized vehicle use in management areas allocated to non-motorized recreation, including the Dunoir Special Management Unit (MA 1.6B). Only summer motorized use was specifically restricted in these areas. Though current plan allocation permits the use, over-snow motorized vehicle use is not occurring in all acres that are open to that use.

When considering the number of acres where wheeled motor vehicle use would be allowed, it must be remembered that this refers only to those acres in management areas where roads and trails may exist and be designated for such use. Those acres are not open to off-trail or off-road use. As shown in table 138, alternative C and D would result in fewer acres available where trails could be designated for wheeled motor vehicle use; whereas alternative E and F have the highest acres available where motorized trails could be designated for this use. Alternatives A and B are relatively the same in the number of acres where trails could be designated for wheeled motor vehicle use (about a 270-acre difference between the two). Alternative G is slightly below those alternatives.

Table 139 and table 140 show the differences between existing and projected additional motorized trails and roads for the various alternatives. Approximately 907 miles of road are currently open and would remain open under all alternatives but alternative C. Alternative C is the only alternative that would include closing system roads and trails currently open to the public on the most recent motor vehicle use map. None of the other alternatives propose any changes to the existing system. All the alternatives project an increase of 2 to 3 miles of new road construction associated with timber management activities. Depending on site specific issues those roads may be open for public use. Alternatives B, D, E, F, and G project an increase in the total miles of motorized trails. The increase range from 8 miles in alternative D to 60 miles in alternative F. Alternatives B and G project 23 new miles. Open roads would generally not be permitted in management areas 1.1, 1.1A, 1.5A, 1.6A, 1.6B, 2.2A, 2.3, 3.1A and 3.1C.

Table 139. Existing and projected additional motorized trail miles by alternative

Motorized trails	Alternatives (miles)						
	A	B	C	D	E	F	G
Existing trails	32	32	32	32	32	32	32
Projected motorized trails additions	0	23	0	8	30	60	23
Total motorized trails	32	55	21	40	62	92	55
Miles open seasonally	32	48	14	37	53	92	48

Table 140. Existing and projected additional road miles by alternative

Roads open to public	Alternatives (miles)						
	A	B	C	D	E	F	G
Existing roads	907	907	800	907	907	907	907
Projected road additions	2	2	2	2	2	3	2
Total roads open to public	909	909	802	909	909	910	909
Miles open seasonally	667	667	218	667	667	668	667

Table 141 displays the miles of roads open for public use by operational maintenance level per alternative.

Table 141. Summary of system roads by operational maintenance level

Operational maintenance level	Alternatives A, B, D, E, F, G (Alt. F has no seasonal closures)			Alternative C		
	Total miles	Miles open to public	Miles open to public in winter	Total miles	Miles open to public	Miles open to public in winter
Level 5	3	3	1	3	3	1
Level 4	6	6	4	6	6	4
Level 3	193	169	127	193	169	74
Level 2	748	697	506	632	590	136
Level 1	182	0	0	162	0	0
Total	**1,132**	**874**	**638**	**995**	**767**	**215**

Alternative A provides the most acres available for over-snow motorized use when compared to all alternatives (887,600). Alternative A allows over-snow motorized use with the Dunoir Special Management Unit. Non-of the action alternative allow over-snow motorized use within the Dunoir Special Management Unit. This change from alternative A was made to make management of the Dunoir area more consistent with its enabling legislation.

Of the action alternatives, Alternative F provides for the largest amount of acres available for over-snow vehicle use. In alternative F, most of the areas on the forest that are capable for over-snow use are open to that use. Alt. G provides the second most acres available of all the action alternatives. Alternative E is similar to alternative G. For the remaining alternatives, their ranking in order of most to least acres available is B, D, and C. Alternative C prohibits any winter motorized use in all inventoried roadless areas.

Table 142 shows the total miles of existing and projected trails open to over-snow vehicle use. All action alternatives, except alternative C, would continue to allow all existing over-snow motorize trails to be used as they are under the current forest plan (alternative A). Alternative C would decrease the total miles of trail allowing over-snow vehicle use (approximately a 113-mile reduction). Alternative F projects an increase of 90 miles in over-snow motorized trails.

Table 142. Snowmobile trail miles by alternative

Snowmobile trails	Alternatives (miles)						
	A	B	C	D	E	F	G
Existing trails	276	276	163	276	276	276	276
Projected motorized trails additions	0	0	0	0	0	91	0
Total motorized trails	276	276	163	276	276	367	276

Much of the discussion thus far in this section pertains to motorized recreation. That does not mean that non-motorized recreation does not have effects. However, the ease of access and the greater distance that can be covered by a motorized recreationist and, as a result, the potential for disturbance and conflict with other Forest users is greater. In addition, the comments received during pre-revision meetings as well as during the public comment period on the draft revised Forest Plan reflected a greater concern over existing motorized use compared to non-motorized use.

Mechanized Use: Under the 1986 Forest Plan as amended, mechanized use is allowed everywhere on the Forest except for designated wilderness. Table 143 shows the total acres where mechanized use is allowed, by alternative. Mechanized acres were calculated using the total acres available for this type of use and were based on the following criteria:

- Total management area acre allowance for mechanized use by alternative;
- Management area objectives that restrict mechanized use to system roads and trails.

Table 143. Total acres allowable for mechanized use by alternative

	Alternatives (acres/total percentage)						
	A *(No action)*	B	C	D	E	F	G
Mechanized use allowed[1]	1,072,000 44%	1,015,400 42%	439,500 18%	846,700 35%	1,027,500 42%	1,042,700 43%	1,013,700 42%
Mechanized use not allowed	1,365,000 56%	1,394,000 57%	1,409,300 58%	1,394,000 57%	1,394,000 57%	1,394,000 57%	1,365,000 56%
Mechanized use restricted to roads and trails	1,280 0.05%	28,630 1%	589,200 24%	197,300 8%	16,500 1%	1,300 0%	59,212 2%

Alternatives vary with regard to the level of restrictions on mechanized use. The acres where all mechanized use is prohibited in similar across all the alternatives and varies strictly based upon how the alternative handle the Dunoir Special Management Unit and the High Lakes Wilderness Study Area. Alternative A permits mechanized use in each of those areas. All the action alternatives prohibit mechanized use in the Dunoir Special Management Unit except for alternative G, which allow use only on designated trails. In the High Lakes WSA all action alternatives, except for C and F allow mechanized use on designated roads and trails. In alternative C no mechanized use is allowed in the High Lakes WSA and in alternative F mechanized use is allowed in the High Lakes WSA.

Other than what is described above the allocations that impact the area where mechanized use is restricted to designated roads and trails are recommended wilderness and proposed research natural areas. These allocations result in variations across the alternatives with the largest acres occurring as a result of the recommended wilderness allocations in alternatives C and D. Alternative C has the greatest number of acres where mechanized use would be restricted to roads and trails. In this alternative, approximately 25 percent of the Forest would be restricted to roads and trails (table 144). In comparison, alternatives B, E, F, and G restrict mechanized use to system roads and trails on roughly 1 percent or less (0.05 percent in alternative F) of all acres on the Forest. Alternative D restricts more acres of mechanized use to system roads and trails than alternatives B, E, F, and G, but much less than alternative C. Management areas that restrict mechanized use to system roads and trails include: 1.2, 1.2A, 1.2B, 1.6A, 2.2A, 2.3, 3.1A, 3.1B, and 3.1C in alternatives C and D. Alternative A restricts mechanized use to system roads and trails in only one management area: 2.2A. Alternative B restricts mechanized use in management areas 1.6A, 2.2A, 2.3, 3.1A, 3.1B, and 3.1C. Alternatives E and F restrict mechanized use in management areas 1.6 and 2.2A, while alternative E also restricts mechanized use to system roads and trails in management area 2.3.

Table 144. Summary of access availability (acres) by alternative based on management area prescriptions and currently closed areas that will remain closed in all alternatives (acres/percentage of forest)

Alternative	Allow wheeled motor vehicle use	Allow over-snow vehicle use	Allow mechanized use*
A	570,000 (23%)	887,600 [1] (36%)	1,073,000 (44%)
B	570,300 (23%)	481,200 (20%)	1,044,000 (43%)
C	321,800 (13%)	103,000 (4%)	1,028,800 (42%)
D	350,000 (14%)	323,800 (13%)	1,044,000 (43%)
E	655,900 (27%)	526,400 (22%)	1,044,000 (43%)
F	823,300 (34%)	825,200 (34%)	1,044,000 (43%)
G	529,000 (22%)	592,400 (24%)	1,044,000 (43%)

* Over-snow vehicle use does not currently occur on all accessible acres in alternative A. Use occurs on approximately the same number of acres that are accessible in alternative B.

Continental Divide National Scenic Trail

Scenic Integrity Objectives: As mentioned in the Affected Environment section, the management area emphasis of each of the alternatives may have effects to the CDNST because of the scenery management system and recreation opportunity spectrum identified within the trail corridor (0.5 mile on either side of the center line). Alternatives are analyzed by the scenery management system and recreation opportunity spectrum proposed by each alternative, as displayed in table 145.

Table 145. Scenic integrity objectives within 1 mile corridor of existing Continental Divide National Scenic Trail

Scenic integrity objective	Percentage of acreage by alternative						
	A	B	C	D	E	F	G
Very High	0	0	6	0	0	0	0
High	18	45	44	47	43	24	100
Moderate	73	54	49	52	56	71	0
Low	9	1	1	1	1	5	0

The desired scenic integrity objective for the CDNST is high or very high depending on the trail segment. The following effects analysis and table 146 describe the varying degree to which each alternative accomplishes this objective. One alternative, G, would have all acres within the 0.5-mile corridor managed for high scenic integrity objective. Alternatives B, C, D, and E are somewhat similar in total percent for these two scenic integrity objectives and vary from 43 percent (alternative E) to 50 percent (alternative C). Alternatives A and F, however, have significantly fewer acres in these two scenic integrity objectives, 18 percent and 24 percent, respectively, when compared to the rest of the alternatives.

Alternative A: Alternative A has the least amount of acres within the CDNST corridor managed for scenic integrity objectives high and very high, when compared to all other alternatives.

Therefore, this alternative would have the greatest negative effect to the CDNST for this measurement indicator.

Alternative B: Alternative B has 45 percent of acres within the CDNST corridor managed for the scenic integrity objectives high and very high. When compared to the other alternatives, alternative B has more acres for these scenic integrity objectives than alternatives A, E, and F, but less than alternatives C, D, and G.

Alternative C: Alternative C has the second most acres (50 percent) within the CDNST corridor managed for the scenic integrity objectives high and very high, when compared to all other alternatives. Therefore, this alternative would have the second least negative effect to the CDNST for this measurement indicator.

Alternative D: Alternative D has fewer acres (47 percent) than alternative C (50 percent) and alternative G (100 percent) within the CDNST corridor managed for the scenic integrity objectives high and very high. However, this alternative has more acres managed for these two scenic integrity objectives when compared to all other alternatives (alternatives A, B, E, and F).

Alternative E: Alternative E has fewer acres (43 percent) than alternative B (45 percent), C (50 percent), D (47 percent), and G (100 percent) within the CDNST corridor managed for the scenic integrity objectives high and very high. However, this alternative has more acres managed for these two scenic integrity objectives when compared to alternatives A and F.

Alternative F: Alternative F has the fewest acres (24 percent) within the CDNST corridor managed for the scenic integrity objectives high and very high when compared to the rest of the action alternatives. However, this alternative has more acres managed for these two scenic integrity objectives when compared to alternative A.

Alternative G: All the acres within the CDNST corridor in this alternative are managed for a high scenic integrity objective, representing the most acres in the high and/or very high category of all the alternatives analyzed.

Recreation Opportunity Spectrum: Where possible, the CDNST should be in recreation opportunity spectrum classes primitive and semi-primitive non-motorized. The following effects analysis describes the varying degree to which each alternative accomplishes this objective.

None of the alternatives would have all acres within the 1-mile corridor managed for recreation opportunity spectrum classes of primitive and semi-primitive non-motorized. Alternatives A, B, E, and G are somewhat similar in total percentage for these two recreation opportunity spectrum classes and vary from 23 percent (alternative E) to 25 percent (alternatives A, B, and G). Alternatives C and D have the greatest number of acres managed for these two classes, 32 percent and 31 percent, respectively. These two alternatives best meet the objective of locating the CDNST in primitive and semi-primitive. Alternative F does not have any acres within these two recreation opportunity spectrum classes.

Table 146. Recreation opportunity spectrum classes within 1-mile corridor of existing Continental Divide National Scenic Trail

Recreation opportunity spectrum class	Percentage of acreage by alternative						
	A	B	C	D	E	F	G
Rural	0	0	0	0	0	0	0
Roaded natural	34	24	24	24	24	24	24
Semi-primitive motorized	42	51	45	45	53	76	51
Semi-primitive non-motorized	25	25	26	31	23	0	25
Primitive	0	0	6	0	0	0	0

Nez Perce National Historic Trail

The desired scenic integrity objective for the NPNHT is high or very high due to the management objectives aimed at preserving the original scenic integrity at the time this route was originally utilized by the Nez Perce. Table 147 and the following effects analysis describe the varying degree to which each alternative accomplishes this objective.

The preferred alternative, G, would have all acres within the 1-mile corridor managed for scenic integrity objectives of high and very high. Alternatives A, B, E, and F are somewhat similar in total percentage for these two scenic integrity objectives and vary from 87 percent (alternative F) to 89 percent (alternatives B and E). Alternatives C, D, and G have the most acres in these two scenic integrity objectives, ranging from 97 percent in alternative D to 100 percent in alternative G. Alternative G best meets the objective of preserving the historic scenic integrity of the Nez Perce trail, followed by alternatives C and D.

Table 147. Scenic integrity objectives within the 1-mile corridor of Nez Perce National Historic Trail

Scenic integrity objective	Percentage of acreage by alternative						
	A	B	C	D	E	F	G
Very high	34	48	51	50	48	48	50
High	54	41	47	47	41	39	50
Moderate	12	11	2	3	11	13	0
Low	0	0	0	0	0	0	0

Recreation Setting

Management area allocations will affect recreation visitation and use, to some extent, in each alternative. The quantity, quality, and distribution of recreation opportunities depend on the mix of recreation opportunity spectrum classes available and the objectives they are attempting to achieve. Management area desired conditions for recreation opportunity spectrum classifications are displayed in table 148 by alternative.

Recreation may affect the natural setting (depending on facilities), site mitigations, user behaviors, user densities, site capability, design, and many other elements. Visitor use is expected to continue increasing, regardless of alternative selected. Management actions, which might include restrictions or limitations on use, such as seasonal or yearlong closures, can be taken to maintain a mix of recreation opportunity spectrum settings. The motor vehicle use maps designate routes open to wheeled motor vehicle use. Additional site-specific travel planning will determine specific routes where motorized use is allowed within the recreation opportunity spectrum.

Table 148. Percentage of recreation opportunity spectrum by alternative

Recreation opportunity spectrum class	Percentage of forest acreage by alternative						
	A	B	C	D	E	F	G
Rural	0.06	0.05	0.05	0.05	0.05	0.05	0.05
Roaded natural	9	7	5	6	7	6	7
Semi-primitive motorized	12	17	8	9	20	27	16
Semi-primitive non-motorized	23	21	5	21	17	10	21
Primitive	56	56	82	64	56	56	56

The recreation opportunity spectrum classifications reflect the overall theme and character expressed by the mix of management area allocations in each alternative; as such, the setting, facilities, and character of recreation vary by alternative. Alternatives C and D reflect additional wilderness and non-motorized back country settings. Alternatives E and F reflect more emphasis on development, active management, and motorized recreation. Alternatives B and G include less wilderness and non-motorized back country settings when compared to alternatives C and D, but more of these settings when compared to alternatives E and F.

Alternative C has the highest percentage of the forest managed for the recreation opportunity spectrum class of primitive (82 percent) followed by alternative D (64 percent). This would have a direct positive effect on the quality and quantity of primitive recreational opportunities available to visitors of the Shoshone National Forest when compared to the no-action alternative (alternative A). Conversely, these two alternatives would have a direct negative effect on the quality and quantity of semi-primitive motorized recreational opportunities available due to the low percentage of the forest managed for these types of recreation. Alternative F has the highest percentage of area managed for the recreation opportunity spectrum class of semi-primitive motorized (27 percent). This has a direct positive effect on the quality and quantity of semi-primitive motorized and an equal and opposite (negative) direct effect on the recreation opportunity spectrum class of semi-primitive non-motorized recreational opportunity when compared to the no-action alternative (alternative A). All alternatives have roughly the same amount of forest managed for both recreation opportunity spectrum classes, rural and roaded natural, when compared to the no-action alternative (alternative A). Cumulatively, alternatives B and G have the least amount of change from the no-action alternative (alternative A) across all recreation opportunity spectrum classes when compared to the other action alternatives.

Developed Recreation Sites

There are no anticipated direct or indirect effects to developed recreation sites from any alternatives. As mentioned in the Recreation affected environment section, persons at one time (PAOTs) have increased over the years due to increases in capacity of individual sites. This trend may continue into the future, but will not be contingent on what alternative is selected.

Dispersed Recreation

Effects to dispersed recreation are indirectly covered under the travel management section, and described by the difference in acres available for wheeled motorized use, over-snow vehicle use, and mechanized use. The number of miles of roads and motorized trails available for wheeled motor vehicle use would change based on the projected future motorized trail and road additions. Because alternative F provides the largest amount of projected future trail and road additions, there would be the largest increase in motorized dispersed recreation under this alternative. Alternative C would have the least amount of motorized dispersed recreation of all alternatives because of the reduction in miles of existing motorized trails and road systems (table 139 and table 140). The number of acres available for cross-country wheeled motor vehicle use is the same for the seven alternatives since there are no proposed changes to the prohibition of cross-country travel in any of the management areas.

Where wheeled motor vehicle use may be allowed (where roads or trails may exist and be designated for such use) in any given alternative affects where potential dispersed use could occur. Alternative F provides the most area (34 percent), followed by E (27 percent), B (23 percent), G (22 percent), D (14 percent), and C with the least area (13 percent).

Similarly, where over-snow motor vehicle use may be allowed in any given alternative affects where potential winter dispersed use could occur. Alternative F provides the most area (34 percent), followed by G (24 percent), E (22 percent), B (20 percent), D (13 percent), and C with the least area (4 percent).

Recreation Special Use Authorizations

In general, new outfitting and guiding activities that are not suitable within a management area allocation would not be allowed. Some outfitting and guiding activities would not be suitable in designated wilderness. In addition, within the pristine wilderness setting commercial outfitting and guiding services are prohibited. The pristine wilderness setting would increase in alternatives C and D. Outfitting and guiding services that are tied to designated wilderness could increase in alternatives C and D, which have additional recommended wilderness.

Scenic Byways

None of the alternatives propose changes to the existing scenic byways or All American Road. In addition, none of the alternatives propose new scenic byways or the removal of these designations. There would be no direct or indirect effects to scenic byways from all alternatives.

Summary of Effects

As described above, the alternatives result in varying degrees of effects to access and recreation. Alternatives F and E would, respectively, would provide the most opportunities for summer and winter motorized recreational opportunities. This is a direct result of the combined increase in allowable acres for summer and winter travel as well as the increase in projected future miles of motorized trails and roads within these two alternatives. Alternatives C and D would, respectively, would provide the least opportunities for summer and winter motorized recreational opportunities of all alternatives. Alternatives B and G would provide a lesser degree of these opportunities than both alternatives E and F, but more than alternatives C and D. There is essentially no change in opportunities for mechanized use across all alternatives. However, alternatives C and D restrict mechanized use to system roads and trails on the largest number of total acres, affecting to the greatest extent of all alternatives, where this type of recreation can take place.

Overall, alternatives C and D would have very minimal effects to both the CDNST and the NPNHT. Alternative B is somewhat similar to alternative A and would have slightly more impacts to these two trails when compared to alternatives C, D, and G, yet less than alternatives E and F.

Recreational settings and objectives would shift as a result of changed recreation opportunity spectrum objectives identified for each alternative. Alternatives F and E have objectives aiming to provide a more developed recreational setting compared to the other alternatives. This is a direct result in the total percentage of the forest managed for recreation opportunity spectrum class semi-primitive motorized. Alternatives C and D have objectives aiming to provide a less developed recreational setting compared to the other alternatives. These two have the highest percentage of acres managed for the recreation opportunity spectrum class of primitive. This is a direct result of both of these alternatives proposing recommended wilderness. As mentioned previously, alternative B and G has the least amount of change from the no-action alternative (alternative A) across all recreation opportunity spectrum classes when compared to all the other action alternatives. Alternative B and G provide for less developed recreational settings than alternatives E and F, but more than alternatives C and D.

Effects to Access and Recreation from Forest Plan Components Associated with Other Resource Programs or Revision Topics

Effects from Timber Harvesting: Commercial timber harvest activities will generally result in road reconstruction and continued application of best management practices on existing system roads. New road construction is likely to be limited with temporary road construction used as a more common method for short-term access needs.

Administrative use of gated roads that normally prohibit public motor vehicle use is likely when management activities such as precommercial thinning, invasive weed treatments, or other non-commercial silvicultural treatments are planned.

Because managed land (management area category 4, 5, and 8) allocations are lowest in alternative C compared to other action alternatives, it would generally be expected to result in the least amount of vegetation management activities and hence a lower amount of road use compared to alternatives B, D, E, F, and G. Consequently, reduced traffic (i.e., number of vehicles on roads), both commercial and administrative, can be expected. Associated with reduced commercial use is the reduction of road reconstruction. Road maintenance activities performed in conjunction with commercial use would also occur less often since this work is only required commensurate with use.

Timber harvest has the potential to affect recreation experiences and opportunities in several ways. Short-term effects may include increased noise and dust levels; temporary road and trail closures due to harvesting activity; the sight of landscapes altered by differing types of harvesting; the presence of slash piles, burned areas, and roads constructed for timber sales; conflicts with logging trucks on roads used by other drivers or by bicyclists; and the removal of snow for winter log hauling from roads frequented by snowmobilers, cross-country skiers, and snowshoers. Users may be temporarily displaced to other locations because of log truck traffic and the noise from harvest activities. Visitors may experience prolonged displacement the longer a project or series of projects continue in the same vicinity.

Alternative F has the highest number of acres generally suitable for timber production (251,200 acres) where most of the timber harvest and other vegetation management activities will take place, followed by alternatives E, B, and G (same number of acres), D, C, and A, respectively. Timber harvest and road building can create changes to the landscape, resulting in changes to recreation opportunity spectrum classifications. Alternative F has the greatest potential to convert semi-primitive settings to roaded natural settings, followed by alternatives E, B and G, D, C, and A in descending order. Partial cutting could lessen the effects to recreationists. Road development for timber management purposes in undeveloped areas has the potential to attract more visitors to the interior of the Forest where motorized access previously has been limited. As use increases, visitors to these areas would experience less solitude and remoteness. Primitive and semi-primitive non-motorized settings could change to semi-primitive motorized and roaded natural settings. This change would only occur after a travel management analysis and decision, and would be reflected in changes to the motor vehicle use map in conjunction with vegetation management activities. Recreational benefits from vegetation management can include new roads and trails and the opportunity to gather firewood. In some cases, roads built for logging operations are then used by recreationists, although these roads typically are closed and/or decommissioned after completion of the timber harvest activity. Depending on resource objectives, some roads may be left open to the general public, causing an increase in the quantity of dispersed recreation opportunities.

Effects from Fires/Fuels Management: Fuels management activities (e.g., prescribed burning) are likely to continue. Administrative use of gated roads that normally prohibit motor vehicle use year-round is likely when these management activities occur.

Fire suppression actions are also likely to continue and could result in the use of gated roads as described above. In some cases, roads that are impassible to motor vehicles (due to re-vegetation or other restrictive condition) may be opened to facilitate suppression actions. These roads would probably be used for the duration of the suppression efforts and post-fire work and then returned to their previous status.

Estimated wildfire acres for the alternatives range from a low of 161,400 acres for alternative F to a high of 185,200 acres for alternative A. Some of the acres burned may be based on the decision to allow fire to accomplish resource objectives related to wilderness and/or ecosystem restoration. In some situations, the fire may be unwanted, but consideration of firefighter safety could warrant less aggressive suppression actions. In both cases, the potential for long-duration fire and its associated effects is likely. Potential effects to recreation include the following:

- Area closures that displace recreationists;
- Loss of opportunity to fill a hunting tag due to an area closure or recent fire impacts;
- Threats and/or loss of revenue to permitted uses such as recreation residences, resorts, and outfitter and guides;
- Damage to trails and trail structures; and
- Loss and damage to developed recreation infrastructure.

Alternatives A through D and G have similar effects. Alternatives E and F have fewer estimated acres burned due to the emphasis on protecting more acres of suitable timber production lands, and thus, would have less potential effects from wildfire on recreation than A, B, C, D, and G.

All alternatives emphasize fuels reduction within and adjacent to the wildland-urban interface, which includes most of the developed recreation sites. Alternatives A, B, C, D, and G would result in similar effects. Alternatives E and F would have more acreage available for potential fuels reduction. Insects and disease affect recreation primarily through increased threats to public health and safety from the presence of hazard trees or increased loss of access to trails due to more downfall. These effects are similar across alternatives A, B, C, D, and G, and somewhat less under alternatives E and F because more acres are assigned to active management.

Effects from Livestock Grazing and Big Game: Recreation would be affected by livestock grazing in much the same way in all alternatives. Effects of livestock management include: presence of riders and herders, cattle or sheep, fences, livestock driveways, cow camp cabins, corrals, pastures, livestock tanks, ponds, and cropped forage. Other effects such as trampled vegetation, manure, and concentrations of insects may adversely affect the recreational experience.

Conflicts can occur between visitors, their dogs, cattle herds, bands of sheep, and the dogs used to control herds. These concerns are most often expressed by recreationists who prefer a livestock-free experience.

Effects from Mineral and Energy Development: The Forest Service does not initiate exploration or development of mineral or energy resources. Proposals for exploration and development are driven by external parties and market forces and regulated by existing mining law. Access resulting from road development (long-term or temporary) is often associated with mineral exploration and development, but a site-specific analysis is required prior to any approval for exploration or development activities.

Any mine reclamation activities would likely use existing roads. These may be roads that are not currently designated for motor vehicle use. These roads would probably be used for the duration of the reclamation work and then returned to their previous status.

Recreation could be affected by mineral exploration and extraction in all alternatives. Non-motorized settings could potentially change to motorized settings. Short-term effects may include noise and visual effects from open-pit or underground mining operations. In the long term, effects may include: development resulting in a less natural-appearing landscape; new permanent underground or open pit mines and physical structures; and new roads and road corridors constructed for mining or drilling operations that may change the recreation setting. The potential for oil and gas development on the Shoshone is low to very low. Well sites and other facilities would affect national forest visitors depending on the location of development and the setting affected.

Effects from Wildlife Habitat Management: All alternatives include direction contained in both the Northern Rockies Lynx Management Direction (USDA Forest Service 2007) and the final conservation strategy for the grizzly bear in the Greater Yellowstone Area (Interagency Conservation Strategy Team 2007). In alternatives A through E and G, those decisions affect locations where wheeled motorized vehicle use will be allowed and limit additional opportunities for over-snow vehicle use.

Forest-wide wildlife management direction can directly affect motorized recreation opportunities. Restrictions that limit types of access and seasonal closures during sensitive periods, such as mating, calving, and when animals emerge from dens, can temporarily displace recreationists to other areas. The Shoshone’s motor vehicle use map limits wheeled, motorized uses to designated routes yearlong or seasonally, often in response to wildlife needs. Alternative C is the only alternative that would reduce the miles of motorized roads and trails open for public motorized use. This is, in part, due to forest plan management direction in alternative C to prohibit public motorized use in inventoried roadless areas.

Restrictions to winter motorized use based on management area allocation vary slightly by alternative. Several management areas prohibit winter motorized recreation, including snowmobiles.

Total percentages of national forest open to over-snow vehicles and motorized winter recreation by alternative are shown in table 144 and range from 4 percent in alternative C, to 36 percent in alternative A. Alternatives D (13 percent), B (20 percent), E (22 percent), and G (24 percent) fall within the range.

Big game crucial winter range (as mapped by the WGFD) is found in numerous areas on the Shoshone. In some cases, these areas prohibit winter motorized travel or limit new groomed trails. This varies by alternative, with alternative F allowing the most acres of crucial winter range open for winter motorized use and alternative C allowing no winter motorized use on crucial winter range.

Recreational benefits from wildlife management could include increased hunter and wildlife viewer satisfaction, as well as maintaining angler satisfaction. The effect on recreation from wildlife management is generally the same for all alternatives.

Effects from Aquatic Management: Recreational benefits from aquatic management could include increased satisfaction by water recreation users as well as those utilizing lakes and streams for fishing. The effect on recreation from aquatic management is the same for all alternatives.

Effects from Land Use Authorizations: Various laws provide for rights-of-way over public lands. The Forest Service is responsible for all existing permits located on NFS lands, including their administration, amendment, and renewal when authorized and appropriate. The effect on recreation from land use authorizations is generally the same for all alternatives.

Effects from Wilderness Areas: Wilderness areas (as well as recommended wilderness areas) provide opportunities for primitive and semi-primitive non-motorized recreation. Motorized use is not allowed within wilderness or recommended wilderness. One effect of additional wilderness designation in Wyoming would be a reduction of areas where nonresidents can hunt big-game unguided, since State law requires a licensed guide within designated wilderness for nonresidents.

As illustrated in table 149, alternative C has the most acres (628,800 acres) of recommended wilderness; it places essentially all of the inventoried roadless areas into recommended wilderness. Alternative D is the only other alternative that proposes wilderness recommendation (194,400 acres). Alternatives A, B, E, F, and G do not recommend any additional wilderness.

Table 149. Recommended wilderness acres by alternative

Wilderness recommendations	Alternatives						
	A	B	C	D	E	F	G
Acres	0	0	628,800	194,400	0	0	0

Effects from Research Natural Area Allocation: Research natural area (RNA) designation can affect the scope of available recreation opportunities. RNA designation prohibits motorized recreation aside from over-snow vehicle travel on designated trails. It also prohibits the construction of new roads and trails, except when they are necessary to correct resource damage occurring from existing travelways or unless needed for administrative purposes consistent with RNA establishment objectives. Potential impacts to recreation opportunities are discussed by potential RNAs below:

- **Beartooth Butte** – Approximately half of this potential RNA lies within the North Absaroka Wilderness and half outside of the wilderness. No system trails or roads lie within this proposed area. Approximately 1 mile of a system trail is located along the west boundary and sections of system trail parallel portions of the proposed boundary on the northeast and southeast. No outfitter and guide assigned sites are located within the area and no assigned sites are located adjacent to or near the area. Beartooth Butte is immediately adjacent to the popular Beartooth Lakes Campground and the Clay Butte Lookout tower and includes popular areas for snow play by snowmobilers. There would be little or no impact to the recreation resource from allocating this area as an RNA.
- **Lake Creek** – All of this potential RNA lies within the North Absaroka Wilderness. There are no system trails or roads within this area. Approximately 1 mile of a system trail is located along the west boundary and sections of system trail parallel portions of proposed boundary on the northwest and the northern border. No outfitter and guide assigned sites are located within the area and no assigned sites are located adjacent to or near the area. This potential RNA is just to the north of the Lilly Lake campground. There would be little or no impact to the recreation resource from designating this area as an RNA.
- **Pat O'Hara** – All but roughly one-sixth of this potential RNA lies within the North Absaroka Wilderness. A little over 2 miles of a system trail, Dead Indian, occurs within the wilderness portion of the area. No outfitter and guide assigned sites occur within the area and the closest assigned site outside of the area is approximately 1 mile west; there would be no effects to existing special use permittees. Use and maintenance of system trails would continue as currently administered. There would be little or no impact to the recreation resource from designating this area as an RNA.
- **Bald Ridge** – All of this potential RNA occurs outside of designated wilderness. No system trails or roads lie within this area, but one system trail borders it for approximately 1 mile on the southwest. This area is adjacent to the Clarks Fork Wild and Scenic River corridor. No outfitter and guide assigned sites are located within the area and no assigned sites are located adjacent to or near the area. There would be little or no impact to the recreation resource from designating this area as an RNA.
- **Grizzly Creek** – Approximately two-thirds of this potential RNA lies within the North Absaroka Wilderness and one-third lies outside of the wilderness. A little over 2 miles of a system trail (Horse Creek Trail) occurs in the area with about half inside wilderness and half outside the wilderness portion. No outfitter and guide assigned sites are located within the area and no assigned sites are located adjacent to or near the area. Use and maintenance of system trails would continue as currently administered. There would be little or no impacts to the recreation resource from designating this area as an RNA.
- **Sheep Mesa** – Approximately half of this potential RNA lies within the Washakie Wilderness and half outside of the wilderness. A little over 3 miles of a system trail (Natural Bridge Trail) occurs in the non-wilderness portion and no system trails occur in the wilderness portion. The Sheep Mesa outfitter and guide assigned site is located at the end of the system trail, outside of the wilderness. A sheep spike camp is also located in the area approximately 0.5 mile from the assigned site. Use and maintenance of system

trails would continue as currently administered. There would be little or no impact to the recreation resource from designating this area as an RNA.

- **Arrow Mountain** – All of this potential RNA lies within the Popo Agie Wilderness area. A short (approximately 1 mile) non-system access trail authorized for use by an outfitter or guide is present that provides access to one assigned site located within the proposed area. Use and maintenance of system trails would continue as currently administered. There would be little or no impact to the recreation resource from designating this area as an RNA.
- **Roaring Fork** – All of this potential RNA lies within the Popo Agie Wilderness. Approximately 1 mile of system trail is within this area that provides access to Stough Creek Lakes. Use and maintenance of this trail would continue as currently administered. No outfitter and guide assigned sites occur within the proposed area. The closest assigned site is approximately 2 miles northwest of the potential RNA. No effects to existing special use permittees are anticipated. There would be little or no impact to the recreation resource from designating this area as an RNA.

In summary, outside of winter motorized recreation, there would be no effects from RNA allocation to the recreation resource by any of the action alternatives when compared to alternative A. Existing roads and trails contained within any new RNA would continue to be open to the public for recreational purposes. A minor negative effect on winter motorized recreation would result from the cross-country prohibition of winter motorized use currently occurring in the Beartooth Butte RNA proposed in alternatives C and D. In these two alternatives, winter motorized use would be allowed only on system trails.

Effects from SIA Allocation: Special interest area (SIA) designations would have very little effect on recreation. Restrictions to certain types of recreation opportunities in these areas are the result of management for reasons other than potential SIA designation. For example, the majority of the Little Popo Agie Moraine and all of Sawtooth Peatbeds lie within inventoried roadless areas, thus limiting motorized recreation opportunities. On the other hand, back country non-motorized recreation opportunities exist. For the most part, current management would continue on the following proposed SIAs.

- **Kirwin Historical Site** – The potential SIA comprises approximately 480 acres under alternatives B, C, D, and E. Under alternatives A and F, Kirwin would not be designated as an SIA. Under alternative G, the area is expanded to roughly 4,500 acres, encompassing the historical mining district. The 53-acre Double D Ranch Historical site would also be added to this SIA under alternative G. The Double D Ranch is less than 4 miles northeast of the Kirwin site; the two areas are not adjacent to each other. Both areas can be accessed via NFS Road 200 (Wood River). Portions of three system trails run through the potential SIA. Use and maintenance of system roads and trails would continue as currently administered. There would be few to no impacts to the recreation resource from designating this area as an SIA.
- **Little Popo Agie Moraine Geological Area** – Approximately two-thirds of the potential SIA lies in an inventoried roadless area. Approximately 1.8 miles of the Maxon Basin Road (NFS Road 354) runs through the portion outside of an inventoried roadless area and just under 2 miles of the Louis Lake Road (NFS Road 300) borders the southwest boundary of the potential SIA. Use and maintenance of these roads would continue as currently administered. There would be few to no impacts to the recreation resource from designating this area as an SIA.

- **Sawtooth Peatbeds Geological Area** – This potential SIA lies entirely within an inventoried roadless area. It is bisected by 1.2 miles of the Morrison Jeep Road (NFS Road 120), which is seasonally closed. Use and maintenance of this road would continue as currently administered. There would be few to no impacts to the recreation resource from designating this area as an SIA.

Considering the various alternatives, B, C, D and G would establish the three SIAs listed above. Under alternative G, the Kirwin Historical Site would be much larger than in alternatives B, C, and D, and would include the Double D Ranch Historical Site. Under alternative E, only the Kirwin Historical Site would be established as an SIA at the same size as in alternatives B, C, and D and without the Double D Ranch property. Under alternatives A and F, no SIAs would be established. There would be no effects from SIA designation to the recreation resource by any of the action alternatives when compared to alternative A.

Cumulative Effects

Recreational access across the Shoshone is likely to be influenced by a variety of factors. Given the mixed land ownership (State lands, private, BLM) in and around the Forest and the continuing management actions taken on these lands, there may be options for new access opportunities through cooperative and cost-share agreements. Future travel management decisions may include changes to individual roads and trails open to motorized use.

A slight rise in population is a general trend in the region, and this often leads to increased use of forest roads and trails. The degree of change in traffic will likely vary due to economic conditions (e.g., energy costs) and other demographics.

Commercial traffic (timber hauling) can be expected to fluctuate to some degree, relative to vegetation management activities. Market conditions and other external factors can often influence activity levels. These traffic conditions are usually limited to relatively small geographic areas and short periods of time. Hauling occurs more often during the summer months, but is not uncommon during the winter months, as well.

Change in ownership of private lands can result in continued requests for road access across NFS lands. Depending on the circumstances, these may be requests for Forest or Private Road Special Use Authorizations. Depending on the terms and conditions written into any new authorizations, opportunities for access to NFS lands may be created.

Continental Divide National Scenic Trail: Currently there are two potential proposed re-routes that have had cultural resource and botanical surveys completed. Because the CDNST relocation planning processes are ongoing, they were considered a reasonably foreseeable future action. The location of the proposed re-routes is designed to improve the intended management objectives related to recreation opportunity spectrum and scenic integrity objective. Alternatives C and D would have the least impacts to any of the proposed routes. These alternatives emphasize minimal development and contain management area allocation more consistent with the general management plan for the CDNST. Alternatives E and F would, respectively, have the most impacts to the alternative locations for the proposed CDNST re-routes because of the management area emphasis of more development. Alternatives B and G would have more impacts in terms of recreation opportunity spectrum, than alternatives C and D, but fewer impacts than alternatives E and F. In terms of the scenic integrity objective, alternative G most closely meets it because 78 percent of the area in the alternate route corridor is in the high category. Alternative A would have the greatest impacts to the proposed CDNST re-routes when using the two measurement indicators of recreation opportunity spectrum and scenic integrity objective.

Recreation: The Shoshone has experienced many changes in recreation since the Forest was established, and even over the life of the 1986 Forest Plan as amended. Initially, recreation was light and concentrated in just several popular areas, with few campgrounds or other site development. Another major boom in recreation occurred after World War II through the early to mid-1960s, as post-war populations started heading to the national forests, demanding more and better recreation facilities.

Since the 1970s, interest in and appreciation of the environment has increased national forest recreation visitation and has shifted activities and expectations. As temperatures increase during the summer and a majority of the Shoshone is free from snow cover, many people venture out to the national forests for relief from the heat and to pursue traditional outdoor recreational opportunities.

Technical advancements in motorized vehicles (all-terrain vehicles, motorcycles, snowmobiles, side-by-sides, rock-crawlers, etc.) allow these types of vehicles to travel many places where they were unable to travel as recently as 5 years ago. The invention and advancement of the mountain bike has added a summer non-motorized use that was not considered when the 1986 Forest Plan as amended was written. All of these issues, along with several others, have led to more crowded recreation experiences during peak use times, increasing levels and range of demands on natural resources and resource managers, and more conflicts among the users themselves.

Continuing changes in equipment technology used for recreational purposes on the Forest will have effects as new or existing uses change the ease with which or areas where people recreate. These changes in uses may alter the recreational experience in some areas. Those who pursue non-motorized recreation opportunities, such as hiking or back-country skiing, in remote settings will be more affected than other users.

All alternatives emphasize a mix of recreation opportunities providing today’s recreationists with reasonable assurances of future motorized and non-motorized recreational opportunities. Alternatives E and F may provide more recreation opportunities toward the developed end of the recreation opportunity spectrum classes by accelerating development of the Shoshone with a variety of management actions. Some values such as remoteness, solitude, and wildlife-related recreation opportunities may be reduced in alternatives E and F. Alternatives C and D propose the least amount of forest management, thereby, emphasizing the primitive and semi-primitive classes of recreational opportunities. In comparison, alternative A, B, and G provide a mix of both.

Climate Change

Rice et al. (2012) synthesized past climate, climate projections, and ecosystem implications resulting from climate change as they relate to the Shoshone. In their findings they predict the following potential consequences related to recreation as a result of documented climate trends:

- Potential increase in summer recreation and tourism opportunities, but decreased winter recreation opportunities;
- Potential reductions of snow recreation opportunities for skiing, snowshoeing, and snowmobiling, especially at lower elevations;
- Altered timing of recreational opportunities—potentially earlier and shorter for fishing, rafting, and kayaking;

- Potential reduction of up to half the annual water supply for recreational opportunities during drought;
- Potential reduction or loss of recreational opportunities for fishing native cold water species with the reduction in habitat quality and area; and
- Potential decrease in recreational fishing opportunities.

Special Areas

Designated Wilderness and Recommended Wilderness

Introduction

This section examines the extent to which the no-action (alternative A) and the action alternatives (alternatives B through G) affect designated wilderness on the Shoshone National Forest. The 1964 Wilderness Act defines wilderness as an area of undeveloped Federal land retaining its primeval character and influence without permanent improvements or human habitation. Currently, effects to wilderness are measured by how any particular project or planning effort modifies the wilderness character of a wilderness area. Since the passing of the 1964 Wilderness Act, Forest Service and wilderness scholars have attempted to describe wilderness character. Landres et al. (2011) writes:

> Based on Section 2c, "Definition of Wilderness," in the 1964 Wilderness Act and building on the writing of Howard Zahniser (Zahniser 1956; Harvey 2007), wilderness scholars (Rohlf and Honnold 1988; McCloskey 1999; Scott 2002), and earlier work to describe and use wilderness character (Landres et al. 2005; Landres et al. 2008b), an interagency team published Keeping It Wild (Landres et al. 2008a), which identified five distinct and necessary "qualities" of wilderness character. These qualities were selected to be tangible, link local conditions and management directly to the statutory language of the 1964 Wilderness Act, and apply throughout the entire area of a wilderness. They apply to every wilderness regardless of size, location, agency administration, or any other attribute.

These five distinct qualities used to define wilderness character include:

Natural: Wilderness ecological systems are substantially free from the effects of modern civilization. This quality is degraded by many things, such as loss of indigenous species, occurrence of nonindigenous species, alteration of ecological processes such as water flow and fire regimes, effects of climate change, loss of dark skies, and occurrence of artificial sounds. It is preserved or improved, for example, by controlling or removing nonindigenous species or restoring ecological processes

Solitude or a pristine and unconfined type of recreation: Wilderness provides outstanding opportunities for solitude or primitive and unconfined recreation. This quality is primarily about the opportunity for people to experience wilderness, and is influenced by settings that affect this opportunity. It is preserved or improved by management actions that reduce visitor encounters and signs of modern civilization inside the wilderness. In contrast, this quality is degraded by agency-provided recreation facilities, management restrictions on visitor behavior, and actions that increase visitor encounters.

Undeveloped: Wilderness retains its primeval character and influence and is essentially without permanent improvement or modern human occupation. This quality is influenced by what are commonly called the "Section 4c prohibited uses," that is, the presence of modern structures, installations, habitations, and use of motor vehicles, motorized equipment, or mechanical transport. The removal of structures and not conducting these prohibited uses preserve or improve this quality. In contrast, the presence of structures and prohibited uses degrades this quality, whether by the agency for administrative purposes, by others authorized by the agency, or when there are unauthorized uses.

Untrammeled: Wilderness is essentially unhindered and free from the actions of modern human control or manipulation. This quality is influenced by any activity or action that controls or manipulates the components or processes of ecological systems inside the wilderness. Management actions that are not taken support or preserve the untrammeled quality, while actions that are taken degrade this quality, even when these actions are taken to protect resources, such as spraying herbicides to eradicate or control nonindigenous species or reducing fuels accumulated from decades of fire exclusion.

Other Features: "In addition to these four qualities, there may be a fifth quality, called other features, based on the last clause of Section 2c in the 1964 Wilderness Act, that a wilderness 'may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.' Unlike the preceding four qualities that apply to every wilderness, this fifth quality is unique to an individual wilderness based on the features that are inside that wilderness. These features typically occur only in specific locations within a wilderness and include cultural resources, historical sites, paleontological sites, or any feature not in one of the other four qualities that has scientific, educational, scenic, or historical value. While many different types of features could be included, the intent is to include those that are significant or integral to the park and wilderness. Features mentioned in park or wilderness enabling legislation would likely qualify, such as the historic sites in Death Valley Wilderness and volcanoes in Katmai Wilderness. Likewise, significant cultural sites, whether mentioned in enabling legislation or not, occur in most wildernesses and have scientific, educational, scenic, or historical value." (page 44 Landres et al. 2012).

In addition, the forest planning process requires that unless otherwise provided by law, all roadless, undeveloped areas that satisfy the definition of wilderness found in section 2(c) of the Wilderness Act of 1964 should be evaluated and considered for recommendation as potential wilderness areas during plan development. To satisfy this requirement, an evaluation of areas for potential wilderness was completed in 2008, and edited in 2012. Thirty-four areas were evaluated for capability, and availability, using the process identified in Forest Service Handbook 1909.12, chapter 70.

Legal and Administrative Framework

Laws

These acts, along with other land use laws, executive orders, and policies guide management of designated wilderness on NFS lands. Other laws pertinent to wilderness management of NFS lands can be found in Forest Service Manual (FSM) 2320 - Wilderness Management.

Wilderness Act of September 3, 1964 (16 U.S.C. 1131-1136): This act provides the statutory definition of wilderness and management requirements for these congressionally designated areas. This act established a National Wilderness Preservation System to be administered in such a manner as to leave these areas unimpaired for future use and enjoyment as wilderness. The act also designated the North Absaroka Wilderness as part of the National Wilderness Preservation System.

Public Law 92-476, October 9, 1972: Added the Stratified Primitive Area as Part to the South Absaroka Wilderness and renamed both to the Washakie Wilderness. The law also provided direction on management of the Dunoir Special Management Unit.

National Forest Management Act (NFMA) of 1976, as amended (16 U.S.C. 1600): Provides that management direction for wilderness be incorporated into forest plans and sets minimum standards for the content of the plans.

Public Law 94-557, October 19, 1976: Designated the “Glacier Wilderness Proposed” as the Fitzpatrick Wilderness, a component of the National Wilderness Preservation System.

Public Law 98-550, October 30, 1984 Wyoming Wilderness Act of 1984: Designated portions of the Forest as the Popo Agie Wilderness, added the Glacier Addition to the Fitzpatrick Wilderness, added the South Fork addition to the Washakie Wilderness, added the High Lakes Addition to the Absaroka-Beartooth Wilderness, and designated the High Lakes Wilderness Study Area.

Regulation and Policies

Regulations and policies have been adopted in support of these laws and are documented in the following:

- Forest Service Manual (FSM) 2320 Wilderness Management
- Rocky Mountain Regional supplements
    - 2300-94-1 (2320.1-2323.26b Wilderness Implementation Schedules)
    - 2300-94-2 (2323.3-2328.04 Management of Other Resources in Wilderness)

Other Agreements

A memorandum of understanding (MOU) between the Association of Fish and Wildlife Agencies, the Forest Service, and the Bureau of Land Management, which established policies and guidelines for cooperative management of fish and wildlife in congressionally designated wilderness areas.

An MOU between the Wyoming Game and Fish Department and the Forest Service on fish, wildlife, and habitat management within National Forest Wilderness in Wyoming.

Code of Federal Regulations (CFR)

- 36 CFR 293: Wilderness–Primitive Areas

Key Indicators

- Acres of recommended wilderness
- Miles of wilderness boundary adjacent to areas available for motorized use.

Methodology

Additional areas recommended for wilderness designation would have the effect on existing wilderness of reducing recreation pressure on current wilderness and dispersing it over a larger land base. Total acres recommended for wilderness is used to compare alternatives.

Availability of areas to motorized use, particularly winter motorized use, adjacent to wilderness boundaries can also be considered when comparing effects among alternatives. The more miles of wilderness boundary adjacent to areas allocated to motorized travel, the higher the potential impacts to wilderness characteristics. Conversely, fewer miles of wilderness boundary adjacent to motorized activities lower the likelihood of impacts to existing wilderness. Differences in the total miles of wilderness boundary adjacent to motorized opportunities are used to compare alternatives.

In 2008 (updated in 2012), 34 areas on the Shoshone were evaluated for potential wilderness. This process included three tests—capability, availability, and need. Capability is defined as the degree to which the area contains the basic characteristics that make it suitable for wilderness designation without regard to its availability for or need as wilderness. The availability determination is conditioned on the value of and need for the wilderness resource compared to the value of and need for the area for other resources. Need is the determination that the area should be designated as wilderness through an analysis of the degree the area contributes to the local and national distribution of wilderness.

Resource Protection Methods

Designated wilderness is governed largely by the terms of the Wilderness Act, which limits human uses and activities. These limitations are designed to retain wilderness in a natural and wild state. As mentioned in the Introduction, effects to wilderness are measured by how any particular project or planning effort modifies wilderness character. Project proposals within these areas are evaluated for compliance with wilderness values and how well they maintain the five qualities of wilderness character. Commercial use in wilderness is controlled by special-use permits and the operation plans that are required under the special use permits.

Affected Environment

Since the Wilderness Act of 1964, the National Wilderness Preservation System has grown dramatically. As of 2004, Congress had designated more than 106 million acres of Federal public land as wilderness. Numerous bills are pending in Congress that would create millions of acres of new wilderness areas in national forests, national parks, national wildlife refuges, and land administered by the BLM. However, there are no pending bills for wilderness designation in the State of Wyoming. The wilderness system has been built through subsequent legislation of approximately 104 wilderness bills, typically establishing wilderness areas in a particular state.

Nationally in the National Wilderness Preservation System, there are 757 wilderness areas encompassing approximately 109 million acres. This is approximately 5 percent of the total United States land mass. The Forest Service manages approximately 36 million acres in 439 wilderness areas. This is about 19 percent of all NFS land. In Wyoming, a total of 3.1 million acres is designated wilderness in 15 national forest wilderness areas. Wilderness covers approximately 5 percent of the State’s area. Wyoming wilderness areas administered by the Forest Service represent about 3 percent of the area in the National Wilderness Preservation System.

Designated wilderness on the Shoshone National Forest includes 1,365,154 acres in five congressionally designated areas administered as wilderness unimpaired for future use and enjoyment. The following five wilderness areas are managed either solely by the Shoshone or jointly with neighboring forests:

Absaroka-Beartooth Wilderness: The Absaroka-Beartooth Wilderness, designated in 1978, covers 943,622 acres in Montana and Wyoming (23,672 acres on the Shoshone). The area is dominated by the high granite plateaus of the Beartooth Mountains cut by deep canyons and large expanses of tundra habitats, which are rare in the lower 48 states.

Fitzpatrick Wilderness: The Fitzpatrick Wilderness was designated in 1976. The 198,819-acre area contains 44 active glaciers and many rugged mountain peaks in the northern half of the Wind River Mountains, including Wyoming's highest point, Gannett Peak.

North Absaroka Wilderness: The North Absaroka Wilderness was designated in 1964. Rugged volcanic mountains dissected by numerous creeks forming huge drainages are typical scenes in the 346,082-acre North Absaroka Wilderness.

Popo Agie Wilderness: Designated in 1984, the 102,539-acre Popo Agie Wilderness contains many high granite peaks and alpine and subalpine lakes in the southern portion of the Wind River Mountains.

Washakie Wilderness: At 694,341 acres, the Washakie Wilderness, designated in 1964, is Wyoming's largest wilderness area. The area is characterized by broad, flat-topped mountains and plateaus separated by narrow valleys and unusual geological formations.

Wilderness Setting

Congressionally designated wilderness areas on the Shoshone are further divided into three wilderness recreation opportunity spectrum settings that provide differing levels of solitude and isolation. Table 150 displays the existing wilderness recreation opportunity spectrum setting breakdown (see map 69).

Pristine: The pristine settings provide natural biophysical conditions and a high degree of solitude for both wildlife and humans with no perceptible evidence of human use. Pristine wilderness provides outstanding opportunities for solitude and isolation. Opportunities for unconfined recreation are maximized. Evidence of human uses is not noticeable and does not affect natural biological processes. Encounters with small groups or individuals are infrequent. All travel is cross country. No system trails are identified or managed in the pristine recreation opportunity spectrum setting.

Primitive: The primitive settings provide substantially natural biophysical conditions. Primitive wilderness provides opportunities for solitude. On-site regulation of recreation use is minimal. Campsites are dispersed; usually one would neither hear, nor see visitors at adjacent campsites. Encounters with small groups and individuals are limited. System trails are available for travel within a low-density constructed trail system. Human influences on biophysical conditions and natural biological processes are minimal. Human uses and activities may be evident in the areas of highest visitor use.

Semi-Primitive: Semi-primitive settings provide essentially natural biophysical conditions. In semi-primitive wilderness, trails concentrate use and provide access to popular destinations and travel routes. Encounters with other users can be frequent. Campsites are either dispersed or clustered around destinations and show evidence of repeated but acceptable levels of use. Management actions and regulations to mitigate visitor use effects may be noticeable. Human uses and activities may be evident in the areas of highest visitor use, for example trail corridors. Human activities may influence biophysical conditions and natural biological processes.

Table 150. Total acres of wilderness recreation opportunity spectrum setting

Wilderness recreation opportunity spectrum setting	Acres
Pristine	265,300
Primitive	971,500
Semi-Primitive	128,300
Total	1,365,000

Environmental Consequences

Because direction for wilderness management is detailed in law, regulation, agency policy and in specific management plans; management of existing wilderness does not vary by alternative.

Direct and Indirect Effects

The following discussion of general effects on wilderness addresses effects from adding additional recommended wilderness. Alternatives A, B, E, F and G do not propose any new areas for wilderness recommendation. Alternatives C and D, propose 20 and 7 new wilderness additions, respectively. Table 151 displays the total number of acres proposed for wilderness recommendation by alternative.

Table 151. Total acres of existing and recommended wilderness by alternative

Wilderness ROS setting	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Existing wilderness	1,365,000	1,365,000	1,365,000	1,365,000	1,365,000	1,365,000	1,365,000
Recommended wilderness	0	0	628,800	194,500	0	0	0
Total	1,365,000	1,365,000	1,994,000	1,560,000	1,365,000	1,365,000	1,365,000

Recommended wilderness can affect existing wilderness. Designation of new wilderness may change patterns of recreation use, create larger contiguous areas and reduce pressure within existing wilderness areas. Summer and winter motorized use would be prohibited in areas recommended for wilderness designation, therefore, motorcycle, snowmobile, all-terrain vehicle, utility vehicle, and full-size vehicle use would be displaced. Mechanized use would be restricted to system roads and trails. In the event of congressional designation, use would be prohibited. Recommended wilderness does, however, provide larger areas with wilderness character.

New areas considered for recommendation for wilderness designation in alternatives C and D, would potentially protect wilderness resources on 628,800 and 194,500 acres, respectively. In addition, these areas preserve wilderness character through management efforts to maintain the five wilderness qualities that define wilderness character. These additional wilderness acres will also be assigned to a wilderness setting. Table displays the acres of wilderness setting across the alternatives (maps 70 and 71).

Table 152. Total acres of wilderness recreation opportunity spectrum setting by alternative

Wilderness recreation opportunity spectrum setting	Alts. A, B, E, F, G	Alt. C	Alt. D
Pristine	265,300	287,800	275,900
Primitive	971,500	1,368,000	1,407,000
Semi-Primitive	128,300	338,000	177.000
Total	1,365,000	1,994,000	1,560,000

Only Congress can pass legislation to create wilderness, therefore, management area (MA) allocation for recommended wilderness (management categories 1.2) does not create designated wilderness. Management area categories 1.2 protect the values that make the area suitable for wilderness designation. Management strategies for these areas may affect recreation opportunities and experiences.

Areas Evaluated for Potential Wilderness

Areas evaluated for potential wilderness but not recommended are allocated to management areas with other management prescriptions. Management area prescriptions may or may not be compatible with wilderness principles and may thus impact the wilderness potential of these areas. The effects of the various alternatives can be compared by looking at numbers of acres allocated to management prescriptions by alternative.

An offshoot of management area allocation that would also have an impact on wilderness potential is the amount of land available for motorized use within these areas. Acres available for motorized use are used here for comparing potential effects by alternative.

Alternative F allocates the most acreage, roughly 322,000 acres, of potential wilderness to management prescriptions that allow more active management not consistent with wilderness character. Those management areas are 4.2, 5.1, 5.2, and 5.4 (see table 153). Alternatives A and E are similar and allocate the second highest number of acres, approximately 157,000 and 146,000 acres, respectively, to these management areas. Alternatives B, D, and G follow with between 59,000 and 71,000 acres allocated to MAs with more active management. Finally alternative C allocates the fewest number of acres—roughly 38,000—to those MAs resulting in the lowest potential for impacts to wilderness characteristics.

Table 154 displays the total acres of areas evaluated for potential wilderness available to summer and winter motorized use. Alternative F allocates the greatest number of acres available to summer and winter motorized use of all the action alternatives and therefore the highest potential for effects to wilderness characteristics. In alternative F, 67 percent of potential wilderness acres are available for summer and winter motorized use. Only alternative A (no action) allocates more acres, 14 percent more, to winter motorized use. Alternative E allocates the second most acres to summer motorized use of the action alternatives at 45 percent, but the third most acres to winter motorized at 36 percent. Alternative G allocates more acres to winter motorized use than alternative E.

Alternatives B and G are similar in total acres available for summer motorized at 33 and 30 percent, respectively. Impacts from summer motorized use would be similar in these two alternatives. However, alternative G makes 15 percent more acres of potential wilderness available for winter motorized use, so the effects on wilderness characteristics from this activity would be greater in G.

As mentioned earlier, alternatives C and D are the only two that recommend areas evaluated for potential wilderness be designated as such. They in turn would have the least effects on potential for wilderness. Alternative C recommends 20 areas for wilderness recommendation and alternative D recommends 7. Alternative C offers the most protection to the wilderness character of potential wilderness areas followed by D.

Table 153. Wilderness evaluation acres by management area and alternative

MA	Description	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
1.2	Recommended Wilderness			558,924	164,921			
1.2A	Recommended High Lakes Wilderness			15,224				
1.2B	Recommended Dunoir Wilderness			28,879	28,879			
1.3	Back Country Non-Motorized	426,701	353,341	86,595	367,950	324,317	202,266	261,859
1.5A	Clarks Fork Wild River							
1.6A	High Lakes WSA	15,224	15,224		15,224	15,224	15,224	15,224
1.6B	Dunoir SMU	28,879	28,879			28,879	28,879	28,879
2.2A	Line Creek RNA	1,276	1,276	184	1,276	1,276	1,276	1,276
2.3	Potential RNA	1,143	11,361	3,537	14,422			13,065
3.1B	Potential Little Popo Agie Moraine SIA		801	801	801			801
3.1C	Potential Sawtooth Peatbeds SIA		563		563			391
3.3A	Back Country Motorized	115,007	62,766	4,947	8,288	89,870	170,765	78,715
3.3B	Back Country Winter Motorized		86,372	3,157	71,555	43,430		185,175
3.3C	Back Country Summer Motorized		72,091	4,188	10,494	93,927	4,563	45,896
3.5	Back Country Recreation & Restoration		41,458					
4.2	Travel Corridor	61,337	36,181	20,424	36,181	38,153	38,326	38,326
4.3	Back Country Access Corridor		1,612	424	1,609	1,347	156	1,613
4.5A	Proposed Kirwin SIA	173	173	173	173	173		3,782
5.1	Managed Forests & Rangelands	59,578	18,583	7,665	14,142	78,789	283,385	18,583
5.2	Public Water Supply		7,420	1,534	2,645	7,420		7,420
5.4	Managed Big Game Crucial Winter Range	36,321	6,739	8,184	5,717	22,036		6,712
8.2	Ski-based Resort		798	798	798	798	798	798
Grand Total		745,640	745,639	745,639	745,639	745,639	745,639	745,639

Management Area 3.6A, Continental Divide National Scenic Trail is a linear feature that overlaps with the above management areas.

Table 154. Wilderness evaluation acres available for motorized use by alternative

Motorized use acres (%)	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Summer	272,416 (37)	249,186 (33)	43,781 (6)	59,745 (8)	332,513 (45)	498,488 (67)	222,459 (30)
Winter	607,454 (81)	234,700 (31)	20,582 (3)	132,419 (18)	265,071 (36)	503,052 (67)	344,470 (46)
Total Acres	746,134	746,134	746,134	746,134	746,134	746,134	746,134

Looking at the combined effects to areas evaluated for potential wilderness (but not recommended) from MA prescriptions and availability for motorized use, alternative C provides the highest likelihood that wilderness characteristics would be protected. Alternative F, provides the least protection for the wilderness character of these areas. All other alternatives fall somewhere in between.

Effects on Existing Wilderness: Additional recommended wilderness would affect existing wilderness by providing larger areas with wilderness character.

Non-wilderness uses adjacent to wilderness may have a negative effect on the quality of wilderness recreation experiences. Where roads and motorized activities occur along the wilderness boundary, the incidence of illegal use of motorized and mechanized vehicles in wilderness may increase. High standard roads close to the boundary provide easy recreation access to wilderness and tend to increase use. As motorized use increases there is a greater effect on physical, biological, and social conditions in the wilderness.

Areas bordering the wilderness allocated to management areas providing motorized opportunities are more likely to affect wilderness condition and uses. Potential effects could include noise, modified landscapes, and motorized trespass.

The more miles of wilderness boundary adjacent to areas available for motorized use, the greater the potential for impacts to and incursions into wilderness. Conversely, fewer miles of wilderness boundary adjacent to these areas would lower the potential for impacts and incursions.

Motorized use occurs during both winter and summer seasons. Because summer motorized use is limited to roads and trails, it represents less of a potential impact to wilderness than winter motorized use. Though it occurs over snow it may be allowed on roads, trails and cross country increasing the potential for trespass into wilderness areas.

Table 155 displays the total miles of wilderness boundary adjacent to areas available for winter motorized use by alternative. Percentages are also included (parentheses) and were calculated on the total miles of wilderness boundary adjacent to areas with non-wilderness management prescriptions.

Table 155. Miles of wilderness boundary adjacent to areas available for winter motorized use by alternative

	Alt. A Existing	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Winter motorized miles (%)	350 (81)	77 (18)	17 (4)	57 (13)	83 (19)	222 (51)	147 (34)
Total miles wilderness boundary adjacent to other MAs	431	431	431	431	431	431	431

Alternative A (no action): The no-action alternative is used to provide a measure for comparison. In this alternative, all five existing wilderness areas would continue to be managed according to the 1964 Wilderness Act. There is no recommended wilderness in this alternative.

Alternative A has 350 miles of existing wilderness boundary adjacent to areas available for winter motorized use. This represents 81 percent of 431 miles, more than any of the action alternatives.

Alternative B (proposed action): Alternative B does not contain any recommended wilderness. Fewer miles of existing wilderness boundary are adjacent to areas available for winter motorized use in this alternative compared to alternative A. The 77 miles of wilderness boundary adjacent to areas available for winter motorized use represent a 63 percent reduction from the no action alternative making it much less likely to result in impacts to wilderness character from this activity than alternative A.

Alternative C: Alternative C proposes 20 new areas totaling 628,800 acres for wilderness recommendation. Subsequently only 17 miles or 4 percent of the wilderness boundary would be exposed to winter motorized use areas. This alternative is least likely to impact existing wilderness due to the restriction of motorized activities along the existing wilderness boundary.

Alternative D: Alternative D likewise proposes 7 new areas for wilderness designation (194,500 acres). This is more than the no-action alternative (alternative A), but less than alternative C. In this alternative, 57 miles (13 percent) of wilderness boundary are adjacent to areas available for motorized use. The 7 new wilderness areas provide additional boundary along which motorized activity is restricted..

Alternative E: Alternative E is similar to alternative B in terms of amount of wilderness boundary exposed to winter motorized use—83 miles or 19 percent—and would have similar impacts. Like alternatives A and B, this alternative proposes no new recommended wilderness areas.

Alternative F: Alternative F provides for the highest level of motorized use and also does not recommend any areas for potential wilderness. In this alternative, 222 miles of wilderness boundary are adjacent to areas available for motorized use, the most of all the action alternatives and second only to alternative A. It poses the greatest potential of all the action alternatives for impacts to the wilderness character of these areas.

Alternative G: At 147 miles (34 percent) of wilderness boundary exposed to adjacent areas available for winter motorized use, alternative G would be less likely to result in impacts to wilderness character in existing wilderness than alternatives A and F. It also recommends no potential wilderness.

Summary of Effects

As described above, the alternatives result in varying degrees of effects to designated wilderness on the Shoshone. Alternatives F and E would, respectively, have the greatest potential for impacts to wilderness and wilderness character. These two alternatives, like alternatives A, B, and G do not propose any new recommended wilderness. In addition, these two alternatives would have the largest amount of acreage in recreation opportunity spectrum settings rural, roaded-natural, and semi-primitive motorized adjacent to the wilderness boundary. Alternatives C and D would, respectively, have the least potential for impacts to wilderness and wilderness character of all alternatives. These two alternatives are the only alternatives that propose any new recommended wilderness and they also have the least amount of recreation opportunity spectrum settings of rural, roaded-natural, and semi-primitive motorized acres adjacent to the wilderness boundary. Alternatives B and G would provide a lesser degree of potential for impacts when compared to alternatives E and F, but more potential than alternatives C and D.

Effects from Resource Areas

Effects from Other Management Areas: Adjacent management activities can have a direct effect on Wilderness. Although the law forbids buffering wilderness, management along the boundaries can affect both management and use of the area inside the boundary. Areas managed for non-motorized use are usually more compatible with wilderness.

Illegal use of ATVs (all-terrain vehicles and snowmobiles) in designated wilderness is a management concern. Where there are no natural barriers, from trees or terrain, monitoring for unauthorized use is especially important. Monitoring and law enforcement, including aerial surveillance, are continuing efforts.

As mentioned previously, management areas bordering the wilderness and providing motorized use are more likely to affect wilderness condition and uses. The most highly developed areas (for commodity production or recreation use) are generally management areas 3, 4, 5 and 8. If new development occurs adjacent to any of the existing five wilderness areas, effects could include noise, modified landscapes, and motorized trespass. In terms of negative effects from adjacent land uses, alternative A and F could have the greatest effect on existing wilderness, followed by alternatives B, E and G, and then alternatives C and D.

Effects from Invasive Species: Invasive species may include invasive plants, pathogens, insects, birds, mammals, fish and invertebrates. Invasive species can threaten the integrity of wilderness ecosystems. While introduced fish species are the most ubiquitous, non-native plants found in the wilderness, including Dalmatian toadflax, ox-eye daisy, spotted knapweed, and Canada thistle, have the most potential to disrupt native ecosystems.

Visitors' vehicles and livestock from outside wilderness are most likely to introduce non-native, invasive plants. Certified weed-free forage products are required if used for feed, bedding, mulch or any other purpose. The Shoshone currently monitors for the presence of non-native plant species and uses mechanical controls (e.g., hand-pulling, hand tools) where effective and feasible. Chemical controls are approved if necessary. Non-native, invasive plant control is a joint effort between the Shoshone and the county weed and pest control districts.

Effects from invasive species in wilderness may vary by alternative with larger landscapes in alternatives C and D having less probability of vectors getting into existing wilderness.

Effects from Fire and Fuels Management: While all human-caused fires within wilderness have a management objective of suppression, current and past agency direction allows naturally ignited fires within wilderness to be used to accomplish resource benefit objectives such as restoring the natural role of fire in wilderness areas. The Shoshone has been actively managing naturally ignited fires within wilderness to achieve resource benefit for years but not all are managed as such. Some are suppressed to meet protection objectives for values at risk outside of wilderness.

The trend to allow naturally ignited fires to accomplish resource benefits in wilderness is expected to continue in the future. All alternatives have desired conditions and objectives that include allowing fire to play its natural role in the wilderness ecosystem. These objectives pertain to both designated and any recommended wilderness. The beneficial effects to wilderness from fire would be similar in alternatives A, B, C, D, and G. There would be fewer beneficial effects to wilderness in alternatives E and F because more acres outside of wilderness would require a suppression response to meet protection objectives.

Impacts from suppression activities within wilderness in alternatives B and G would be similar and would not change from what is currently happening under alternative A. Impacts include possible use of mechanized equipment such as chainsaws for fireline construction, use of motorized equipment such as helicopters, and application of retardant. Minimum impact suppression tactics are used and they minimize these impacts to the extent possible while meeting the suppression objective. Impacts would be higher in alternatives C and D, because these alternatives recommend more acres of wilderness. In addition, impacts are higher in alternatives E and F because more acres outside of designated wilderness would require a suppression response to meet protection objectives.

Effects from Livestock Grazing and Big Game: Commercial livestock grazing is permitted in wilderness, where it was established prior to wilderness designation in accordance with congressional grazing guidelines. Livestock can affect both resource and wilderness values.

Recreational livestock grazing activities are not directly regulated by a permitting process; only livestock used by commercial outfitters and guides is under permit. Guidelines and monitoring included in the revised Forest Plan provide a framework for monitoring effects of recreational livestock grazing and determining the appropriate management response. Monitoring levels of commercial and recreational livestock is also used to determine impacts to wilderness values.

Effects from Minerals Management: With the relatively small number of mining claims on the Shoshone, mineral management is expected to have little to no effect on designated wilderness.

Cumulative Effects

Wilderness management in accordance with the standards and guidelines in the revised Forest Plan is designed to maintain or improve wilderness character in all five wilderness areas on the Shoshone. Current monitoring indicates that effects of concentrated recreational use exceed guidelines in some areas and management actions may be needed to improve conditions. Management options include restoration activities, visitor information and education, limits on use, recommendation of additional areas or some combination of options.

Our relationship to wilderness and wild lands is changing in response to societal changes including technological advances, environmental attitudes, knowledge of natural processes and disturbance factors, and the diversification of the economy. Balancing environmental protection with the maintenance of existing lifestyles is a continuing public debate. Awareness of natural disturbances (fire, insects, and disease, wind) is heightened where they threaten homes or economies based on timber or tourism. These issues will influence the public's knowledge and understanding of wilderness in the future.

The seven alternatives do not change the amount of existing wilderness designated on the Shoshone, in Wyoming, or in the National Wilderness Preservation System.

Climate Change

Climate change has the potential to have widespread negative effects on wilderness and wilderness character (Stevenson and Millar 2012). Predicted species migration, patterns of precipitation, and vegetative shifts due to temperature increase would have impacts on all wilderness areas and wilderness character (Millar et al. 2007). Rice et al. (2012) highlighted the following conclusions related to climate change that may affect the five wilderness qualities that define wilderness character for each wilderness on the Shoshone.

- Potential increase in summer recreation and tourism opportunities, but decreased winter recreation opportunities.
- Micro-climate conditions in the high elevations of the Shoshone have, and will likely continue to provide refugia for unique and sometimes rare ecologic components.
- Water resources are vulnerable as warmer temperatures are projected to reduce snowpack, increase evaporation, lengthen summer seasons, and start spring runoff earlier.
- Shoshone landscapes may be more vulnerable to increased fire occurrence, magnitude, and severity as warmer temperatures cause drier conditions and longer fire seasons.
- Shoshone habitats and wildlife that are particularly vulnerable to climate change are alpine ecosystems, wetlands, and species that are stressed, with lower adaptive ability to higher temperatures, or existing at the edge of an environmental tolerance.
- Potential reduction or loss of recreational opportunities for fishing native cold water species with the reduction in habitat quality and area.
- Potential decrease in recreational fishing opportunities.

Designated and Eligible Wild and Scenic Rivers

Introduction

This section examines the extent to which the no-action (alternative A) and the action alternatives (alternatives B through G) affect designated and eligible wild and scenic rivers on the Shoshone National Forest. Congress enacted the Wild and Scenic Rivers Act in 1968 to preserve select river's free-flowing condition, water quality, and outstandingly remarkable values. The most important provision of the Wild and Scenic Rivers Act is protecting rivers from the harmful effects of water resources projects.

The Shoshone National Forest has one designated wild and scenic river. In 1990, the Clarks Fork Wild and Scenic River Designation Act designated a 20.5-mile segment of the Clarks Fork of the Yellowstone River to be included in the National Wild and Scenic Rivers System with a classification of wild. Wild rivers are those rivers or sections of rivers that are free of impoundments, protect the outstandingly remarkable values and water quality of the rivers, and have essentially primitive shorelines.

In addition, the forest planning process requires a comprehensive evaluation of the Forest's rivers to identify those that have the potential to be included in the National Wild and Scenic Rivers System. Sixteen river segments were found to be eligible, their outstandingly remarkable values were identified, and a classification of wild, scenic, or recreational was identified.

The next step is a suitability determination, which is done through a suitability study, and provides the basis for determining whether to recommend a river as part of the national system. No suitability studies are being conducted in this forest plan revision. Suitability determinations of the 16 eligible river segments are being deferred, pending:

- Public interest or support of wild and scenic river study.
- Congress expressing interest in a specific river for wild and scenic river designation.
- A proposed project that would alter the free-flowing character of a stream, such as impoundment, or adversely affect outstandingly remarkable values, or the river's inventoried classification.

Rivers identified as eligible are managed to maintain eligibility until suitability is determined.

Legal and Administrative Framework

Laws

These acts, along with other land use laws, executive orders, and policies guide management of both designated and potential wild and scenic rivers on NFS lands. Other laws pertinent to wild and scenic river management of NFS lands can be found in Forest Service Manual (FSM) 2354, River Management.

Organic Administration Act of June 4, 1897 (30 Stat. 11, as amended; 16 U.S.C. § 473 et seq.): This act provides the Secretary of Agriculture the authority to regulate the occupancy and use of NFS lands.

Multiple-Use Sustained-Yield Act of June 12, 1960 (P.L. 86-517, 74 Stat. 215): This act provides direction to provide access and recreation opportunities on NFS lands. The act states, "The policy of Congress is that national forests are established and administered for outdoor recreation…."

Wild and Scenic Rivers Act of October 2, 1968 (P.L. 90-542, Stat. 906, as amended; 16 U.S.C. § 1271(note), 1271-1287): This act established a policy for preserving selected rivers or sections thereof in a free-flowing condition. The intent was to protect water quality of such rivers and to fulfill other vital national conservation measures that would balance the development of water, power, and other resources for the benefit and enjoyment of present and future generations.

Federal Land Policy and Management Act of October 21, 1976 (P.L. 94-579, 90 Stat. 2742, as amended): This act declares (per Sec. 102) that "…the public lands be managed in a manner that…will provide for outdoor recreation and human occupancy and use."

National Forest Management Act (NFMA) of October 22, 1976 (P.L. 94-588, 90 Stat. 2949; 16 U.S.C. § 1600 et seq.): The act requires the Forest Service to establish a comprehensive system of land and resource planning, including the development and maintenance of a comprehensive and detailed inventory of lands and resources. The act also specifies the use of a systematic interdisciplinary approach to achieve integrated consideration of the physical sciences into planning for the management and use of NFS lands and resources.

Regulation and Policies

Regulations and policies have been put into effect in support of these laws and direction is documented in the following:

- Forest Service Manual (FSM) 2354 River Management
- 36 CFR 297 — Wild and Scenic Rivers

Resource Protection Measures

Comprehensive River Management Plan for the Clarks Fork of the Yellowstone Wild and Scenic River

Key Indicators

- Miles of designated wild, scenic or recreational rivers
- Miles of eligible, wild, and scenic or recreational rivers

Methodology

As per the Wild and Scenic River Act at 5(d) (1) and Forest Service Manual policy (FSM 1924.03) a systematic inventory of named streams and rivers was completed for the Shoshone National Forest (see appendix D). The wild and scenic river process requires a determination to be made regarding a river's eligibility, classification, and suitability. Eligibility and classification represent an inventory of existing conditions. Eligibility is an evaluation of whether a river is free-flowing (without major dams, diversions, or channel modifications) and possesses one or more outstandingly remarkable values. These values should be a unique or exceptional representation for the area studied and must be related to the river or its immediate environment.

First, the Shoshone National Forest planning team reviewed the Nationwide Rivers Inventory, the American Rivers list, and input from the public, non-governmental organizations, and employees to determine a list of potential eligible rivers. This process identified 35 potential eligible rivers for further analysis.

The next step of the process was to determine if the potential eligible rivers were free flowing. Forest Service specialists identified impoundments or other structures that would disqualify these rivers as free flowing. The act defines free flow as

> . . . existing or flowing in natural condition without impoundment, diversion, straightening, riprapping, or other modifications of the waterways. The existence of low dams, diversions, works, and other minor structures at the time any river is proposed for inclusion in the National System shall not automatically bar its consideration for such inclusion: Provided, that this shall not be construed to authorize, intend, or encourage future construction of such structures within components of the national wild and scenic rivers system.

It was determined that 34 river segments had no significant impoundments or other structures and were free flowing. The remaining river segment, Little Popo Agie River, was found to have a significant impoundment and was disqualified.

The next step was to use eligibility criteria to consider whether each of the 34 potentially eligible rivers had an outstandingly remarkable value (or values). To help identify outstandingly remarkable values, the planning team used the criteria in Forest Service Handbook 1909.12, 82.14a and identified additional factors to make it meaningful for application on the Shoshone National Forest, which served as the area of consideration for the comparative analysis.

Outstandingly remarkable values are unique, rare, or exemplary features that are significant at a comparative regional or national scale. Outstandingly remarkable values must be related to the river or its immediate environment. The seven outstandingly remarkable values and their attributes are:

> **Scenery**: The landscape elements of landform, vegetation, water, color, and related factors that result in notable or exemplary visual features and/or attraction within the Nation or region. Seasonal variations in vegetation, scale of cultural modifications, and the length of time negative intrusions are viewed may also be considered.
>
> **Recreation**: The amount of time the river corridor is used or available for recreation purposes, the number and variety of recreation uses, the number of similar experiences available in the region, availability of private and public access points, and the ability to attract visitors from outside the region. Rivers with the longest season of use are of higher value. Rivers that provide for the largest number and diversity of recreation uses are of higher value. Rivers that provide the most unique opportunities are of higher value. Rivers or corridors highly used by anglers, hunters, and wildlife viewers are usually of higher value.
>
> **Geology**: The river or corridor contains an example of a geologic or hydrologic feature, process, or phenomenon that is rare or unique to the region, or an outstanding example of a commonly occurring feature. The feature may represent a textbook example.
>
> **Fish**: The presence, extent, and carrying capacity of spawning areas, rearing areas, and adult habitat; the number and variety of species present; and the value of these species. Rivers highly used by anglers or that offer unusual recreation experiences for the region are of higher value.

Wildlife: The presence, extent, and carrying capacity of a variety of wildlife habitats, including winter range, summer range, transition zones, travel corridors, and calving areas; the number and variety of species present; and the value of these species. River corridors with the greatest and best habitat and habitat for rare species are of higher values. River corridors with the greatest diversity of species or the greatest number of wildlife are of higher value.

Prehistory: The river, or area within the corridor, contains a site or sites where there is evidence of occupation or use by Native Americans.

History: The river, or area within the corridor, contains a site or feature associated with a significant event, an important person, or a cultural activity of the past that was a rare or one-of-a-kind in the region.

Forest Service specialists reviewed the 34 potential eligible rivers to assess whether the segments had one or more of these seven outstandingly remarkable values.

The planning team then evaluated each of the potentially eligible rivers with identified outstandingly remarkable values to determine whether one or more value was regionally or nationally significant:

- Regional importance—the value is important in the Greater Yellowstone Area
- National importance—the value is important nationally

As a result of this process, 16 rivers were found to possess one or more outstandingly remarkable value of regional or national importance, and are therefore, eligible for the national system.

Finally, each of the 16 eligible river segments was classified into a category. The potential classification of a river found to be eligible is based on the condition of the river and the adjacent lands as they currently exist. Section 2(b) of the Wild and Scenic Rivers Act (1968) specifies and defines these terms as follows:

- Wild Rivers: Rivers or sections of rivers free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.
- Scenic Rivers: Rivers or sections of rivers free of impoundments, with shorelines or watersheds still largely undeveloped, but accessible in places by roads.
- Recreational Rivers: Rivers or sections of rivers readily accessible by roads or railroad, which may have some development along their shoreline and which may have undergone some impoundments or diversions in the past.

Affected Environment

Designated Wild and Scenic Rivers

Congress authorized the Clarks Fork of the Yellowstone River (Clarks Fork) for study in 1975. The Clarks Fork of the Yellowstone Wild and Scenic River Study (River Study) and Final Environmental Impact Statement were completed in 1979 and recommended inclusion of a 21.5-mile segment of the Clarks Fork into the National Wild and Scenic Rivers System as a wild river.

Although the recommendation went to Congress soon thereafter, it was not until November 28, 1990, that the Clarks Fork Wild and Scenic River Designation Act (Designation Act) of 1990 added a 20.5-mile segment of the Clarks Fork to the National Wild and Scenic Rivers System. The legislation classified the river as wild and specified a river corridor of 0.25 mile on each side of the river’s ordinary high water mark.

In the 1979 River Study and Final Environmental Impact Statement, the Clarks Fork River was divided into three segments based on the physical characteristics of the canyon. These descriptions provide a helpful overview of the landscape character.

Upper Canyon. This approximately 8-mile segment begins at the upper terminus of the designated river downstream of the Crandall Bridge and flows to Canyon Creek. It is characterized by slopes of 40 to 90 percent covered by stands of Douglas-fir with some Engelmann spruce and lodgepole pine. Most of this segment has a well-developed floodplain, which supports stands of Englemann spruce.

Most of the Upper Canyon has a gentle gradient. In the central portion of the Upper Canyon the river is contained within a shallow, narrow canyon. The river gradient increases here, resulting in several waterfalls, cascades, and rapids; most are impassable by boat or raft. In places, 500-foot granite cliffs contain the river and its immediate environment.

Middle Canyon. This segment runs downstream from the confluence of the Clarks Fork River and Canyon Creek for approximately 8 miles. Douglas-fir with limited shrub understory is confined to benches or narrow floodplains where some soil development has occurred. The segment is deeply incised into granite, with walls towering to 1,200 feet vertically from the water’s edge. The river drops very fast throughout the entire segment, forming several rapids, plunge pools, and waterfalls that preclude raft or boat use, and most kayakers. This middle canyon contains the section known as the “box,” which is an extremely technical kayak run with numerous portages.

Lower Canyon. In the eastern segment of about 7 miles, the river character changes dramatically. The canyon opens to a 0.5-mile wide u-shaped glacial valley with canyon walls towering up to 4,000 feet above the river. A combination of granite and overlying sedimentary rock form a very interesting and scenic geological display. There are a few rapids and, generally, the river gradient is nearly flat in this segment.

Vegetation on the canyon walls is limited to widely scattered Douglas-fir, grasses, and forbs. Vegetation in the canyon is typical of extremely dry sites, which is unusual for mountain valleys in the Absaroka-Beartooth area. Yucca and common junipers are the most noticeable species. Prolonged periods of high wind have prohibited the junipers from growing as trees, resulting in dense mats and mounds known as krummholz.

There has been very little development within the designated river corridor because of the rugged terrain. Lands in the corridor are part of the National Forest System, except for 136 acres of private land in Section 6, Township 56 North, Range 105 West, known in the past as the Wright Place (now part of the Switchback Ranch). This inholding is located on the river below Reef Creek, about 3.5 miles downstream from the west end of the river corridor. The land is occupied by a house and several barns and sheds, and is used for the irrigated production of hay. Access is by a 4WD road (Road 174) that crosses NFS lands. Road 174 is not open for public use; a special use permit (easement) is in place to provide authorized private land access. A bridge provides access across the river. An electricity transmission line parallels some of the wild river corridor on the south side, from about the box to Crandall Creek in the middle and upper segments. A transmission line also crosses the river canyon in the Middle Canyon section, providing electricity to the Switchback Ranch (private land) on the Dillworth Bench.

Past and present use includes a minor amount of commercial livestock grazing. In the Lower Canyon, it consists primarily of trailing activities along a livestock driveway and limited amount of use on the benches above the canyon but within the 0.5-mile wild and scenic corridor. Portions of four grazing allotments (Bench, Table Mountain, Ghost Creek, and Crandall I) overlap the 0.5-mile river corridor. Overall, grazing use is minimal throughout the corridor.

Opportunities for vegetation management are limited due to the steepness and lack of accessibility.

There are no known valid mining claims in the wild river corridor. Limitations on mineral entry and development on public lands are specified in section 9 of the Wild and Scenic River Act. Fires have occurred very infrequently, although some evidence in the form of vegetation patterns suggests past wildfires, the most evident being the Dano Fire of 1996.

Three outstandingly remarkable values were identified in the River Study and Final Environmental Impact Statement.

<u>Scenic value</u>: The River Study identified the scenic qualities of the landforms and waterforms that are of a tumultuous whitewater nature, broken occasionally by deep, slick water pools. Deep chasms, soaring cliffs, and whitewater combine to provide outstanding scenery in the canyon. The overall setting has stunning vistas of mountain scenery and magnificent geologic features and landforms, and outstanding opportunities for wildlife viewing (bears, wolves, mountain goats, and other big game). The geology, vegetation, and wildlife combine to create the scenic beauty of the area. Scenic vistas are in a relatively wild and natural state; the Chief Joseph Scenic Byway parallels the wild river corridor for about 20 miles.

<u>Recreational value</u>: The Clarks Fork Wild and Scenic River was identified as having an outstandingly remarkable recreational value in the River Study. Although traditional forms of water-based recreation are limited, the canyon provides high potential for challenging and superb whitewater kayaking. The Middle Canyon of the Clarks Fork (the box) is recognized as one of the ultimate whitewater challenges in the Northern Rockies because of its spectacular scenery, challenging rapids, arduous portages, and long length. The “honeymoon section” just upstream offers less challenging rapids that appeal to a broader range of the paddling community. The lower Clarks Fork features yet another great whitewater run, a relatively popular road-accessible Class IV/V section. Recreation and tourism based on natural beauty, relative solitude, and the opportunity to view natural settings and wildlife abound in the river corridor. The canyon provides opportunities for viewing spectacular scenery and enjoying a unique and unusual environment, including numerous waterfalls and cascades, wet microenvironments, deep and narrow canyon walls, boulder floodplains, sand dunes, and wind-blown juniper krummholz. It is a rugged and primitive mountainous/canyon area that is home to populations of special species of wildlife including elk, bighorn sheep, black and grizzly bears, wolves, cougars, moose, coyote, bobcat, pine marten, beaver, golden and bald eagles, osprey, and peregrine falcons.

<u>Historical value</u>: The Clarks Fork Wild and Scenic River was identified as having an outstandingly remarkable historical value in the River Study because of an event of nationwide interest. In 1877, Chief Joseph and the Nez Perce eluded the U.S. Cavalry in a 1,300-mile chase from Oregon to Montana. Although their exact route is unknown, they are said to have escaped

through the mouth of the lower canyon, thus avoiding a cavalry detachment waiting on the plains to the east. In addition, the Clarks Fork is named after William Clark of the Lewis and Clark Expedition. The Nez Perce (Nee-Me-Poo) Trail, a designated National Historic Trail, roughly follows the scenic byway and is an important historic resource in the greater Clarks Fork River area. Historically, the greater Clarks Fork River area has served as an important transportation artery. Native Americans indigenous to the area west of the Continental Divide were using this area as a route to reach the buffalo hunting grounds of the Great Plains. The nearby Dead Indian Pass may have been in use as early as 1700 B.C. and is only about 2 to 3 miles south of the river corridor. In 1869, gold was discovered along the upper Clarks Fork River and a mining camp was established, later to become Cooke City, Montana.

Potentially Eligible Wild and Scenic Rivers

Through the interdisciplinary process, 16 segments totaling approximately 286.1 miles were identified as potentially eligible for protection. These segments are identified in table 156. Map 56 displays the existing and potentially eligible wild and scenic river segments.

Table 156. River segments having outstandingly remarkable values of regional or national importance

River	Segment	Outstandingly remarkable value(s) rating	Classification
Bear Creek	South of wilderness boundary to Forest boundary	Prehistory high national	scenic
Clarks Fork	Montana state line to Clarks Fork Wild and Scenic River	Scenery high national Recreation high national	recreational
Crandall Creek	Headwaters to Clarks Fork Wild and Scenic River	History high national	wild/ recreational
Dinwoody Creek	Headwaters to Forest boundary	Scenery high regional Geology high national Wildlife high regional	wild
Greybull River	Headwaters to ~0.5 mile past wilderness boundary	Fish high regional	wild
Middle Popo Agie River	Wilderness boundary to trailhead	Geology high regional Recreation high regional	wild/ recreational
North Fork Popo Agie River	Headwaters to wilderness boundary	Scenery high national Geology high regional	wild
North Fork Shoshone River	Wilderness boundary to Forest boundary	Scenery high national Recreation high national Wildlife high national Fish high regional Prehistory high regional History high national	recreational
South Fork Little Wind River	Headwaters to Forest boundary	Scenery high regionally	wild
South Fork Shoshone River	Headwaters to wilderness boundary	Scenery high regional Fish high regional Wildlife high national	wild

Table 156. River segments having outstandingly remarkable values of regional or national importance

River	Segment	Outstandingly remarkable value(s) rating	Classification
Sunlight Creek	Wilderness boundary to confluence with Clarks Fork of the Yellowstone River	Geology high national History high regional	recreational
Torrey Creek and tributaries	Headwaters of East and West Torrey Creeks to Forest boundary	Scenery high national Wildlife high regional	wild
West Fork DuNoir Creek	Headwaters to ~1.5 miles from Forest boundary	History high national	wild
Wiggins Fork	Trailhead to Forest boundary	Recreation high regional Fish high regional prehistory high national	wild, recreational
Wind River	Headwaters to Forest boundary	Fish high regional History high regional	recreational
Wood River	Kirwin to Forest boundary	Geology high regional History high regional	recreational

Environmental Consequences

Direct and Indirect Effects

The no-action alternative is used to provide a measure for comparison. In this alternative, the existing designated wild and scenic river corridor (Clarks Fork of the Yellowstone) would continue to be managed according to the 2009 Comprehensive River Management Plan which protects the free flowing status and outstandingly remarkable values. Management of the 16 eligible wild and scenic segments would be dictated by the 1986 Forest Plan. Under the 1986 Forest Plan as amended all sections of eligible rivers classified as wild are within designated wilderness and as such are protected under this alternative. Eligible rivers classified as scenic occur mostly in management areas that also protect their eligibility, such as MA 2A semi-primitive motorized, but some short sections fall within MA 2B rural and roaded natural recreation and MA 7E wood fiber production, which may allow some activities that may impact the scenic values. Eligible rivers in the recreation classification fall primarily under the MA 2B rural and roaded natural recreation and the 5A big game winter range (non-forested) management areas, both of which maintain the recreational values.

Alternatives B, C, D, E, F, and G: All action alternatives protect the 20.5-mile segment of the Clarks Fork of the Yellowstone River and eligibility of the 16 potentially suitable river segments totaling 286.1 miles until such time as a suitability determination is needed.

Effects from Other Management Areas: The more active management there is in an alternative, the more potential that those management activities may need to be modified or mitigated to protect the free-flowing status and outstandingly remarkable values of the eligibility of the 16 potentially suitable river segments. Of the action alternatives, alternative F has the most potential followed by E, B and G, D, and finally C.

Inventoried Roadless Areas

Introduction

This section discusses the inventoried roadless areas as identified in the 2001 Roadless Rule (36 CFR 294). These areas are different than the wilderness evaluation areas that are discussed elsewhere in this document. Inventoried roadless areas are distributed across the Shoshone comprising approximately 684,800 acres.

In 1970, the Forest Service evaluated all roadless and undeveloped areas in the National Forest System greater than 5,000 acres for the purpose of prioritizing areas with strong wilderness characteristics. This study, known as the Roadless Area Review and Evaluation (RARE), was halted after a legal challenge. In 1977, the Forest Service embarked on another nationwide Roadless Area Review and Evaluation (RARE II) to identify roadless and undeveloped areas that were suitable for inclusion in the National Forest Wilderness Preservation System. The RARE II inventory was completed in 1979, consisting of the 684,000 acres described above.

The Shoshone National Forest Land and Resource Management Plan (1986 Forest Plan as amended) and Final Environmental Impact Statement were completed and released with a Record of Decision dated February 27, 1986. The Wyoming Wilderness Act was recognized in the final 1986 Forest Plan as amended, and all roadless areas outside of wilderness were allocated for non-wilderness management areas. Of the 684,800 roadless acres allocated in the 1986 Forest Plan as amended, all but 50,000 acres were included in management areas allowing some road construction and reconstruction

The Roadless Area Conservation Rule (36 CFR Part 295) was published January 12, 2001. The Final EIS for the Roadless Area Conservation Rule published in November 2000, included a map of inventoried roadless areas based on the 1979 RARE II inventory. The Roadless Area Conservation Rule (Roadless Rule) prohibits road construction and road reconstruction in inventoried roadless areas with some exceptions. The rule also prohibits cutting, sale, and removal of timber in inventoried roadless areas with some exceptions.

The roadless rule defined inventoried roadless areas as areas identified in a set of inventoried roadless area maps, contained in the Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000, and any subsequent update or revision of those maps.[31]

Public opinions regarding the use of these areas vary greatly, and future management of roadless areas is a controversial and polarized issue. Management direction for inventoried roadless areas has been proposed in the revised Forest Plan and for each alternative. Not all proposed direction in the plan revision is consistent with the Roadless Rule. Reasonable alternatives, which may require a change in existing law or policy to implement, can be formulated if necessary to address a major public issue, management concern, or resource opportunity identified during the planning process (1982 rule at 36 CFR 219.12 (f)(5)). Inventoried roadless areas are currently managed under the 2001 Roadless Rule (36 CFR 294). While a management allocation may allow development activities such as vegetation management in a roadless area, it does not require it. Such activities may be proposed, but must be further evaluated in site-specific NEPA prior to approval and implementation.

[31] Currently, there is no procedure for updating inventory roadless area maps, so the original maps are still in effect.

In this analysis, inventoried roadless areas are not the base used to evaluate and determine what areas should be recommended for wilderness. The wilderness evaluation areas are used for that purpose. This approach is used because the 1986 Forest Plan as amended allowed activities to occur in inventoried roadless areas that changed their roadless characteristics and made some areas no longer suitable for wilderness evaluation. The evaluation of wilderness areas is included in appendix C.

Legal and Administrative Framework

Laws

The 1984 Wyoming Wilderness Act (PL-98-550) designated the Cloud Peak Wilderness on the Bighorn National Forest. Section 401 of the act releases areas, not designated wilderness or wilderness study, for multiple-use management, and says the areas need not be managed to protect their suitability for wilderness designation prior to or during revision of the initial land management plans. The same section requires the Department of Agriculture to review wilderness options for the NFS lands again, when the forest management plans are revised. If areas are recommended for wilderness, during the revision of management plans, those areas are to be managed to protect their wilderness suitability. Areas not recommended need not be managed to protect their suitability for wilderness designation.

Code of Federal Regulations (CFR)

36 CFR Part 294 Special Areas; Roadless Area Conservation: this final rule established prohibitions on road construction, road reconstruction, and timber harvesting in inventoried roadless areas on NFS lands.

Methodology

The inventoried roadless areas are identified in a set of inventoried roadless area maps, contained in the Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000. For the purposes of analysis, small changes were made to the maps to edge match them with existing designated wilderness and the latest ownership layer.

Spatial and Temporal Context for Effects Analysis

The affected area for direct and indirect effects to inventoried roadless areas is the mapped areas as described above. The timeframe addressed is the 15 years for the anticipated life of the revised Forest Plan.

Affected Environment

The Shoshone has 684,800 acres of inventoried roadless areas (see map 57). These acres are currently being managed according to the Roadless Rule.

On many national forests, including the Shoshone, roadless area management has been a major concern for land management planning and program development. Roadless areas are valued for many resource benefits including their undeveloped fisheries and wildlife habitat, biological diversity, and non-motorized recreation. The same areas are also valued for their development potential, particularly for wood products and motorized recreation. Controversy continues to accompany most proposals to harvest timber, build roads, or otherwise develop inventoried roadless areas.

The roadless inventory areas for the Shoshone have not been updated since 1978. As a result, they contain areas that no longer meet roadless characteristics (43,000 acres). Inventoried roadless areas may contain improvements such as motorized trails, roads, unauthorized routes, fences, outfitter camps, cow camps, evidence of historic logging activities, more recent timber harvest areas, utility corridors, and ski areas. Because of this, the inventoried roadless areas were not used to start the wilderness evaluation process. A new inventory was done to start that process. Many of the inventoried roadless areas fall within those areas, but not all of them. The areas evaluated for wilderness potential are discussed in appendix C.

The inventoried roadless areas include two special designated areas. One is the 15,000-acre High Lakes Wilderness Study Area. It is currently being managed as directed under the 1984 Wyoming Wilderness Act that established the area. The second area is the 29,000-acre Dunoir Special Management Unit. The Dunoir Special Management Unit was established as part of the act that designated the Washakie Wilderness in 1972. The designation requires that the wilderness characteristics of the area be protected.

Desired Condition

The desired conditions for inventoried roadless areas are to manage the areas consistent with the management areas' designations and the Roadless Rule. Where management area direction and Roadless Rule direction conflict, the most restrictive direction applies.

Environmental Consequences

General Effects

This analysis evaluates the effects of the revised Forest Plan and alternatives and whether they are consistent with the Roadless Rule.

Management areas (MA) are grouped into broad categories. Some categories are more consistent with the Roadless Rule than other categories. Management categories 1 and 2 (except for MA 1.3) include direction that generally does not allow road building or timber harvest and that direction is integral to the desired condition. Management areas from this category are generally consistent with the Roadless Rule direction.

Management categories 3 and 4 (and MA 1.3) include direction that allows limited road building and timber harvest that is incidental to the management area desired conditions. Management areas in this category can generally be managed in a manner that is consistent with Roadless Rule direction and still meet management area desired conditions.

Management categories 5 and 8 include direction that emphasizes road building and timber harvest activities that are integral to meeting desired conditions. Management areas from this category generally cannot meet the Roadless Rule direction and management area desired conditions at the same time. Management area allocations will not directly result in actions that are consistent or inconsistent with the Roadless Rule until management activities are planned and implemented.

Direct and Indirect Effects

Alternatives B, C, D, and G are designed to be consistent with the Roadless Rule direction. Alternatives E and F were developed to address managing roadless areas in a manner that is supported by some public groups and some local government officials. The 1986 Forest Plan as amended direction, as displayed and analyzed in this EIS as the no-action alternative, is not consistent with the Roadless Rule direction. The 1986 Forest Plan as amended is being implemented consistent with the Roadless Rule, but it has not been amended to adjust plan direction to be consistent with the Roadless Rule. For the purposes of this analysis, it is being analyzed as it currently exists. If the no-action alternative is selected as the preferred alternative in the final EIS, it would need to be adjusted to be consistent with the Roadless Rule.

Alternative B contains a management area designation (MA 3.5) that includes areas that some people feel should be removed from inventoried roadless designation because of past timber management activity, the existence of established roads, the proximity of infrastructure, or overriding management need. Currently, there are no established procedures for modifying inventoried roadless area boundaries. In lieu of making a change, the desired condition for these areas is, to the maximum degree possible, to actively manage the area while remaining consistent with the Roadless Rule direction. In alternative B, there is a portion of MA 5.2 that falls within an inventoried roadless area. That portion of MA 5.2 will be managed similar to MA 3.5, consistent with the Roadless Rule, while allowing the maximum amount of activity necessary to meet the 5.2 management area direction.

Table 157 summarizes the management areas allocated to inventoried roadless areas for each alternative. All of the acres shown are included in the roadless inventory conducted for forest plan revision. Shoshone acres outside of inventoried roadless areas are not included in this table.

Alternative C allocates the most area to management areas that are the most consistent with the Roadless Rule direction. Alternatives D, B, and G manage consistently with the Roadless Rule direction, but have the portions of management areas where allowed activities need to be modified. These alternatives are still generally able to meet management area desired conditions as allocated. Alternatives A and E, and alternative F to a greater degree, allocate inventoried roadless areas to management areas where it is not possible to meet management area direction and the Roadless Rule direction over the long term.

Indirect effects were not evaluated for this topic. The consistency with Roadless Rule direction can be fully evaluated by addressing the direct effects from management area allocation. The indirect effects to roadless area characteristics are addressed in conjunction with analysis of wilderness evaluation areas elsewhere in this document.

Table 157. Inventoried roadless area management area acre allocation by alternative

MA	Description	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
1.2	Recommended wilderness			534,700	152,100			
1.2A	Recommended High Lakes Wilderness			15,200				
1.2B	Recommended DunoirWilderness			28,900	28,900			
1.3	Back country non-motorized	409,700	333,400	94,500	367,800	310,600	194,500	246,300
1.5A	Clarks Fork Wild River	5,050	5,050	1,480	5,050	5,050	5,050	5,050
1.6A	High Lakes WSA	15,200	15,200		15,200	15,200	15,200	15,200
1.6B	Dunoir SMU	28,900	28,900			28,900	28,900	28,900
2.2A	Line Creek RNA	1,090	1,090		1,090	1,090	1,090	1,090
2.3	Potential RNA	1,070	10,400	2,920	13,300			12,600
3.1B	Potential Little Popo Agie Moraine SIA		1,140	1,140	1,140			1,140
3.1C	Potential Sawtooth Peatbeds SIA		650		650			400
3.3A	Back country motorized	95,500	51,900			79,600	152,200	67,300
3.3B	Back country winter motorized		78,300		68,900	35,900		168,700
3.3C	Back country summer motorized		56,900			76,600	4,562	36,500
3.5	Back country recreation and restoration		66,300					
3.5A	Back country recreation and restoration (winter motorized)							29,100
3.5B	Back country recreation and restoration (summer motorized)							8,030
3.5C	Back country recreation and restoration (non-motorized)							13,300
3.5D	Back country recreation and restoration (motorized)							14,600
4.2	Travel corridor	41,000	23,100	4,900	23,100	24,700	24,700	23,000
4.3	Back country access corridor		6,650	70	6,620	2,370	480	6,720
4.5A	Potential Kirwin SIA							850
5.1	Managed forests and rangelands	53,000				78,800	257,100	
5.2	Public water supply		4,920			4,920		4,920
5.4	Managed big game crucial winter range	34,300				23,600		
8.2	Ski-based resort		1,010	1,010	1,010	1,010	1,010	1,010
	Total	684,800	684,800	684,800	684,800	684,800	684,800	684,800

Summary of Effects to Resource

Alternatives B, C, D, and G management direction is consistent with the Roadless Rule. Desired conditions for those alternatives can be met in conjunction with meeting Roadless Rule direction. Alternatives A, E, and F include management direction that is not consistent with the Roadless Rule. This means that alternatives A and E, and alternative F to a greater degree, cannot meet desired conditions and Roadless Rule direction over the long term.

Cumulative Effects

There are no cumulative effects to address for this topic which deals with an analysis of whether the direct effects from management area allocation are consistent with the Roadless Rule direction.

Research Natural Areas

Introduction

On July 19, 1993, the Chief of the Forest Service issued a national strategy for recognizing the expanding role of research natural areas (RNAs) in ecosystem management. Giving regional foresters the authority to designate RNAs and outlining expectations the regions would work to build a representative network of RNAs were important parts of this strategy. On November 1, 1993, the Rocky Mountain Regional Forester and the Director of the Rocky Mountain Forest and Range Experiment Station directed national forests in the region to expand the RNA system. The Regional Forester and the Director asked the forests to make a concentrated effort to identify potential RNAs in their forest plan revision processes. Selection of potential RNAs was done jointly by the Shoshone National Forest and Rocky Mountain Station, under the guidance of the Regional RNA Steering Committee to meet national and regional RNA objectives. Eight potential RNAs were selected to provide a spectrum of relatively undisturbed areas representing important natural ecosystems and environments of the Rocky Mountain Region that are best represented on the Shoshone.

RNAs are selected to provide a spectrum of relatively undisturbed areas representing important natural ecosystems and environments: for example, forest, shrubland, grassland, alpine, aquatic, and geologic environments. They are also selected to represent areas with special or unique scientifically important characteristics. RNAs serve the following important functions nationally, regionally, and locally:

- Reference areas – The Forest Service intends to have a wide spectrum of high quality areas that represent the major forms of variability found in forest, shrubland grassland, and alpine ecosystems. These RNAs serve as benchmarks for monitoring and evaluating the sustainability, effectiveness, and impacts of land management practices on lands with similar ecosystems. To determine the impact of management on an area, it is useful to have, as a control, a similar area maintained in natural condition for comparison. These control areas protect against human-caused environmental disruptions and RNAs contribute to ecosystem management by providing these controls. In addition, RNAs serve as baseline areas for measuring long-term ecological changes associated with other potential ecosystem stressors such as climate change.
- Biological diversity – RNAs provide protection for representative and key elements of biological diversity at the genetic, species, population, community, and/or landscape levels. A representative RNA system provides some degree of assurance that a wide array of plant and animal species will be afforded a high degree of protection in the future by protecting against human-caused environmental disruptions. This protection may be most important for soil microorganisms, fungi, insects, and other forms of biological diversity on which ecosystems often depend the most, but about which we know the least. RNAs also can be selected to help protect specific populations of threatened, endangered, and/or sensitive species.
- Research and education – RNAs provide representative sites for research into how ecosystems function, particularly in areas in which ecological and evolutionary processes are functioning in a relatively natural state. They serve as control areas for comparing results from manipulative research. They serve as sites for monitoring long-term change in ecosystems such as global climate change and shifting patterns in the landscape that result from such disturbances as fire, floods, insect epidemics, and natural succession. Research projects in an identified RNA can greatly increase our

understanding of particular ecosystems and improve the quality of ecosystem management. RNAs also serve an important educational function by providing excellent examples of ecosystems in a relatively natural condition, with functioning ecological processes.

In addition the Shoshone's RNA designations are important considerations in evaluating the status of rare plant species, as recognized by the Forest Service, U.S. Fish and Wildlife Service (USFWS), or Wyoming Natural Diversity Database (WYNDD) program. RNAs are among the "regulatory factors" considered in determining global and State ranks of rare plants. Establishment of RNAs and special interest areas (SIAs) in regard to rare plant habitat can help avert threats to their habitat. They are a proactive approach to reduce the risk of species being listed under the Endangered Species Act.

Legal and Administrative Framework

Laws

36 CFR 219.25 (1982 regulations) – "Forest planning shall provide for the establishment of Research Natural Areas (RNAs). Planning shall make provision for the identification of important forest, shrubland, grassland, alpine, aquatic and geologic types that have special or unique characteristics of scientific interest and importance that are needed to complete the national network of RNAs."

Forest Service Manual, Title 4063 – Provides specific direction concerning establishment and management of RNAs.

Region 2 Guidance-Research Natural Area Guide for the Rocky Mountain Region USDA Forest Service, 1993, 1997, 2005 – A principal purpose of the Research Natural Area System is to provide a representative range of relatively undisturbed sites for research, monitoring, biodiversity protection and as reference areas for management activities throughout the NFS lands. The RNA matrix in the RNA Guide includes plant series elements targeted for inclusion in the Region 2 RNA system and plant associations and community types known to occur on NFS lands. The matrix targets specific series for each forest or grassland in the Region. This helps assure that the RNA system will represent the broad range of natural variability that occurs from the northern to the southern ends of the Region.

Methodology

Forest resource specialists, along with the Rocky Mountain Research Station, identified NFS lands on the Shoshone that possess ecological characteristics that make them desirable for RNA establishment.

The following criteria were used in selecting potential RNAs:

- Quality: How well a site represents the targeted ecosystem type or protected biodiversity elements.
- Condition: How much the site has been degraded or altered from natural or optimal conditions.
- Viability: The likelihood of long-term survival for the ecosystem and its protected biodiversity.

- Defensibility: Extent to which the ecosystem and biodiversity elements can be protected from extrinsic human factors.

Each proposed RNA was reviewed to minimize conflicts of past or current activities, such as roads, logging or active grazing allotments. Vacant allotments, or areas outside allotment boundaries, were favored for consideration of RNA designation to lessen the impacts on the Shoshone grazing program. Potential RNA boundaries were designed at the landscape level to maintain ecosystem processes and allow management flexibility.

After the regional RNA steering committee review and approval process, the Shoshone contracted with the WYNDD to inventory the eight potential RNA candidates. The WYNDD inventories include: detailed descriptions, RNA criteria evaluations, distinguishing features, acreage by vegetation cover type, and the compatibility of past and present human use with the RNA criteria. These reports are found in the project records.

Spatial and Temporal Context for Effects Analysis

Spatial context used for Forest-wide RNA analysis is the area within the Shoshone boundary. The spatial context for the regional RNA steering committee was the Region 2 boundary. The timeframe of the analysis is 15 years or the life of the revised Forest Plan.

Affected Environment

Five potential RNAs were identified in the 1986 Forest Plan as amended to be considered for future RNA establishment. These were all recognized as important areas of biodiversity in the Greater Yellowstone Area (Clark 1989). The following changes occurred with these potential 1986 Forest Plan as amended RNAs by an evaluation process that occurred in the mid-1990s:

- Pickett’s Knob was dropped because vegetation types were better represented elsewhere;
- Pat O’Hara was modified to include more vegetation types and sensitive plant habitat;
- Bald Ridge was modified to include more vegetation types and sensitive plant habitat;
- Twin Lakes became part of Line Creek RNA; and
- Sawtooth Peatbeds did not meet RNA criteria and became a potential SIA.

The Line Creek Plateau RNA was established in 2000 to protect an example of Rocky Mountain alpine tundra vegetation types and associated features (USDA Forest Service 2000). The area comprises 3,050 acres on the Shoshone and 19,370 acres on the adjacent Custer National Forest. The area exhibits a Rocky Mountain alpine tundra vegetation type with examples of alpine turf, alpine wetland, alpine snow bed, and subalpine conifer forest. In June 2000, the 1986 Forest Plan as amended was amended by the Decision Notice/Finding of No Significant Impact for the Line Creek Plateau RNA (USDA Forest Service 2000).

Currently, there are eight potential RNAs identified on the Shoshone (table 158 and map 58). They include Lake Creek, Beartooth Butte, Pat O’Hara, Grizzly Creek, Sheep Mesa, Arrow Mountain, Roaring Fork, and Bald Ridge. The eight potential RNAs comprise approximately 71,000 acres of which approximately 80 percent is in designated wilderness. If RNAs are designated, management plans will be written to recognize and protect these areas for their special characteristics and research value. Draft establishment reports are found in the forest plan project record.

Three other areas were identified in the mid-2000s as potential RNAs: Little Popo Agie Moraine, Sawtooth Peatbeds, and the Deep Lake landslide. These areas did not meet RNA selection criteria and were instead evaluated for SIA designation.

Table 158. Potential research natural area acres

Potential RNA	**Acres**
Arrow Mountain	14,450
Bald Ridge	2,310
Beartooth Butte	2,450
Grizzly Creek	11,680
Lake Creek	5,860
Pat O'Hara	5,010
Roaring Fork	13,480
Sheep Mesa	15,320
Total RNA Acres	70,570

Desired Condition

Within RNAs ecological processes will prevail, with minimal intervention, providing for natural conditions. RNAs on the Shoshone also provide for conservation of rare plant species and exceptional examples of biological diversity.

Environmental Consequences

The intent of RNAs is to provide for baseline ecological processes and systems. Humans are intervening in every ecosystem globally, so it is important to provide some representative areas that are close to "natural" to make sustainability determinations on lands more actively managed. RNAs are managed to maintain natural conditions, while allowing ecological processes to prevail with minimal human intervention. Vegetation, habitat, soil productivity, water quality, and ecological processes are left in a natural condition or in as close a natural condition as practicable. However, under some circumstances, deliberate manipulation may be utilized to maintain the ecosystem or unique features for which the RNA was established or to re-establish natural ecological processes.

A variety of uses, including most non-motorized recreation activities, are allowed in RNAs as long as the activity or uses do not become a threat to the values for which the RNA was established and as long as RNA management plan direction is followed. Heritage resources are generally protected by RNA designation since ground-disturbing activities are limited.

Direct and Indirect Effects

The eight potential RNAs were jointly selected by the Rocky Mountain Research Station and the Regional RNA Steering Committee to meet Forest Service regional and national RNA goals. The management area allocations for existing and proposed research natural areas by alternative are displayed in table 159.

Table 159. Management area allocations for existing and potential research natural areas by alternative

Management Area	Description	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
1.1	Wilderness	54,730	54,730	54,730	54,730	54,730	54,730	54,730
1.2	Recommend wilderness			11,996				
1.2A	Recommend High Lakes WSA			2,358				
1.3	Back country non-motorized	9,775	1,662	53	55	11,448	11,448	55
1.6A	High Lakes WSA	2,358	2,358		2,358	2,358	2,358	2,358
2.2A	Line Creek RNA	1,278	1,278	186	1,278	1,278	1,278	1,278
2.3	Potential RNA	28	12,125	4,298	15,200			13,829
3.3A	Back country year-round motorized	310	248			248	758	250
3.3B	Back country summer non-motorized/winter mot					539		477
3.3C	Back country summer motor/winter non-motorized		510			510		508
3.5	Back country recreation/forest restore		679					
4.2	Travel corridor	1,595	5	5	5	1,805	1,805	138
4.3	Back country corridor		3			3	3	3
5.1	Manage forests	2,504					1,245	
5.2	Municipal watershed							
5.4	Big game crucial range	1,049	27			706		
	Total	73,625	73,625	73,625	73,625	73,625	73,625	73,625

Alternatives C, D, and G establish eight potential RNAs that lead to plant associations and communities on the Shoshone being represented within a designated RNA, meeting Forest Service RNA goals. Various numbers of RNAs are proposed under alternatives A, B, E, and F, resulting in some plant associations and communities on the Shoshone not being represented within a designated RNA.

Populations of federally listed threatened and endangered species located within any of the potential RNAs will be protected according to stipulations under the Endangered Species Act and applicable Forest-wide standards and guidelines. Sensitive species located within any of the proposed RNAs will be protected by applicable Forest-wide standards and guidelines. The overall effect of RNA designation would be to provide additional protection for rare plant species.

In considering the alternatives, alternatives C, D, and G establish the eight potential RNAs which lead to the greatest regulatory protection of rare plants. No new RNAs are proposed under alternatives A and F, subsequently, rare plants receive no additional regulatory protection. Alternatives E and B would only partially add regulatory protections, increasing the risk of potential listing of rare plants.

Effects from Timber Harvesting: The potential RNAs are located in areas that are generally not considered suitable for timber harvest and have not been harvested in the past. Exceptions are in alternatives F and A. In alternative F, 1,250 acres in the Bald Ridge and Beartooth Butte potential RNAs would be open for timber activities. Timber stands in both of these areas are of lower productivity. In alternative A, 2,500 acres are open for timber activities. Access and lower productivity reduce potential harvest activities. In alternatives where RNAs are established, those areas would not be available for timber harvest.

In considering the various alternatives, alternatives A and F are expected to have the greatest amount of timber harvesting activities within potential RNAs. Alternatives B, C, D, E, and G propose no timber harvesting. There is little or no effect on RNA establishment from timber harvesting.

Effects from Roads and Trails Management: On the Shoshone, potential RNAs are without system roads and the primary access is via trails. New road construction in RNAs outside of wilderness would be prohibited. Motorized use is not allowed in RNAs outside of wilderness, unless deemed necessary for research or authorized administrative access.

Trails that exist prior to RNA designation are allowed and maintained for recreation, scientific, or educational access. The construction of new trails is discouraged unless they are to provide better resource protection.

There is little or no effect on RNA establishment by roads and trails management under any alternative.

Effects from Disturbance Processes (fires/fuels management and insect/disease mortality): Natural outbreaks of native insects and disease are allowed to proceed without intervention, unless they are a substantial threat to important resources inside or outside the RNA boundary.

Prescribed fire activities and mechanical fuels management are not allowed unless the approved establishment record and or RNA management plan dictates otherwise. Managed wildfires may be allowed to burn to accomplish RNA resource objectives. There may be situations where suppression actions need to occur to protect values inside and outside the RNAs. Minimum-impact suppression techniques would be used; however, application of these tactics may occur in some situations such as fireline construction, retardant application, and construction of helispots. These activities are not expected to occur frequently.

There is little or no effect on RNA establishment from disturbance processes under any alternative.

Effects from Livestock Grazing: Grazing allotments tend to follow watershed boundaries. Within allotments, there is considerable acreage of non-suitable areas. RNAs are generally located in areas of little conflict with livestock grazing. Incidental grazing by livestock may occur because the potential and existing RNAs will not be fenced. When cattle are found or reported in the RNAs, they are removed as a part of the normal livestock herding practice.
Table 160 compares allotments and acres of proposed RNAs.

Table 160. Allotment acres compared with potential research natural areas

Allotment name	Acres in RNA	RNA name
Beartoooth and Face of the Mountain	1,090	Line Creek
Bench	1,900	Bald Ridge
Basin	1,570	Pat O’Hara
Bald Ridge	410	Bald Ridge
Bald Ridge	1,800	Pat O’Hara
Robber Roost	1,690	Pat O’Hara

Line Creek RNA (established 2002)

Portions of the Beartooth cattle and horse allotment are contained within the Line Creek RNA. There is no planned livestock grazing within the RNA, however, occasionally incidental livestock use occurs. There have been no negative impacts to the existing commercial livestock grazing operation on the Beartooth cattle and horse allotment from the establishment of the Line Creek RNA.

Potential Bald Ridge RNA

The entire 1,900 acres of the proposed Bald Ridge RNA that falls within the Bench cattle and horse allotment are both unsuitable and not capable from a rangeland forage standpoint and totally inaccessible from a livestock grazing standpoint. This area consists primarily of a portion of the south face of the lower Clarks Fork Canyon. There would be no negative impacts to the existing commercial livestock grazing operation on the Bench cattle and horse allotment as a result of establishment of the Bald Ridge RNA.

The majority of the 410 acres of the proposed Bald Ridge RNA that falls within the Bald Ridge cattle and horse allotment are both suitable and capable from a rangeland forage standpoint. Even though this area is within a pasture with annually planned livestock grazing, it receives very little use due to the distance to any available source of livestock water. The area is not large enough or productive enough to result in the need for a stocking reduction. There would be no negative impacts to the existing commercial livestock grazing operation on the Bald Ridge cattle and horse allotment from the establishment of the Bald Ridge RNA.

Potential Pat O’Hara RNA

The majority of the 1,570 acres of the proposed Pat O’Hara RNA that falls within the Basin cattle and horse allotment are both unsuitable and not capable from a rangeland forage standpoint. This portion of the proposed RNA is a combination of heavy timber and steep bare slopes. No past use of this area by livestock has been documented nor any future use anticipated. There would be no negative impacts to the existing commercial livestock grazing operation on the Basin cattle and horse allotment as a result of establishment of the Pat O'Hara RNA.

The majority of the 1,800 acres of the proposed Pat O'Hara RNA that falls within the Bald Ridge cattle and horse allotment are both unsuitable and not capable from a rangeland forage standpoint. This portion of the proposed RNA is primarily comprised of heavy timber and steep bare slopes. The one area of potential conflict would be an inclusion of open south-facing slopes on the north side of the proposed RNA. These open slopes and meadows receive significant commercial livestock and recreational horse grazing use. This area does not contain crucial vegetation types or rare plant communities typical of this proposed RNA.

The majority of the 1,690 acres of the proposed Pat O'Hara RNA that falls within the Robber Roost cattle and horse allotment is capable, but not suitable from a rangeland forage standpoint due to steep slopes and distance to water. As such, even though this area is within a pasture with annually planned livestock grazing, it receives little to no livestock use. Since there is little suitable rangeland, there is no need for a stocking reduction. There would be no negative impacts to the existing commercial livestock grazing operation on the Robber Roost cattle and horse allotment as a result of establishment of the Pat O'Hara RNA.

Effects from Recreation: The Forest Service would not promote RNAs as destinations for recreation use. Existing non-vehicular recreation use would be allowed as long as the use does not pose a threat to the values for which the RNA was proposed. Current levels of horseback riding, hunting, hiking, fishing, camping, and related low-impact uses by the public would be allowed to continue. If resource degradation develops from increased use, the public would be encouraged to shift use to other, less ecologically important areas.

There is little or no effect on RNA establishment from recreation activities under any alternative.

Effects from Noxious and Invasive Species: Management of invasive species is allowed in RNAs to protect valued resources.

There is little or no effect on RNA establishment from invasive species management under any alternative.

Effects from Oil and Gas and Mineral and Energy Development: Oil and gas leasing is allowed, however, no ground-disturbing activities are permitted within the boundaries of the RNA. Protecting recommended RNAs to maintain their consideration for designation would impact oil and gas exploration in proportion to the number of acres where surface occupancy is prohibited. There is expected to be no impact to oil and gas leasing from the designation of RNAs under any alternative.

When withdrawal from locatable mineral entry is necessary to protect the values for which the area was designated, a request for withdrawal from mineral entry will be made. Extraction of salable mineral (sand gravel, hard rock for crushing, and landscape materials) would not be allowed in RNAs.

There is no effect on RNA establishment from oil and gas development or mineral and energy development under any alternative.

Effects from Land Use Authorizations: Proposals for non-manipulative research would require approval of the Rocky Mountain Research Station Director and the applicable Forest Service authorized officer. Special use permits are required for the collection of all products, as well as for many other types of commercial uses. Effects from land use authorizations will be the same across all alternatives.

There is little or no effect on RNA establishment from land use authorization under any alternative.

Summary of Effects to Resource

Alternatives C, D, and G establish eight potential RNAs which lead to plant associations and communities on the Shoshone being represented within a designated RNA, meeting Forest Service RNA goals. Lesser numbers of RNAs are proposed under alternatives A, B, E, and F, resulting in some plant associations and communities on the Shoshone not being represented within a designated RNA.

Cumulative Effects

Cumulative effects resulting from designation of RNAs would include present and future loss of commodity production (principally wood products and grazing products), although these effects are small due to the negligible level of these activities currently occurring. Recreational pursuits in the future could be affected by some of the limitations prescribed by RNA direction on types of recreation allowed and limits on accessibility, but only if future use levels substantially increase over present levels. Designation of RNAs will add to the acreage on the Shoshone where ecological processes are largely unaffected by human influences.

The life of the revised Forest Plan (10 to 15 years) was considered the future time horizon for this cumulative effects analysis. There are no reasonably foreseeable actions that would add to either the RNA system or the BLM system of Areas of Critical Environmental Concern (ACEC), which are approximately equivalent to RNAs. For this analysis, draft BLM Resource Management Plans or draft revised forest plans were considered reasonably foreseeable actions.

The cumulative effects analysis area for the present status of RNAs and ACEC include:

- NFS lands administered by Custer National Forest, Beartooth Ranger District, Montana.
- BLM lands administered by the Lander Field Office (Lander Planning Area) and Worland District Office (Bighorn Basin), Wyoming.

Custer National Forest, Beartooth Ranger District shares the Line Creek RNA with the Shoshone. This RNA was established jointly between the forests. The shared RNA has a beneficial effect in protecting the resource values for which the RNA was established.

The Lander BLM Field Office has five ACEC designations that are adjacent to the Shoshone boundary. These include Lander slope, Red Canyon, Dubois badlands, Whiskey Mountain, and East Fork. The eastern portion of Whiskey Mountain ACEC shares a boundary with the proposed Arrow Mountain RNA. This ACEC has a beneficial effect to the potential RNA.

The Worland BLM Field Office has five ACEC designations that are adjacent to the Shoshone boundary. These include Carter Mountain, Upper Owl Creek, Clark Fork Canyon, Rattlesnake Mountain, and Sheep Mountain. The western portion of the Clark Fork ACEC shares a boundary with the potential Bald Ridge RNA. This ACEC has a beneficial effect to the potential RNA.

Special Interest Areas

Introduction

Certain limited areas of National Forest System (NFS) lands have outstanding or unique examples of plant and animal communities, geological features, scenic grandeur, or other special attributes that merit special management. These areas may be designated administratively as special interest areas (SIAs) and are managed to emphasize uses in harmony with the purpose for designation. Currently, one SIA is established, Swamp Lake Botanical Area. Three additional SIAs are proposed (see map 58). They include Sawtooth Peatbeds Geological Area, Kirwin Historical Area, and Little Popo Agie Moraine Geological Area. One proponent proposed area, the Deep Lake Slide, was not considered because of its location in a management area that allows adequate protection.

Legal and Administrative Framework

Regulations and Policies

FSM 2372: This manual provides guidance in establishing and managing special interest areas.

FSH 1909.12: This handbook provides guidance in establishing and managing special interest areas.

36 CFR 294.1: This CFR provides guidance in establishment and management of special interest areas.

Methodology

Shoshone resource specialists identified NFS lands that possess “Special Area” characteristics and have submitted them for the recommended designation.

Spatial and Temporal Context for Effects Analysis

Spatial context used for SIA analysis is the area within the Shoshone National Forest boundary. The timeframe of the analysis is 15 years or the anticipated life of the revised Forest Plan.

Incomplete and Unavailable Information

The Shoshone National Forest has numerous areas that could qualify as SIAs. It has many outstanding examples of plant and animal communities, geological features, scenic grandeur, or areas of other special attributes. These have not been systematically analyzed for this current planning effort.

Affected Environment

The existing 580-acre Swamp Lake Botanical SIA was established in 1987. This SIA contains eight different wetland vegetation types and an unusually high concentration of regionally rare, boreal disjunct plants. The riparian wetland complex comprises an unusual and perhaps unique set of ecological conditions. The extensive marl deposits and scenic qualities make it an area of extraordinary interest. A detailed description can be found in the project record.

Three new areas are potential SIAs: Sawtooth Peatbeds Geological Area, the Kirwin Historical Site, and Little Popo Agie Moraine Geological Area.

The Sawtooth Peatbeds are a unique fen palsa located in a broad subalpine valley shaped by glacial scouring. It has a large peat deposit with permafrost at 46 centimeters depth (18 inches). The palsa has exposures of peat polygons caused by frost heaving and areas of thaw depression pools. This geomorphologic feature is the only known palsa in the lower 48 states. The potential geologic area encompasses 650 acres. The peatbeds themselves encompass the center of the potential area.

The mining town of Kirwin was formed in the mid-1880s after gold and silver were discovered in the area. By 1902, exploration was well established, and by 1904 about 200 miners and their families lived in Kirwin. Although miners found some promising veins, the geology of the area is such that viable quantities of silver or gold were never found. The Kirwin mines produced very little ore, and the railroad, crucial to any mining district, never came to Kirwin. Adding to Kirwin's troubles, a national financial panic in 1907 cut the flow of investment capital to the mines. The town declined steadily after that. In 1962, the American Metals Climax Mining Company purchased the Kirwin properties and conducted extensive operations in the area, mapping a rich deposit of copper under Spar Mountain. Plans to mine the deposit were dropped after the price of copper fell and startup expenses for the operation became too high. In 1992, the Richard King Mellon Foundation and Conservation Fund purchased the Kirwin properties and facilitated the donation of 3,490 acres of land in the Upper Wood River Valley to the Shoshone. The property, known as the Kirwin property, is an eligible National Historic District. Today, visitors can explore the old mining town site and surrounding area, including cabins, mining equipment, and a mine shaft. The central portion of potential historical SIA encompasses 480 acres. A larger area that would encompass many of the surrounding mining areas and the Double D Ranch encompasses 4,550 acres.

The Little Popo Agie Moraine is unique in the Wind River Mountains and the Middle Rocky Mountains due to glacial ice stalling at about 8,300 feet. Other large glaciers on the eastern slope of the Wind Rivers flowed to basin level. These wetlands resulted from a slow rate of glacial recession, leaving a hummocky topography that is influenced by groundwater flowing through the 3-square-mile terminus. The result is the largest and most dense collection of kettle lakes and ponds at this elevation in the Wind River Range. The groundwater system that flows through the entire area is extensive. The glacial moraine deposits created approximately 160 kettle ponds, lakes, and marshes. They are surrounded by forests dominated by lodgepole pine, spruce/fir, whitebark pine, and aspen. Wetlands contain a unique assemblage of unusual plant and animal species. Unusual plants for the area include a disjunct population of trapper's tea (*Ledum glandulosum*), and the only record of lanceleaf grapefern (*Botrychium lanceolatum*) in Wyoming was documented adjacent to Louis Lake.

Wildlife species that inhabit the moraine include elk, moose, mule deer, black bear, little brown bat, water voles, and beaver. A verified sighting of a fisher was made along the Little Popo Agie River in the summer of 1991. Bird life includes bald eagle, goshawk, black-backed woodpecker, Northern three-toed woodpecker, Brewer's sparrow, loon, Sandhill crane, goldeneye, sapsucker, flycatcher, and osprey. Of particular interest is the large breeding population of ring-neck ducks. Field census indicated that it probably is the largest breeding population of ring-neck ducks in the Middle Rocky Mountains. These ducks are forest pond nesters that require the habitat provided by the moraine environment. Elsewhere, they occur in one to a few pairs on isolated forest or beaver ponds.

Past grazing and timber management exclude this area from becoming a research natural area. This potential geological SIA encompasses 1,710 acres.

Designation and management plans would recognize and protect these special interest areas for their unique and/or special characteristics.

Desired Condition

SIAs on the Shoshone recognize outstanding or unique examples of geological, historical, and botanical resources.

Environmental Consequences

Swamp Lake Botanical Area, Sawtooth Peatbeds Geological Area, and Little Popo Agie Moraine Geological Areas are managed to maintain natural conditions, while allowing ecological processes to prevail with minimal human intervention. Vegetation, habitat, soil productivity, water quality, and ecological processes are left in a natural condition or in as close a natural condition as practicable. However, under some circumstances, deliberate manipulation may be utilized to maintain the ecosystem or unique features for which the SIA was established or to re-establish natural ecological processes. Kirwin Historical Area SIA is managed to maintain, protect, preserve, and interpret its historic values.

A variety of uses, including most non-motorized recreation activities, are allowed in the SIAs as long as the activity or uses do not become a threat to the values for which the SIA was proposed and as long as SIA management plan direction is followed. Heritage resources are generally protected by SIA designation since ground-disturbing activities are limited.

SIAs may provide regulatory protection of rare plant habitat. Alternatives B, C, D, and G would provide the most protection of rare plant habitat associated with the SIAs. Alternatives A, E, and F do not include the Sawtooth Peatbeds Geological SIA and Little Popo Agie Moraine Geological SIA. These two potential SIAs include rare plant habitat that would not have regulatory protection and may increase the risk of listing.

Direct and Indirect Effects

The Shoshone selected the three potential SIAs to recognize these areas for outstanding or unique examples of plant and animal communities, geological features, historical attributes that merit special management. For each of the management program activities described below, the environmental consequences for SIA resources are compared by alternative, based on key indicators of disturbance for each type of activity. Not all management activities would impact SIA resources due to location of facilities or potential use or development e.g., there is low potential for minerals development in the SIA areas, therefore, no impacts are anticipated under any alternative to SIA resources from minerals development.

Effects from Timber Harvesting: In considering the various alternatives, A, E, and F have acreage that is designated for timber harvest in the potential Little Popo Agie Moraine Geological Area.

There is little or no effect on SIA establishment from timber harvesting under any alternative.

Effects from Disturbance Processes (fires/fuels management and insect/disease mortality): Fire could detrimentally affect Swamp Lake Botanical SIA, proposed Sawtooth Peatbeds Geological SIA, and proposed Kirwin Historical Site SIA. Fuels reduction projects would have a positive effect in protecting these SIA values at risk. Wildfire could threaten historic structures, exposed peat soils, and rare plant communities. Vegetation communities of the Little Popo Agie Moraine would benefit from the effects of fire.

There is little or no effect on SIA establishment from disturbance processes under any alternative.

Effects from Livestock Grazing: Grazing allotments tend to follow watershed boundaries. Within allotments there is considerable acreage of non-suitable areas. The proposed SIAs are generally located in areas of little conflict with livestock grazing. Incidental grazing by livestock may occur because portions of the proposed and existing SIAs are not fenced. When cattle are found or reported in the SIAs they are removed as a part of the normal livestock herding practice. Table 161 compares allotments and acres of proposed SIAs.

Table 161. Acres of special interest area by grazing allotment

Allotment name	Allotment acres in SIA	SIA name
Crandall I & II	30	Swamp Lake Botanical Area
Ghost Creek	550	Swamp Lake Botanical Area
Maxson Basin	420	Little Popo Agie Moraine Geological Area
Kirwin & Wood River	480 to 4,550	Kirwin Historical Area

Swamp Lake Botanical SIA (established 1987)

This SIA is part of the Crandall I & II cattle and horse and Ghost Creek Allotments. The current situation has been in place since establishment of the SIA in 1987. There is no planned livestock grazing within the SIA, however, during periods of extreme drought and low water incidental livestock use may occur. Livestock on the allotment are managed under a multi-pasture deferred rotation grazing system and when cattle are found or reported in the SIA they are removed as a part of the normal livestock herding practice. Additional protection for the SIA is planned in the form of exclusion fencing. Very little suitable rangeland would be within the exclosure and all costs for the fence construction and maintenance would be the responsibility of the Forest Service. There have been no negative impacts to the existing commercial livestock grazing operation on the Crandall I & II cattle and horse or Ghost Creek Allotments from the establishment of the Swamp Lake SIA.

Potential Little Popo Agie Moraine Geological SIA

This potential SIA is part of the Maxson Basin cattle and horse allotment. The majority of the 420 acres of the potential Little Popo Agie Moraine SIA that fall within the Maxson Basin cattle and horse allotment are neither capable nor suitable from a rangeland standpoint due to heavy timber, rock outcroppings, and wetlands. As such, even though this area is within a pasture with annually planned livestock grazing, it receives very little livestock use. Establishment of this SIA acknowledges and accepts incidental livestock use and if cattle are found or reported in the SIA they would be removed as a part of the normal livestock herding practice. Since there is little suitable rangeland, there is no need for a stocking reduction. There would be no negative impacts to the existing commercial livestock grazing operation on the Maxson Basin cattle and horse allotment as a result of establishment of the Little Popo Agie Moraine Geological SIA.

Kirwin Historical Site SIA

This potential SIA is part of the Kirwin & Wood River cattle and horse allotment. There is no planned livestock grazing within the smaller (480 acres) or larger (4,600 acres) proposed SIA, however, occasional incidental livestock use may occur. This use usually occurs when ATV riders encounter livestock on the road in the narrow valley and inadvertently herd them up the drainage. Livestock on the allotment are managed under a multi-pasture deferred rotation grazing system, and when cattle are found or reported in the SIA they would be removed as a part of the normal livestock herding practice. Additional protection for the SIA is planned in the form of a drift fence and cattleguard located at the upper end of the grazing area. All costs for the fence and cattleguard construction would be the responsibility of the Forest Service. There would be no negative impacts to the existing commercial livestock grazing operation on the Kirwin & Wood River cattle and horse allotment from the establishment of the Kirwin Historical SIA.

There is little or no effect on SIA establishment from livestock grazing under any alternative.

Effects from Noxious and Invasive Species: Invasive plants are considered to have detrimental effects to SIAs. They can be treated in all alternatives to protect resource values. There is little or no effect on SIA establishment from invasive plant management under any alternative.

Effects from Heritage Management: In considering the various alternatives, A and F do not propose addition of the Kirwin Historical Site, and the opportunity to recognize this area as a valuable historic site and provide special management would be lost. Alternatives B, C, D, E, and G designate Kirwin Historical Site as an SIA, allowing the preservation and management of this historic Wyoming mining town.

Summary of Effects to Resource

Overall potential impacts to SIA resources would be least under alternatives B, C, D, and G with the establishment of the three potential SIAs. Alternative E would protect one potential SIA, the Kirwin Historical Site. No new SIAs are proposed under alternatives A and F; their historical and geological features are not emphasized.

Cumulative Effects

Cumulative effects resulting from designation of SIAs would include present and future loss of commodity production (principally wood products and grazing products), although these effects are small due to the negligible level of these activities currently occurring. Recreational pursuits in the future could be affected by some of the limitations prescribed by SIA direction on types of recreation allowed and limits on accessibility, but only if future use levels substantially increase over present levels. Designation of three of the SIAs would add to the acreage on the Shoshone where ecological processes are largely unaffected by human influences. The Kirwin Historical SIA recognizes the effect of early Wyoming extraction of resources.

The life of the revised Forest Plan (10 to 15 years) was considered the future time horizon for this cumulative effects analysis. There are no reasonably foreseeable actions that would add to either Shoshone SIAs or the BLM ACEC system, similar to the Forest Service SIA designation. For this analysis, draft BLM Resource Management Plans or draft revised forest plans were considered reasonably foreseeable actions.

The cumulative effects analysis area for the present status of SIAs and ACECs include BLM lands administered by the Lander Field Office (Lander Planning Area) and Worland District Office (Bighorn Basin), Wyoming.

The Lander BLM field office has six ACEC designations that are adjacent to the Shoshone boundary. These include Lander slope, Red Canyon, Dubois badlands, Whiskey Mountain, and East Fork. The South Pass ACEC is similar to the potential Kirwin Historical Site SIA because both recognize Wyoming historic mining areas.

The Worland BLM Field Office has five ACEC designations that are adjacent to the Shoshone boundary. These include Carter Mountain, Upper Owl Creek, Clark Fork Canyon, Rattlesnake Mountain, and Sheep Mountain. None of these areas share similarities to the potential Shoshone SIAs.

Scenery Resources

Introduction

Scenery management is concerned with providing scenic integrity, through time, to meet the public desire for attractive natural landscapes and to support recreation and tourism uses. The scenery management system replaces the visual management system used in the 1986 Shoshone National Forest Land and Resource Management Plan (1986 Forest Plan as amended).

The scenery management system is used to inventory and analyze scenery, to assist in establishing resource goals and objectives, to monitor the scenic resource, and to ensure high-quality scenery for future generations. The new system applies to all national forests and grasslands administered by the Forest Service and to all Forest Service management activities.

Legal and Administrative Framework

The **Multiple-Use Sustained-Yield Act of 1960 (16 U.S.C. 528)** authorizes and directs the Secretary of Agriculture "to develop and administer the renewable surface resources of the National Forests" for "harmonious and coordinated management of the various resources . . . with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output."

The **Forest and Rangeland Renewable Resources Planning Act of 1974,** as amended by the National Forest Management Act of 1976 (16 U.S.C. 1601) directs the Secretary of Agriculture to prepare land management plans which provide for outdoor recreation and to develop and keep current a comprehensive inventory of all NFS, as well as state and private, lands and resources. Section 6 of this act requires an assessment of potential aesthetic impacts during the interdisciplinary review of proposed timber sale areas that would include clear-cutting and other cuts designed to regenerate an even-aged stand of timber. It also specifies treatment of cut blocks and protection of aesthetic resources, and directs that multiple use and sustainable yield guidelines be used with private lands involved with government programs.

The **National Forest Management Act of 1976 (16 U.S.C. 1600)** requires that the removal of trees, portions of trees, or forest products "be compatible with multiple use resource management objectives in the affected area."

- **Title 36 of the Code of Federal Regulations, Part 219, Subpart A, National Forest System Land and Resource Management Planning (36 CFR part 219, subpart A)**, includes requirements for consideration, treatment, and protection of intangible resources such as scenery and aesthetics.
- **Title 36 of the Code of Federal Regulations, Part 219, Subpart A, 219.21 (f) National Forest System Land and Resource Management Planning (36 CFR part 219.21(f))**, "The visual resource shall be inventoried and evaluated as an integrated part of evaluating alternatives in the forest planning process, addressing both the landscape's visual attractiveness and the public's visual expectation. Management prescriptions for definitive land areas of the forest shall include visual quality objectives."
- **Title 36 of the Code of Federal Regulations, Part 223, Sale and Disposal of National Forest System Timber (36 CFR part 223)**, includes requirements for protecting environmental quality and for minimizing adverse effects on, or providing protection for and enhancing, other NFS resources.

The **National Environmental Policy Act of 1969 (42 U.S.C. 4321)** directs the Federal Government to "(2) assure for all Americans ... healthful, productive, and aesthetically and culturally pleasing surroundings; (3) attain the widest range of beneficial uses of the environment without degradation, [or] risk to health ..., (4) preserve important historic, cultural, and natural aspects" of our environment. It further directs agencies to "insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making which may have an impact on man's environment." This act directs agencies to develop methods and procedures "which will insure that [scenery and other] unquantified environmental amenities and values may be given appropriate consideration in decision making along with economic and technical considerations."

The **Wilderness Act of 1964 (16 U.S.C. 1131)** directs the United States to administer wilderness areas to provide for the "preservation of their wilderness character," to retain their "primeval character and influence," and to protect and manage the natural conditions of wilderness areas so that they "generally appear to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable." Scenic use is identified as one of the six public purposes of wilderness areas.

- **Title 36 of the Code of Federal Regulations, Part 293, Wilderness – Primitive Areas (36 CFR part 293)** includes requirements for scenic use, preservation and protection of wilderness character, and promotion and perpetuation of specific values including solitude and inspiration.
- **Title 36 of the Code of Federal Regulations, Part 292, National Recreation Areas (36 CFR part 292)** includes requirements for preservation, conservation, and protection of natural, scenic, and pastoral values, and other values contributing to public enjoyment of these areas.

The **National Trails System Act of 1968 (16 U.S.C. 1241)** authorizes the Secretary of Agriculture to administer and manage national scenic trails "for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas through which such trails may pass."

Intermodal Surface Transportation Efficiency Act of 1991 (23 U.S.C. 101) directs the establishment of a National Scenic Byways Program with designation criteria to include consideration of scenic beauty. It further recommends that designated travelways have operation and maintenance standards which include "strategies for . . . protecting and enhancing the landscape and view corridors surrounding such a highway."

Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271) directs the United States, in its administration of components of the National Wild and Scenic Rivers System, to give primary emphasis to protecting "its aesthetic, [and] scenic ... features."

- **Title 36 of the Code of Federal Regulations, Part 297, Wild and Scenic Rivers (36 CFR part 297),** includes requirements for the protection of scenic and natural values from the effects of any water resources project.

Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1201) authorizes the Secretary of Agriculture to permit surface coal mining operations on NFS lands if there are no significant recreational or other values which may be incompatible.

- **Title 36 of the Code of Federal Regulations, Part 228, Subpart A, Locatable Minerals (36 CFR part 228, subpart A)** includes requirements for harmonizing mineral operations with scenic values (sec. 228.8), and protecting scenic values when approving access to those operations (sec. 228.12).

North American Wetlands Conservation Act of 1989 (16 U.S.C. 4401, 4401-4413; 16 U.S.C. 669b) recognizes the aesthetic values of fish, shellfish, and other wildlife; it further recognizes that wetland ecosystems provide aquatic areas which are important for recreational and aesthetic purposes. It directs the head of each Federal agency, to the extent consistent with the agency's mission and statutory authorities, to cooperate to restore, protect, and enhance the wetland ecosystems and other habitats for migratory birds, fish, and wildlife.

Title 36 of the Code of Federal Regulations, Part 254, Landownership Adjustments (36 CFR part 254), include requirements for protecting aesthetic values on lands involved in these transactions.

Title 36 of the Code of Federal Regulations, Part 290, Cave Resources Management (36 CFR part 290), includes requirements for protecting and maintaining the scenic values of significant caves.

FSM, Chapter 2380, Landscape Management provides direction for Forest Service landscape management including aesthetics and scenery.

Resource Protection Measures

Scenery resource protection measures are included in forest-wide and management area standards and guidelines. Scenery resource methods and techniques are described in the following USDA handbooks:

- National Forest Landscape Management, Vol. 1. Agriculture Handbook 434: 1973.
    - National Forest Landscape Management, Vol. 2, Chapter 1: The Visual Management System. Agriculture Handbook 462: 1974.
    - Utilities, Volume 2 - Chapter 2. Agriculture Handbook 478: 1975.
    - Range, Volume 2 - Chapter 3. Agriculture Handbook 484: 1977.
    - Roads, Volume 2 - Chapter 4. Agriculture Handbook 483: 1977.
    - Timber, Volume 2 - Chapter 5. Agriculture Handbook 559: 1980.
    - Fire, Volume 2 - Chapter 6. Agriculture Handbook 608: 1985.
    - Ski Areas, Volume 2 - Chapter 7. Agriculture Handbook 617: 1984.
    - Recreation, Volume 2 - Chapter 8. Agriculture Handbook 666: 1987.
- Landscape Aesthetics, A Handbook for Scenery Management. Agriculture Handbook 701: 1995

Methodology and Analysis Process

In 1986, when the Forest Plan was adopted, scenic resources were inventoried and analyzed using the visual management system as outlined in Forest Service Handbook 462 (USDA Forest Service 1974). This system, which was released in 1974, established standards of measurement (i.e., visual quality objectives) for assessing proposed and existing impacts to scenic quality.

In 1995, after 20 years of experience with the visual management system and after additional research in the public and private sectors, the Forest Service revised the visual management system and replaced it with the scenery management system. This revised system is described in Agricultural Handbook 701, Landscape Aesthetics: A Handbook for Scenery Management (USDA

Forest Service 1995). The scenery management system was used in combination with the visual management system in this analysis because the scenery management system will not fully replace the visual management system on the Shoshone National Forest until the revised Forest Plan is adopted.

Although the visual management system and scenery management system both manage scenic resources, the scenery management system takes the visual management system process one step further by rating the importance of the landscape and developing scenic classes to measure the value of a landscape being viewed. Scenic classes allowed managers to compare the scenic value of a landscape with the value of other resources during the planning process. Most concepts are the same in both systems, but often terminology has changed. Both systems establish objectives (visual quality objectives or scenic integrity objectives) to measure the degree of alteration or deviation permissible in a landscape. The definitions for these objectives are similar, but application is slightly different.

The scenery management system measures deviations from the existing landscape character, and ecosystems provide the environmental context for the scenery management system. With ecosystems providing the context, the focus is on movement toward the desired landscape character (USDA Forest Service 1995, 20). The scenery management system also places additional emphasis on constituent analysis.

The scenery management system, as outlined in Agricultural Handbook 701, is today’s best science to achieve high-quality scenery as an outcome of national forest ecosystem management practices. Scenery management system inventories were completed for the Shoshone as part of the land and resource management plan revision process. ArcMap and geographic information system (GIS) data layers were used to analyze current forest plan direction for scenic resources (referred to in the 1986 Forest Plan as amended as visual resources), inventory scenic resources as outlined in the scenery management system to determine the relative value of scenic resources, develop scenic integrity objectives for the action alternatives, and analyze the alternatives in regard to desired conditions for scenic resources (i.e., visual quality objectives or scenic integrity objectives).

The scenery inventory process is fully documented in the Scenery Management System Inventory Report for the Shoshone National Forest Land and Resource Management Plan Revision (SMS Inventory Report). The effects analysis will consider how each alternative manages scenic resources by considering the management prescriptions proposed in each alternative and the amount of each visual quality objective established or scenic integrity objective proposed on NFS lands in each alternative. To ensure clarity, the following cross walk between visual quality objectives and scenic integrity objectives is provided (table 162).

Table 162. Scenic integrity, visual quality objective, and perception crosswalk (USDA Forest Service 1995, 2-4)

Scenic integrity (both existing and objective)	Visual quality objective	The Forest's scenic integrity as people perceive it
Very high	Preservation	Unaltered; landscape character is intact
High	Retention	Appears unaltered; deviations to landscape character are not evident
Moderate	Partial retention	Slightly altered; deviations are subordinate to landscape character being viewed
Low	Modification	Moderately altered; deviations begin to dominate the valued landscape character being viewed
Very low	Maximum modification	Appears heavily altered; deviations may strongly dominate the valued landscape character.
Unacceptably low	Unacceptable modification	Appears extremely altered; this level is only used to inventory existing scenic integrity. It is never an objective on NFS lands

The effects analysis will also consider how each alternative provides for management of natural appearing scenery. The very high, high, and moderate scenic integrity objectives result in a relatively natural-appearing landscape. It is important for national forests to manage scenery at this level. "Research has shown that high-quality scenery, especially that related to natural-appearing forests, enhances people's lives and benefits society" (USDA Forest Service 1995, 17). It should also be noted that according to "Floyd Newby's findings that 'people expect to see natural or natural-appearing scenery'" (quoted in USDA Forest Service 1995, 2 3). Furthermore, "research shows that there is a high degree of public agreement regarding scenic preferences. This research indicates that people value most highly the more visually attractive and natural-appearing landscapes" (USDA Forest Service 1995, 30).

Issues Addressed in this Analysis

During public meetings and public feedback periods scheduled throughout the plan revision process, the public identified no key issues in regard to scenic resources. However, the interdisciplinary team determined that the revised Forest Plan would affect how scenic resources are managed, and these effects should be analyzed. The following issues regarding scenery are analyzed in this analysis.

- Issue – The best available science for managing scenic resources may not be used in each alternative.

  Indicator – Whether the scenery management system is being implemented to manage scenery.

- Issue – Existing or proposed plan direction may provide for varying amounts of natural-appearing scenery for forest visitors.

  Indicator – Percentage of NFS land provided by plan language (visual quality objective or proposed scenic integrity objective allocations) of natural-appearing scenery

- Issue – Existing or proposed plan direction provides for varying amounts of lands allocated to travel corridors management area prescription, which provides scenery prescriptions for management activities that provide for the public enjoyment of scenery over time.

Indicator – Percentage of NFS land allocated to travel corridors management area prescription.

- Issue – Existing or proposed management prescription categories may affect scenic resources.

  Indicator – Alternative(s) disclosed with least potential impact to scenic resources.

Spatial and Temporal Context for Effects Analysis

The temporal timeframe for direct, indirect and cumulative effects was run for 15 years, the anticipated life of the revised Forest Plan. The analysis area used was the Shoshone, where land management actions may be prescribed.

Affected Environment

As area populations increase, so does visitation to area national forests. Driving for pleasure and viewing scenery have become some of the most popular national forest activities as shown from National Visitor Use Monitoring Survey data. Visitors expect a certain level of “naturalness” in the recreation and tourism settings they pursue. Even individuals who have never visited the Shoshone expect a certain level of “natural intactness” in these landscapes. This natural beauty contributes to their sense of well-being and quality of life. The scenic integrity of national forest landscapes (which measures landscapes' inherent scenic attractiveness and the public's visual expectations for naturalness) is the system by which projected alterations in national forest landscapes are evaluated.

National forest visitors are attracted to a variety of areas for the natural character they possess. Visitors and residents value the forested backdrops that frame the surrounding communities. The transportation network and associated use areas provide visitors with scenic routes and vantage points to experience the region's vast expanse of rugged back country.

The Shoshone has a variety of landscape character types created by glaciers, rivers, continental uplifting, and mass wasting. The Shoshone contains many areas of outstanding scenic beauty unique to the Rocky Mountain Region. The American public generally recognizes that NFS lands with exceptional scenic resources are valuable public assets that should be protected and managed for the enjoyment of future generations. Landscapes on the Shoshone contain alterations from past events and activities such as fire, mining, logging, and ranching, even though many of these changes are not readily visible to most forest visitors. The most visible effects to scenery from past human activities have generally been caused by the removal of vegetation in patterns that contrast with the natural forms, lines, colors, and textures of the natural landscape. Forest vegetation management is generally done via timber sales or prescribed burning. Other activities that require alteration of landforms often result in more permanent changes to the landscape. Examples of these types of activities include: roads, trails, buried utilities, mines, reservoirs, communication sites, and gravel pits. Structures such as power lines, communication sites, buildings, fences, and other structures located on NFS lands also have potential to be noticed and create negative visual changes.

National forest travel routes have been evaluated for the estimated level of public concern for alterations to the landscape. Travel routes classified as concern level 1 (including those routes that are designated state scenic highways or national forest scenic byways) indicate that the public is most concerned about alterations; concern level 3 indicates the least concern. In evaluating landscape visibility, landscape managers have recognized that “distance” is one of the primary perceptual factors for determining whether alterations are visually noticed. Foreground distance zones reveal even the subtlest alterations; background distance zones are able to absorb greater alterations, provided color contrasts are minimized.

Landscape management is used to meet people's scenery expectations for the management of national forest landscapes. To ensure that scenic integrity is maintained, six levels of scenic integrity objectives have been established, derived from the landscape's attractiveness and the public's expectations or concerns. Each scenic integrity objective depicts a level of scenic integrity used to direct landscape management: very high (unaltered), high (appears unaltered), moderate (slightly altered), low (moderately altered), and very low (heavily altered).

Generally, landscapes that are most attractive (as classified by scenic attractiveness class) and are viewed from popular travel routes (as classified by concern level) are assigned higher scenic integrity objectives. The methodology for establishing scenic integrity objectives is provided in Agriculture Handbook 701.

The 1986 Forest Plan as amended used the visual management system described in the publication titled National Forest Landscape Management (USDA Forest Service 1977). The visual quality objectives shown in table 163 were established for the 1986 Forest Plan as amended.

Table 163. 1986 Forest Plan as amended visual quality objectives

Visual quality objective	Acres	Percentage of Forest
Preservation	1,365,000	56%
Retention	360,900	15%
Partial retention	683,900	28%
Modification	28,100	1%
Maximum modification		
TOTAL	**2,438,000**	100%

In some landscapes, human influence is evident through changes in vegetation patterns, landform alterations, or the introduction of structural elements. For the most part, national forest landscapes in the planning area remain natural-appearing in character, with many of the valued landscape attributes still intact.

The Scenic Integrity Scale

The scenic integrity scale is used to describe both existing and desired conditions. The scenic integrity scale describes a range of scenic quality conditions. The first five categories are not inherently good or bad. This scale is a continuum of scenic condition ranging from a landscape where changes are natural occurrences, to a landscape where management activities and uses overwhelm the original landscape character. This scale is used to evaluate existing condition and to describe future objectives. In general, landscapes with very high, high, and moderate scenic integrity have a natural appearance; landscapes with low, very low, and unacceptably low scenic integrity are dominated to varying degrees by development and use.

Very high The valued landscape character “is” intact with only minute if any deviation. The existing landscape character and sense of place is expressed at the highest possible level.

High The valued landscape character “appears” intact. Deviations may be present but must repeat the form, line, color, texture and pattern

	common to the landscape character so completely and at such scale that they are not evident.
Moderate	The valued landscape character “appears slightly altered.” Noticeable deviations must remain visually subordinate to the landscape character being viewed.
Low	The valued landscape character “appears moderately altered.” Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, edge effect, and pattern of natural openings, vegetative type changes, or architectural styles outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed but compatible or complimentary to the character within.
Very low	The valued landscape character “appears heavily altered.” Deviations may strongly dominate the valued landscape character. They may borrow from valued attributes such as size, shape, edge effect, and pattern of natural openings, vegetative type changes, or architectural styles within or outside the landscape being viewed. However deviations must be shaped and blended with the natural terrain (land forms) so that elements such as unnatural edges roads, landings, and structures do not dominate the composition.
Unacceptably low	The valued landscape character being viewed “appears extremely altered.” Deviations are extremely dominant and borrow little if any form, line, color, texture, pattern, or scale from the landscape character. Landscapes at this level of integrity need rehabilitation. This level should only be used to inventory existing integrity. It must not be used as a management objective.

The Scenic Byways

There are three scenic byways and one All American Road crossing the Forest: Chief Joseph Scenic Byway, (U.S. Highway 296), Buffalo Bill Scenic Byway (U.S. Highway 14-16-20), Wyoming Centennial Scenic Byway (U.S. Highway 26-287), and the Beartooth All American Road (U.S. Highway 212). Each road provides a unique and different view of the Shoshone because they vary in viewshed, vegetation, geological features, and historical uses. They provide opportunities for approximately 306 miles of scenic travel on the Shoshone and adjacent national forests. These roads provide forest access for the majority of tourists and local visitors.

Desired Condition

The desired visual condition for the Shoshone is administered so that management activities maintain or improve the scenic integrity. Management activities are not evident or remain visually subordinate along forest arterial and collector roads and primary trails. In other portions of the Shoshone, management activities may dominate the foreground and middleground views, but harmonize and blend with the natural setting. Landscape rehabilitation is used to restore landscapes to a desirable scenic integrity. Enhancement aimed at increasing positive elements of the landscape to improve visual variety is also desired.

Environmental Consequences

This section of the scenery analysis describes the environmental consequences for all alternatives. Potential environmental consequences for scenic resources include: implementation of the scenery management system, general effects of varied management activity prescriptions, differences in the proposed scenic integrity objective(s) among the alternatives, and differences in proposed management area prescriptions among the alternatives. The proposed scenic integrity objective(s) for each alternative are based on the relative value for scenery (scenic class), the theme of the alternative, and the desired condition and mix of management areas in each alternative.

Consequences of Implementing the Scenery Management System

Under alternative A, scenic resources would continue to use visual quality objectives, developed from the 1986 visual management system inventories, to manage scenic resources. Under the visual management system, scenic resources would not be managed in an ecosystem context. Any human activities in the landscape, even when planned to improve ecosystem processes, could be considered a deviation in the landscape character. The 1986 visual management system inventories would not be updated to reflect the current concern for scenery on the Shoshone. Alternative A would not use best available science, the scenery management system, to manage scenic resources in the context of ecosystem management to sustain scenic resources in the long term.

During the development of the revised Forest Plan, an inventory of scenic resources was conducted using the scenery management system as outlined in the Scenery Management System Handbook (USDA Forest Service 1995). As part of the interdisciplinary revision process, proposed scenic integrity objectives were developed from the scenery management system inventories. It is part of the revised Forest Plan and alternatives B, C, D, E, F, and G to fully implement the scenery management system including goals, standards and guidelines to manage scenic resources in the context of ecosystem management.

Alternatives B, C, D, E, F, and G use best available science, the scenery management system, to manage scenic resources. In the scenery management system, ecosystems provide the environmental context for the scenery management system and increased concern for the Shoshone scenery has been considered.

Direct and Indirect Effects

The quality of the visitor experience may be affected by the condition of the forest environment encountered, depending on the number and types of manmade activities and the degree of deviation from the landscape’s inherent natural condition that has occurred. Each alternative will affect landscape character to varying degrees over time, based on the amount of change from the natural condition that is allowed.

Changes in scenery may be the result of natural events and human activities. Project planning, design and layout techniques may be used to minimize changes in scenic integrity. The observer’s viewing location, distance from the change, the season, landform and vegetation screening, weather conditions, and the duration of the view affect how noticeable changes are.

Management activities and uses such as timber harvest, road building, mining, grazing, utilities, trail construction, ski area development, and developed and dispersed recreation affect scenery. Activities designed to blend in with the surrounding landscape may have a positive effect on scenic integrity; poorly designed activities that contrast sharply with the surrounding landscape usually result in an adverse effect on scenic integrity. The planning, design, and layout of projects are critical to achieving scenic integrity objectives.

Each alternative developed for the forest plan revision includes varied management prescriptions and each management prescription is assigned a proposed scenic integrity objective(s) based on the desired condition of the management area. Scenic integrity objectives assigned to management area prescriptions influence the amount, degree, intensity, and distribution of management activities needed to achieve the desired condition. Distribution includes both distribution in space and distribution through time.

Alternatives C and D, enhance or protect the inherent naturalness of scenic landscapes for the highest number of acres. These alternatives are most likely to provide the greatest public benefit from a scenery resources standpoint. Scenery is an integral component of all national forest settings and must be considered in the analysis for all activities on NFS land. Each site-specific project must be analyzed in detail to determine compliance with forest plan direction and determine if mitigation measures are required.

Scenic integrity objectives have a range from very high to low. The scenic integrity objectives for each alternative are based on the proportionate mix of management areas in each alternative. Each management area has a range of proposed scenic integrity objectives as a guideline. These ranges are set to be compatible with the desired condition for the management area.

As stated in the methodology section, the very high, high, and moderate scenic integrity objectives result in a relatively natural-appearing landscape. Providing for naturally appearing scenery is an indicator for this analysis. Alternatives A, B, C, D, E, and G provide for an equal amount of naturally appearing scenery, 99 percent of NFS lands. Alternative F provides less naturally appearing scenery than the other alternatives, 98 percent of NFS lands. Alternatives C and D allocate the highest percentage of NFS lands as very high scenic integrity objective. Table 164 displays the proposed scenic integrity objective categories by alternative based upon the allocation of the management areas.

Map 59 displays the visual quality objectives for alternative A. Maps 60–64 and 78 display the scenery integrity objectives for alternatives B through G.

Table 164. Percentages of the Shoshone acreage by scenic integrity objective and alternative

Scenic integrity objective	Percentage of Shoshone acreage by alternative						
	A[a]	B	C	D	E	F	G
Very High	56[b]	59	82	66	58	58	58
High	15[c]	27	8	23	26	20	27
Moderate	28[d]	14	9	11	15	21	13
Low	1[e]	1	1	1	1	2	1
TOTAL	**100**	**100**	**100**	**100**	**100**	**100**	**100**

[a] Alternative A (No-action – 1986 Forest Plan as amended) does not have scenic integrity objectives established using the scenery management system. When the 1986 Forest Plan as amended was completed, scenery was described using the Visual Management System (USDA Forest Service 1977) with areas of the forest classified using visual quality objectives (VQO).

[b] In the 1986 Forest Plan as amended this was the percent assigned to the “Preservation” VQO.

[c] In the 1986 Forest Plan as amended this was the percent assigned to the “Retention” VQO.

[d] In the 1986 Forest Plan as amended this was the percent assigned to a “Partial Retention” VQO.

[e] In the 1986 Forest Plan as amended this was the percent assigned to a “Modification & Maximum Modification” VQO.

The Scenic Byways

A management area prescription helps define the purpose and need for future projects in that area. Management area 4.2, travel corridors, provides scenery prescriptions for management activities that provide for the public enjoyment of scenery over time (see map 43). The scenery prescription is applied to areas of concentrated recreation use (e.g., campgrounds, visitor centers) and along scenic byways.

Scenic byways provide opportunities to enjoy scenic beauty. The designated scenic integrity objective for this management area is moderate to high.

Effects from other Resource Management

For each of the resource areas described below, the environmental consequences for scenery resources are compared by alternative, based on key indicators of disturbance for each type of activity. In general, alternatives that propose greater levels of disturbance activities for various resource uses generally have the greater potential to impact scenery resources.

Effects from Insects and Disease and Fire and Fuels Management: In all alternatives, natural disturbance factors have the potential to alter the appearance of the Shoshone. While these changes are consistent with the landscape character of the Shoshone, they occur within the historic range of variability of that character type. It is difficult to compare the potential effects of insects, disease, or wildfire to the more predictable effects of management activities and development. Opportunities to minimize natural disturbances through active management will be evaluated for scenery effects when projects are developed. Opportunities may be identified for rehabilitation work to reduce the visual effects of insects, disease, and wildfire. Insects, disease, and wildfire are natural disturbance factors with a high potential to change scenic beauty, but no direct effect on scenic integrity. Effects to scenic integrity might result from the development of roads for timber management.

Prescribed fires that are used to reduce fuels, improve forest, range and habitat conditions also affect the scenery. The significance of the effect depends on the vegetation type(s), the number of acres treated and the duration of the effect. Prescribed fires in rangeland usually have short-term visual effects. Prescribed fires with crown fires in a timber stand usually have a more apparent and lasting impact. Other types of fuel treatments (e.g., thinning and burn piles) affect scenery as well. Based on the prescribed burning projected annually for forested acres, impacts on scenery would be similar throughout all alternatives on a percentage basis. The greatest number of acres anticipated to be affected by mechanical treatment, prescribed fire, and wildfire would occur under alternative A , followed by alternatives D, C, B and G, and F, respectively.

Effects from Mineral, Oil and Gas Development: Mineral and energy development may affect scenery on the Shoshone. Scenic integrity would be reduced if the landscape is modified by energy development. Location of structures (e.g., roads, pipes, pumpjacks, tanks, and fences) would affect scenery. Mineral development may occur for common minerals such as gravel. Alternative C has fewer acres available under standard lease terms for energy development than other alternatives, and would have the least potential for effects to scenery resources. However, minerals development potential is low to very low, and effects are anticipated to be minimal under any alternative.

Effects from Timber Management: Timber management activities can be designed to minimize effects on scenic integrity, although design criteria may conflict, in varying degrees, with timber management objectives. Timber harvest can be used to maintain or enhance scenic integrity over time if that objective is identified in project planning. Negative effects on scenic integrity are usually noticed when harvest units dominate the landscape. Management areas emphasizing forest products from suited timber lands have the potential for reduced scenic integrity as a result of timber management. The potential for reduced scenic integrity is least under alternative C, followed by alternatives D, A, B and G, E, and F, respectively.

Summary of Effects to Resource

All alternatives provide goals and guidelines to manage scenic resources. The main difference among alternatives is the management system used (visual management system vs. scenery management system) and whether that system manages scenic resources in the context of ecosystem management. Alternative A manages scenic resources using visual quality objectives, developed from the 1986 visual management system inventories. Visual quality objectives range from preservation to modification. Alternatives B, C, D, E, F, and G use the scenery management system to maintain scenic resources. Scenic integrity objectives proposed for every acre of NFS lands vary from very high to low. The proposed scenic integrity objectives focus on movement toward the desired landscape character.

Scenic byways provide opportunities to enjoy scenic beauty. Alternatives vary little with respect to acres of byway corridors that would be managed for scenery values and uses.

Proposed management prescription categories may impact scenery across alternatives. Alternative C provides the least potential impact from oil and gas development and timber harvest when compared to the other alternatives.

All alternatives provide for an equal amount of naturally appearing scenery of NFS lands. “Research has shown that high-quality scenery, especially that related to natural-appearing forests, enhances people's lives and benefits society” (USDA Forest Service 1995, 17).

Cumulative Effects

The cumulative effects analysis area for scenic resources is the Shoshone and the lands adjacent to and within the Shoshone under other ownership. Cumulative consequences are those consequences of past, present, and foreseeable activities on lands of other ownership that, in conjunction with management activities likely to occur on the Shoshone, may intensify, negate, improve or otherwise affect scenic resources. Below are considerations of consequences of activities that will likely occur on adjacent or nearby ownerships to the Shoshone. The Shoshone shares borders with the Bridger-Teton, Custer, and Gallatin National Forests, Bureau of Land Management (BLM), National Park Service, State of Wyoming, Wind River Indian Reservation, and private land.

Any guiding documents or plans for lands in and around the Shoshone were reviewed to determine if they would contribute to cumulative consequences. If lands have some management direction (goals, objectives, guiding principles, etc.) for scenic resources or natural character, it is assumed that scenic resources would be considered in any future project planning.

The Bridger-Teton, Custer, and Gallatin National Forests manage scenic resources using the visual management system and visual quality objectives allocated in their current land management plans. The Shoshone would implement the scenery management system before adjacent national forests. Consistent management of scenic resources would be beneficial to scenery in the long term, especially when scenery objectives (scenic integrity objectives or visual quality objectives) are edge-matched across forest boundaries.

The BLM is currently revising resource management plans for the Wind River/Bighorn Basin District and Lander Field Office planning areas. The BLM manages scenic resources using the Visual

Resource Management System. Under this system, scenic resources are inventoried and assigned visual resource management classes which provide objectives for managing scenery including level of change visible in the landscape. Scenic resources were inventoried and new visual resource management classes were assigned in the Bighorn Basin and Lander Draft Resource Management Plans to update the 1986 and 1987 resource management plans. Proposed visual resource management classes in the Bighorn Basin and Lander Draft Resource Management Plans' DEIS were reviewed.

Yellowstone National Park includes outstanding scenic resources adjacent to the Shoshone. Strategic and comprehensive plans include goals and frameworks preserve important cultural, natural, and scenic resources.

The State of Wyoming and Wind River Indian Reservation manage some lands adjacent to or within the Shoshone boundary. While these lands permit public access, they are not managed like other public lands such as national forests or parks. As these lands are managed, scenic resources may or may not be considered in that action.

Since most private lands do not have regulations for scenic resource management, the effects of ongoing private developments next to NFS lands can sometimes have negative effects on scenic resources when viewing the continuous landscape. Shoshone visitors often view scenery as a continuous landscape with little discernment regarding the land ownership being viewed. Sometimes management activities occurring on ownership boundaries can be quite noticeable if the change in form, line, color, or texture of the activity follows ownership boundaries rather than a natural landscape feature. If activities on private lands are designed to lessen impacts to scenic resources, the difference between private lands and NFS lands is less apparent.

The cumulative effects table at the beginning of chapter 3 (table 20) includes the list of past, present, and reasonably foreseeable future activities that were considered for the scenery resource. Effects were evaluated for the Shoshone. Any activities implemented on NFS lands (roads and trails, timber harvest, recreation development, prescribed fire, etc.) can affect scenery when viewed from nearby lands. The appraised value of property is often influenced by the proximity to the forest and the natural-appearing landscapes (i.e., high scenic integrity) of the forest. A cumulative effect of the subdivision of rural acreage and the development of residences is to raise the level of concern for scenic integrity. This effect is likely to increase over time as subdivision and development increases. The effect is similar for all alternatives, although alternatives that emphasize more active management may be more difficult to implement.

In conclusion, in consideration of the proposed scenic integrity objectives, the summary of effects of the alternatives on the scenery resource ranked from most to least is alternative A , followed by alternatives D, C, B and G, E, and F, respectively. The largest impacts are expected to result from vegetation treatments. Vegetation treatments might include harvests, thinning, and prescribed fire.

Land management plans for the lands in other ownership adjacent to and within the Shoshone may also have cumulative consequences. Below are considerations of consequences of activities that will likely occur on adjacent or nearby ownerships to the Shoshone.

With the National Park Service emphasis on preserving natural and scenic resources, all alternatives consistently manage scenic resources across these ownership boundaries. Any cumulative consequences promote natural or natural-appearing scenery.

In alternative A, the visual quality objectives of the 1986 Forest Plan as amended would not manage scenic resources consistently with the adjacent national forests once their plans are adopted, but would be consistent with the current land management plan's visual resource management.

Under alternative A, the visual quality objectives of the 1986 Forest Plan as amended may not manage scenic resources consistently with other land managers or owners, such as the BLM resource management plans, which would update their visual resource management systems. Overall, cumulative consequences of alternative A result in the potential for discrepancies across ownership boundaries in how scenic resources are managed for natural-appearing scenery. These discrepancies are anticipated since alternative A manages scenery with visual quality objectives, while the adjacent land managers mentioned above would manage scenery under the scenery management system or updated visual resource management systems in the foreseeable future when new management plans are adopted.

Alternatives B, C, D, E, F, and G would manage scenic resources more consistently across national forest boundaries in the foreseeable future because the scenery management system would be implemented. Proposed scenic integrity objectives were not edge-matched with visual quality objectives on adjacent national forests because it is assumed that the future plan revisions of adjacent forests would implement the scenery management system and establish new scenic integrity objectives. It is assumed that during the plan revision process, adjacent forests would edge-match the Shoshone scenic integrity objectives when possible. Some inconsistencies across the national forest boundaries may occur under alternatives B, C, D, E, F, and G until new forest plans are adopted.

Proposed BLM visual resource management classes in the Bighorn Basin and Lander Draft Resource Management Plans' DEIS were reviewed. The consistency of managing scenic resources varies across alternatives. This analysis primarily focuses on comparing the Shoshone proposed scenic integrity objectives to the preferred alternatives of the BLM draft resource management plans.

The Lander BLM Draft Resource Management Plan DEIS identifies their alternative D as the agency preferred alternative and assigns the lands adjacent to the Shoshone as visual resource management class II; the objective is to retain the existing character of the landscape. A proposed scenic integrity objective of low or visual quality objective of modification would manage the landscape with more noticeable alternations than adjacent lands.

For this analysis, alternatives E and F propose the highest amount of low scenic integrity objective along the ownership boundary, followed by alternatives B and G, and D. Alternative C proposes the least amount of low scenic integrity objective along the ownership boundary. Alternative A proposes no modification to visual quality objective along the ownership boundary. Alternatives A and C provide more consistency across ownership boundaries to manage for natural to naturally appearing scenery (very high, high, and moderate scenic integrity objectives and visual resource management class II) when compared to the Lander BLM Draft Resource Management Plan DEIS preferred alternative. Alternatives E and F provide more discrepancies by managing for more modified scenery (low scenic integrity objective) along this ownership boundary than the other alternatives for the Lander Field Office area. The Bighorn Basin BLM Draft Resource Management Plan DEIS identifies their alternative D as the agency preferred alternative.

The Bighorn Basin BLM Draft Resource Management Plan DEIS alternative D assigns the lands adjacent to the Shoshone as mostly visual resource management class II, with some visual resource management class III in the northern portion; the objectives are to retain and partially retain the existing character of the landscape. A proposed scenic integrity objective of low or visual quality objective of modification would manage the landscape with more noticeable alternations than adjacent lands.

This analysis indicates alternatives A, E, and F propose the highest amount of low scenic integrity objective or modification of visual quality objective along the ownership boundary. Alternatives B and G, C, and D propose no low scenic integrity objective along the ownership boundary. Alternatives B and G, C, and D provide the most consistency across ownership boundaries to manage for natural to natural-appearing scenery (very high, high, and moderate scenic integrity objectives and visual resource management class II) when compared to the Bighorn Basin BLM Draft Resource Management Plan DEIS preferred alternative. Alternatives A, E, and F provide more discrepancies by managing for more modified scenery (low scenic integrity objective or modification visual quality objective) along this ownership boundary than the other alternatives for the Bighorn Basin area.

It is anticipated that alternatives B, C, D, E, F, and G would more consistently manage scenic resources with other land managers or owners since the scenery management system would be implemented. The cumulative consequences of alternatives B, C, D, E, F, and G, with the known management plans discussed above result in more consistency across ownership boundaries in how scenic resources are considered and managed for natural and natural-appearing scenery. It is assumed that any future site-specific actions occurring on any adjacent Federal lands would consider scenic resources in their environmental analysis and any needed mitigation measures to meet scenic resources standards and guidelines would be applied.

Heritage Resources

Introduction

Heritage resources within the Shoshone National Forest are represented by various sites or structures, including their landscape settings that exemplify the cultural, architectural, economic, social, political, or historic heritage of the Shoshone and its surrounding areas and communities. Hundreds of recorded heritage resources are located within the Shoshone.

Legal and Administrative Framework

In the early 20th century, the public began to recognize that heritage resources (items modified by humans over 50 years old; i.e., stone artifacts, stone circles, wagon roads, mining, homestead cabins, etc.) were an important aspect of our country's history and cultural values, that these resources are nonrenewable, and that they should be protected for future generations. A series of Federal laws were enacted to protect heritage resources on Federal lands from damage or loss due to Federal programs and/or federally funded or permitted activities.

The following acts, along with other land use laws, executive orders, and policies guide management of cultural resources on NFS lands. Other laws pertinent to historic property management on NFS lands can be found in Forest Service Manual (FSM) 2300 – Recreation, Wilderness, and Resource Management; Chapter 2360 – Heritage Program Management.

Laws

Antiquities Act of 1906 (16 U.S.C. 431) – This act protects historic or prehistoric remains or any object of antiquity on Federal lands and applies to both cultural and paleontological resources. It imposes criminal penalties for unauthorized destruction or appropriation of antiquities without a permit.

National Historic Preservation Act (NHPA) of 1966 (16 U.S.C. 470) – This act protects historic and archaeological values during the planning and implementation of Federal projects (CFR 36.800 and CFR 36.60). The law requires the following: (1) location and identification of cultural resources during the planning phase of a project, (2) a determination of eligibility for inclusion in the National Register of Historic Places and (3) provisions for mitigation of any significant sites that may be affected.

National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321-4346) – This act establishes the national policy for the protection and enhancements of the environment. NEPA establishes part of the function of the Federal government is to "preserve important historic, cultural, and natural aspects of our natural heritage."

The Archaeological and Historic Preservation Act (AHPA) of 1974 (16 U.S.C. 469) – This act requires Federal agencies to collect, protect, and preserve historic and archaeological data, as the results the agencies' undertakings/actions. This act also applies to agencies' actions that fund or license projects and these effects on heritage resources.

Federal Land Policy and Management Act (FLPMA) of 1976 (43 U.S.C. 1701 § 102(8)) – This act requires that "public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource and archeological values; that, where appropriate will preserve and protect certain public lands in their natural condition …" This law applies to cultural and paleontological resources.

American Indian Religious Freedom Act of 1978 (AIRFA) – This act protects American Indian rights to exercise traditional religions including access to sites and freedom to worship through ceremonial and traditional rites.

Archaeological Resources Protection Act (ARPA) of 1979 **(16 U.S.C. 470)** – This act imposes civil penalties for the unauthorized excavation, removal, damage, alteration, or defacement of archaeological resources.

Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 (25 U.S.C. 3001) – American Indian burials and sacred items are protected by this act. If human remains or objects of cultural patrimony are discovered, this law requires consultation with the Indian tribes. The tribe then determines the appropriate treatment of the remains. This may include repatriation or scientific study and curation at a university.

Executive Orders

Executive Order 11593: Protection and Enhancement of the Cultural Environment (1971) – This order directs Federal agencies to inventory cultural resources under their jurisdiction, nominate all federally owned properties that meet the criteria to the National Register of Historic Places.

Executive Order 13007: Indian Sacred Sites (1997) – This order directs Federal agencies to accommodate access to and ceremonial use of American Indian sacred sites by tribal religious practitioners, to avoid adversely affecting the physical integrity of such sacred sites, and, where appropriate, to maintain the confidentiality of sacred sites.

Executive Order 13175: Consultation and Coordination with Indian Tribal Governments (2000) – This order directs Federal agencies to establish regular and meaningful consultation and collaboration with Tribal officials in the development of Federal policies that have Tribal implications.

Executive Order 13287: Preserve America (2003) – This order establishes Federal policy to provide leadership in preserving America's heritage by actively advancing the protection, enhancement, and contemporary use of the historic properties owned by the Federal government. The order also requires agencies to review and report their policies and procedures for compliance with the National Historic Preservation Act § 110 and 111 and improve Federal stewardship of historic properties.

Regulation and Policies

Regulations and policies have been passed in support of these laws and require the following:

- **Uniform Rules and Regulations (16 U.S.C.G 432-433)** – These regulations coincide with the Antiquities Act of 1906. They give the Secretary of Agriculture "jurisdiction over ruins, archaeological sites, historic and prehistoric monuments and structures, objects of antiquity, historic landmarks, and other objects of historic or scientific interest" on the NFS lands. These regulations also apply to paleontological resources.
- **Code of Federal Regulations: Property (36 CFR 261.9 (g), (h)) –** This regulation prohibits excavating, digging or injuring/damaging in any way prehistoric and/or historic heritage resources, structure, site, artifact, or property and removing any prehistoric and/or historic heritage resource, structure, site, artifact, or property.
- **Protection of Historic Properties (36 CFR part 800)** – These regulations implement the National Historic Preservation Act (NHPA) Section 106 and define how Federal agencies meet the statutory responsibility to take into account the effects of their undertakings on historic properties. The regulations identify the goal of consultation, which is "to identify historic properties potentially affected by the undertaking, assess its effects, and seek ways to avoid, minimize or mitigate and adverse effects on historic properties" (36 CFR 800.1)
- **National Register of Historic Places (36 CFR part 60)** – These regulations establish the National Register of Historic Places as a planning tool to assist Federal agencies to evaluate cultural resources in consultation with State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (ACHP). Criteria for determination of historic property eligibility are also outlined.
- **Protection of Archaeological Resources Uniform Regulations (36 CFR part 296)** – These regulations implement the Archaeological Resource Protection Act by establishing the uniform definitions, standards, and procedures for Federal land managers to follow in providing protection for archaeological resources located on public lands and Indian lands. Prohibited acts, including excavating, removal, damaging, or otherwise altering or defacing archaeological remains; and selling, purchasing, exchanging, transporting, or receiving any archaeological resource that was removed from Federal land in violation of ARPA of any other Federal law.
- **Native American Graves Protection and Repatriation Regulations (43 CFR part 10, Subpart B)** – These regulations carry out provisions of the Native American Graves Protection and Repatriation act of 1990. These regulations establish a systematic process for determining the rights of lineal descendants and Indian tribes and Native Hawaiian organizations to certain Native American human remains, funerary objects, sacred objects, or objects of cultural patrimony that are in Federal possession or control or in the possession or control of any institutions of State or local government receiving Federal funds.
- **Forest Service Manual (FSM) 2300** – Recreation, Wilderness, and Resource Management; Chapter 2360 – Heritage Program Management.

Other Agreements

Programmatic Agreement among the USDA Forest Service, Wyoming Forests, Wyoming State Historic Preservation Officer and Advisory Council on Historic Preservation (2008) – The Purpose of this programmatic agreement is to expedite compliance with the regulations “Protection of Historic Properties” 36 CFR Part 800 implementing Section 106 of the NHPA. The programmatic agreement was developed to streamline Section 106 compliance when appropriate circumstances permit the application of routine procedures and to decrease the need for review. Another goal of the programmatic agreement is to facilitate compliance with Section 110 of the NHPA through planned 110 activities and reporting of these activities in the annual report prepared for the SHPO by the Shoshone.

Resource Protection Measures

FSM 2300 – Recreation, Wilderness, and Related Resource Management, Chapter 2360 – Heritage Program Management

2364.02 Objectives – Forest Service objectives related to cultural resource protection and stewardship are to:

- Protect cultural resources in a manner consistent with their National Register qualities and management allocations
- Avoid or minimize the effects of Forest Service or Forest Service-authorized land use decision and management activities on cultural resources.
- Safeguard cultural resources in NFS lands from unauthorized or improper uses and environmental degradation.
- Mitigate adverse effects to historic properties when it is impossible or impractical to maintain them in a non-deteriorating or threatened condition.
- Recognize archaeologically, historically, or culturally significant properties and landscapes thorough formal National Register, National Historic Landmark, and other special designations.
- Develop, interpret, and use cultural resources for the public benefit under the framework of Windows on the Past.

2364.03 – Policy

1. Protection. It is the policy of the Forest Service to:

- Ensure that land use decisions and management practices do not have an inadvertent adverse effect on the characteristics that qualify cultural resources for listing on the National Register or on the uses determined appropriate through the evaluation and allocation processes.
- Determine whether proposed Forest Service or Forest Service-permitted undertakings will have effects on National Register listed or eligible properties and take those effects into account in land use decisions, following the procedures set forth in 36 CFR part 800, or national, regional, or State programmatic agreements that are applicable to the undertaking proposed.
- Consult with the SHPO, Indian tribes, Advisory Council, and the interested public about proposed land use decisions and their potential effects on cultural resources, in accordance with 36 CFR part 800 or national, regional, or State programmatic agreements that are applicable to the undertaking proposed.

- Monitor, assess, and document the physical conditions of and human or environmental threats to National Register eligible or listed historic properties on a frequent and systematic basis.
- Implement management treatments that protect, conserve, stabilize, rehabilitate, restore, and enhance cultural resources based on their National Register qualities and values, their importance to cultural groups, and their recommended management allocation.
- Integrate law enforcement in cultural resources monitoring, protection, and investigation of human-caused disturbance, destruction, or theft.
- Create public education and awareness programs under the Windows on the Past program and pursuant to ARPA Section 10(c).
- In coordination with the Tribal Government Relations Program, treat American Indian human remains recovered from public lands in strict accordance with the requirements of NAGPRA and 43 CFR part 10, and any applicable State laws. Coordinate with the Tribal Government Relations Program to implement requests for reburial of remains on NFS lands (FSM 1563.3).
- Follow State law or the "Advisory Council on Historic Preservation Policy Statement Regarding Treatment of Burial Sites, Human Remains, and Funerary Objects," for reburial of non-Indian remains.

2. Stewardship. It is the policy of the Forest Service to:

- Complete National Register and National Historical Landmark nominations and seek other special designations as appropriate for historic properties in collaboration with State and local governments, other agencies, Indian tribes, and interested historic preservation organizations.
- Develop and implement preservation-related programs to recognize, enhance, restore, interpret, and use National Register eligible or listed properties in accordance with their management allocations.
- Conduct stewardship-related activities in consultation and involvement with other Federal, State and local agencies, Indian tribes, historic preservation organizations, interested parties, and the private sector.
- Develop historic property plans (FSM 2362) for National Register-eligible or listed historic districts, properties, or property types to establish short- and long-term stewardship goals (desired conditions), proposed treatments, funding needs, and work schedules.
- Establish partnerships with the public and private sector to achieve stewardship goals and enhance capacity to meet public education and outreach goals (FSM 2365).

Methodology

Analysis methods used for historic properties include a review and synthesis of pertinent literature, records, and documentation available on the history and prehistory of the Forest. This information includes not only that which is available from a variety of generalized sources, but also information resulting from several years' worth of Forest Service cultural resource inventories. Information from previously documented sites can be used as an indicator of the type, frequency, and location of sites likely to be found within the analysis area.

To analyze existing condition and effects, the corporate database that tracks infrastructure (INFRA), and the Forest GIS heritage layers were used to identify acres inventoried to standard and sites that have been documented.

Affected Environment

The Shoshone is situated near or within the Wyoming Basin, Great Plains, and Rocky Mountain culture areas in the prehistoric cultural sub-area known as the Northwestern Plains. The Northwestern Plains stretch from central Alberta to southern Wyoming and from western North Dakota to western Montana. For the purpose of this discussion, when describing the archaeological record of the Shoshone, it helps to broadly categorize cultural materials and properties into three general eras, the prehistoric, proto-historic, and historic periods.

Through examination of geological, biological, sociological, and archaeological evidence, the prehistory of the Shoshone goes back at least 12,000 years. These early people were mobile hunters and gatherers, taking advantage of the wide range of resources available in the Northwestern Plains. Resources utilized consisted of numerous plant, animal, and aquatics, as well as lithic resources. Site types found in the Shoshone prehistoric record include trails, plant processing, tool stone quarries and tool manufacture, tepee ring and open camps, stone alignments, rock shelters, animal processing, rock art and ceremonial sites. Although the lifestyle of these early residents is becoming clearer, there is still much to be learned about the interaction of these people with their environment.

The proto-historic period took place in the Northwestern Plains from roughly 1725 A.D. to 1800 A.D. This period is characterized by the hunting and gathering adaptive strategy, which was dependent on the horse and Euro-American trade goods prior to recorded contact with Euro-Americans. There is a continuity of site types in the proto-historic with the prehistoric. The distinction between the two eras being the introduction and use of trade goods witnessed in the archaeological record of the proto-historic period. The introduction of the horse also brought about significant changes in subsistence economies, demographic characteristics, social reorganization, and settlement patterns.

The historic period in the Northwestern Plains started with the introductions and encounters between indigenous native cultures and Euro-American trappers, traders and explorers in the early 1800s. The early traders and trappers were sent by Hudson’s Bay and the Northwest Fur Trade companies. These early encounters between cultures were followed by a steadily increasing influx of Euro-American missionaries, miners, homesteaders, and loggers who gradually increased the size of the population of northwestern Wyoming. As conflicts arose between Native culture and the new Euro-American settlers, the United States government attempted to settle the armed conflict with a number of treaties and military actions.

The history of the Shoshone began with the creation the Yellowstone Timber Reserve in March of 1891, by President Benjamin Harrison. This reserve was the first established in the Nation and was originally under the administrative control of the Department of the Interior, General Land Office. In 1905, administration of the country’s forest reserves transitioned to the Department of Agriculture, under the newly created U.S. Forest Service. In 1908, President Theodore Roosevelt ordered the creation of the Shoshone National Forest out of the northeastern quarter of the old Yellowstone Forest Reserve. The southern zone of the current Shoshone was made into the Bonneville National Forest. For the first 37 years of their existence, these forests were managed as separate units. In 1945, the then-named Washakie National Forest was merged into the Shoshone National Forest.

All of the aforementioned histories and events have left their mark on the Shoshone in the form of cultural sites. To date, 1,198 cultural resource inventories have been conducted over approximately 168,500 acres of the Forest (approximately 7.5 percent). The Shoshone has 1,506 recorded sites. Of this total, 469 sites have been determined “Eligible” for listing in the National Register of Historic Places, 595 sites have been determined “Not Eligible,” and 442 sites remain unevaluated.

Information on cultural sites is kept on file as hard copy site and inventory forms, as well as on GIS and within the National Heritage Infra data base. Information concerning the nature and location of any cultural resource is confidential and not subject to public disclosure as per Public Law 94-456, [16 U.S.C. 470 hh Section 9 (a and b)].

Environmental Consequences

Potential effects to cultural resources are similar under all alternatives. What will vary is the volume of effects to these resources. The most prevalent effect to cultural resources across the alternatives would be from surface-disturbing activities in relation to the direct project actions involving the management of other resources. Effects to cultural resources are also caused by indirect project actions, public use and vandalism, and natural causes. Direct project actions include all of those activities, both beneficial and harmful, that are conducted by the Forest Service or authorized by Forest Service permits, including timber and silvicultural management, prescribed fire, wildlife and fisheries management, road and trail construction, facilities construction and maintenance, recreation use and management, and special uses authorization to third parties. Public use and vandalism of historic facilities and archaeological sites can cause the deterioration or destruction of cultural resources. Natural causes include damage by erosion, fire, wind, weathering, and other natural processes. The type of cultural resource and the management allocation must be taken into account to determine the significance of the effect.

The criteria for assessing adverse effects under the NHPA are found at 36 CFR 800.5(a) and are defined as:

> “(1) Criteria of adverse effect: An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.
>
> (2) Examples of adverse effects: Adverse effects on historic properties include, but are not limited to: (i) Physical destruction of or damage to all or part of the property; (ii) Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation and provision of handicapped access, that is not consistent with the Secretary’s Standards for the Treatment of Historic Properties (36 CFR part 68) and applicable guidelines; (iii) Removal of the property from its historic location; (iv) Change of the character of the property’s use or of physical features within the property's setting that contribute to its historic significance; (v) Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features; (vi) Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and (vii) Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.”

Direct and Indirect Effects

Effects from Vegetation Management/Timber Harvesting: Vegetation management activities have the potential for affecting cultural resources. Large-scale thinning, harvesting, skidding, piling, decking, and construction of service roads have the potential to destroy the integrity of cultural objects, sites, historic districts, and historic landscapes. The National Historic Preservation Act (NHPA) determinations for Federal undertakings are utilized in NEPA review and decisions. Successful implementation of vegetation management projects using the process outlined in 36 CFR 800 regulations will lead to little or no effect to archaeological and historical sites.

Alternative A is the no-action alternative. Impacts to cultural resources would remain similar to current levels under the 1986 Forest Plan as amended. Alternatives B and G would maintain similar levels of impact as alternative A. Under alternatives C and D, potential impacts to heritage resources from ground-disturbing activities would be lessened due to a decreased amount of vegetation management and timber harvesting. Under alternatives E and F, there is a greater potential of increased impacts to cultural resources due to a higher volume of ground-disturbing activities associated with a more robust vegetation management and timber harvesting emphasis.

Effects from Roads and Trails Management: Construction, reconstruction, and maintenance of roads and trails may also affect cultural resources. Motorized routes tend to cause more damage than horse, bike, and foot trails, but all roads and trails that pass through heritage resources have the potential to partially or completely destroy these resources. Transportation features also provide access to cultural sites, potentially leading to public vandalism and incidental damage from parking and camping off roads. Unauthorized, user-created routes and areas could affect cultural resources. A direct effect could be caused by motorized vehicle uses or the consequences of such use; including physical damage resulting in or from erosion, down-cutting, rutting, and damage to cultural resources.

Indirect effects are associated with motorized vehicle uses, but occur outside designated routes and areas, such as adjacent dispersed camping areas or areas where travel off of designated routes or areas may occur. The proximity of sensitive cultural resources, such as rock art, rock shelters, to designated routes or areas is important when determining where resources could be susceptible to greater threats or risks.

Alternative A is the no-action alternative. Impacts to cultural resources would remain similar to current levels under the 1986 Forest Plan as amended. Alternative B would maintain similar levels of impact as alternative A. Under alternatives C and D, with an increase in the amount of wilderness and an emphasis toward non-motorized use in the back country, there would be fewer impacts to known and unrecorded cultural resources through a reduction of access and the volume of roads and trail users. Under alternatives E and F, there is a higher potential for impacts to known and unrecorded cultural resources due to increased miles of motorized road and trails. Alternative G (proposed action) would likewise maintain similar levels of impact seen within alternative A.

Effects from Fire and Fuels Management: Fire and fuels management activities have the potential to adversely affect cultural objects, sites, and historic districts and landscapes. Prescribed fire and wildfire may destroy historic cultural sites with burnable features, such as cabins, mine structures, lookouts, dendroglyphs,[32] and administrative sites. Prehistoric cultural sites with burnable features include Bighorn sheep traps, hunting blinds and game fences, eagle traps, wooden conical and

[32] Carvings in the bark of living trees.

cribbed lodges, and rock art sites. The loss of forest duff (otherwise known as the O Horizon) also endangers cultural materials to looting and erosional events.

With appropriate planning and following the regulations outlined in 36 CFR 800, the potential for impacts to cultural resources from prescribed fire is relatively low, while wildfire is relatively high due to its unplanned nature. Prescribed fire implementation actions and wildfire suppression activities may also adversely affect cultural resources through construction of fire line, backfires, clearing of vegetation, and location of staging areas. Alternatives A through D and G would have more acres or potential wildfire acres and more potential to impact heritage resources than alternatives E and F, which have lower anticipated acres of wildfire. Under all alternatives, known objects and sites may be protected by various suppression techniques.

Effects from Recreation: Recreation management activities have the potential to affect objects, sites, historic districts, and historic landscapes. Construction of developed recreation sites may damage or destroy cultural resources and continued management of existing recreation sites that overlay cultural resources can continue to affect those extant portions of cultural resources that were not damaged in the original construction activities or subsequent use.

Additional potential to affect cultural resources comes from the management of beetle-killed or affected vegetation, which could also have a direct effect. Other effects could occur from recreation site use and would include activities such as trampling; which could adversely affect traditional plants, as well as changing the traditional character of an area by introducing negative visual and audio impacts.

Alternative A is the no-action alternative. Impacts to cultural resources would remain similar to current levels under the 1986 Forest Plan as amended. Alternative B would see a slight increase of impacts with new summer trails being allowed in some inventoried roadless areas when compared to alternative A. Under alternatives C and D, the impact to both known and unrecorded cultural materials would decline due to a reduction of open roads due to management area allocation, and the closing of roads and motorized trails in inventoried roadless areas. Under alternatives E and F, there is a greater potential for quantitative impacts to known and unrecorded cultural resources due an increase of motorized recreation activities throughout the forest. Alternative G (proposed action) with potential changes to summer motorized recreation would see an increase of impacts.

Effects from Fisheries and Wildlife Management: Aquatic management activities are typically small scale, affecting river and stream channels and their adjacent terraces or culvert and bridge configurations to allow for aquatic biota passage. Archaeological and historical sites are commonly found along the terraces of stream channels and may be affected when channel restoration projects restore original or more natural channels.

Successful implementation of fisheries and wildlife management projects using the process outlined in 36 CFR 800 regulations will lead to little or no effects to archaeological and historical sites.

Impacts to cultural resources would remain similar to current levels under the 1986 Forest Plan as amended under all alternatives.

Effects from Minerals, Oil, and Gas Development: Mineral activities have the potential for affecting cultural resources. Ground disturbing development activities have the potential to destroy the integrity of cultural objects, sites, historic districts, and historic landscapes. The National Historic Preservation Act (NHPA) determinations for Federal undertakings are utilized in NEPA review and decisions. Successful implementation of mineral projects using the process outlined in 36 CFR 800 regulations will lead to little or no effect to archaeological and historical sites.

The possibility of mineral development in the planning period is predicted to be low or very low under all alternatives. Potential adverse effects would be from roading, land disturbance, and potential spills. For lands suitable for oil and gas surface development, alternative A has the most acreage. Alternatives F, B, and E have less acreage in decreasing order. Alternatives C and D have less land available and alternative G has the least acreage. If oil and gas development were to occur, implementation of heritage resource regulations would minimize the effects to archaeological and historical sites.

Effects from Land and Special Use Authorizations: Various laws provide for rights-of-way over public lands. The Forest Service is responsible for all existing grants and permits located on NFS lands, including their administration, amendment, and renewal when authorized and appropriate.

Lands and special use actions have the potential to adversely affect cultural objects, sites, historic districts, and historic landscapes. Sale or trade of lands out of Federal ownership, even with management covenants may lead to the damage or destruction of cultural resources by the third party to which the land is conveyed.

As with other Federal undertakings, special use permits may adversely affect historic properties if regulations outlined in 36 CFR 800 are not followed. Many special use actions are relatively small compared to other actions and involve less than an acre for access, water, or utility corridors, but they can also affect very large areas, such as in the case of major pipe and power line projects.

Impacts to cultural resources would remain similar to current levels under the 1986 Forest Plan as amended for all alternatives.

Cumulative Effects

Cumulative effects over and above the direct and indirect effects mentioned above are minimal on the Shoshone due to the limited amount of private land within the Forest boundary. There are no known proposals for additional development of any of these lands. Lands adjacent to the Forest are primarily private or BLM. Private lands receive minimal pressure from urban development trends. The adjacent lands would likely continue to receive impacts from livestock grazing, recreational uses, and potential fires. These activities should not impact heritage sites on the Forest, but may increase exposure if heritage resources are adjacent to the affected areas. Individual site protections would be ensured through preparation of site-specific NEPA analysis, with protection offered through Forest-wide standards and guidelines.

Other natural impacts, such as weathering and deterioration, erosion, landslides, fires, and other physical/natural processes would occur under all alternatives and could be influenced by management activities. Any adverse effects can be resolved through compliance with Section 106 of the NHPA.

Finally, long-term consequences of unauthorized activities are also incorporated; for example, unauthorized vehicle travel through an historic property and vandalism and/or illegal excavation and collection of heritage resource artifacts. The most likely activities through forest planning that would affect heritage resources are vegetation management.

Social and Economic

Introduction

The social and economic implications of land management on the Shoshone are of interest to local residents surrounding the Forest, users of the Forest, and to people throughout the country who value or are interested in national forest resources. Historically, individuals in local communities developed strong place attachments to public lands that provided recreational, aesthetic, employment, and other contributions to their social environment. Work, place, and lifestyles became an integral part of the culture and social characteristics of such communities. These communities developed particular interests in the interactions of public lands with their ways of life and their economic present and future. These interests are expressed in their interactions with public lands in addition to the actions and comments of local interest groups.

People throughout the Nation also have interests and concerns about public lands in general as well as particular public lands such as those of the Shoshone. These interests are expressed in public comments to management actions as well as in direct experiences recreating, visiting, or otherwise using public lands. Some people also express their interest through national organizations with both broad-based concerns about the management of public lands and in specific resources such as old-growth forests, grizzly bears, or other threatened and endangered species. Thus, they are part of the social environment of public lands through the values and beliefs that motivate actions about particular places and by their comments and actions related to these places.

Policy decisions that influence the management of national forests attempt to balance the wide variety of uses and values individuals hold for forest resources. It is unlikely that any alternative selected in this process will answer the needs of all those interested in management of the Shoshone. Each alternative will be a compromise between the competing uses and values of the Forest. The balance achieved between conserving areas for recreation and providing commodity uses is important in contributing to the economic growth of rural economies (Lorah et al. 2012).

This analysis describes the potential social and economic impacts to different interests and values of the Shoshone resources by alternative. The analysis includes a description of the analysis area, demographics and trends within Wyoming, environmental justice considerations, and potential social and economic impacts by alternative on various Shoshone interests and values and resource user groups.

Legal and Administrative Framework

Laws and Executive Orders

- **Multiple-Use Sustained Yield Act of 1960**: Identifies principles for managing the resources of the National Forest System (NFS). The direction to manage these resources for the greatest good over time includes the use of economic and social analysis to determine management of the NFS.
- **National Environmental Policy Act of 1969**: Mandates consideration of the consequences to the quality of the human environment from proposed management actions. The agency must examine the potential impacts to physical and biological resources as well as potential socioeconomic impacts (40 CFR 1508.14).
- **Forest and Rangeland Renewable Resources Planning Act of 1974**: As amended by the National Forest Management Act of 1976, this act requires consideration of potential economic consequences of land management planning.

- **Office of Management and Budget Circular A-116 (issued August 16, 1978)**: Requires executive branch agencies to conduct long-range planning and impact analysis associated with major initiatives.
- **Executive Order No. 12898 on Environmental Justice (issued February 11, 1994)**: Mandates Federal agencies to make achieving environmental justice part of their mission. This includes identification and response to disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.
- **National Forest Revenue Act (amended 1908)**: Requires 25 percent of revenues generated by NFS lands to be paid to the states for use by the counties in which the lands are situated for the benefit of public schools and roads.
- **Secure Rural Schools and Community Self-Determination Act of 2000**: Designed to stabilize annual payments to states and counties containing NFS lands and public domain lands managed by the BLM. Funds distributed under the provisions of this act are for the benefit of public schools, roads, and related purposes.

Regulation and Policies

Regulations and policies have been passed in support of these laws and require the following:

- **1982 Planning Rule Procedures**: The procedures of the 1982 NFS Land and Resource Management Planning Rule requires the comprehensive consideration of economic benefits and costs, specifically identifying the social sciences, economic considerations, cost-efficient alternatives, impacts on present net value, and impacts on local employment.

Methodology

Various data sources were used to describe population, land ownership, employment, income, and county payments. These data sources include U.S. Census Bureau, the Bureau of Economic Analysis, Bureau of Labor Statistics, Montana Natural Resource Information, and the Economic Profile System — Human Dimensions Toolkit.

National forest contributions to employment and income and changes by alternative were estimated with input-output analysis using the IMPLAN (IMpact analysis for PLANning) modeling system (MIG 2003) and Forest Economic Analysis Spreadsheet Tool) (Alward et al. 2010). The IMPLAN modeling system allows the user to build regional economic models of one or more counties for a particular year. The model for this analysis used the 2009 IMPLAN data. Forest economic analysis spreadsheet tool (FEAST) is a spreadsheet modeling tool that serves as an interface between user inputs and imported data from an existing IMPLAN model.

Input-output analysis is a means of examining relationships within an economy, both between businesses and between businesses and final consumers. It captures all monetary market transactions for consumption in a given time period. Economic contribution analysis is defined as “the gross change in economic activity associated with an industry, event, or policy in an existing regional economy” (Watson et al. 2007). By using Forest Service expenditure data, resource output data, and other economic information, IMPLAN can describe, among other things, the jobs and income that are supported by NFS management activities. The direct employment and labor income benefit employees and their families and, therefore, directly affect the local economy. Additional indirect and induced, multiplier effects (ripple effects) are generated by the direct activities. Together the direct and multiplier effects comprise the total economic contribution to the local economy. The data used to estimate the direct effects from timber harvest is information provided by University of

Montana. The economic effects tied to other Forest Service programs and the multiplier effects were estimated using IMPLAN. Resource-specific data (recreation visits, range head months, timber volume harvested, etc.) were collected and input into the IMPLAN and FEAST models. For current management levels, a 3-year average using 2008 to 2010 data was calculated for resources to eliminate the year-to-year variability inherent in the data.

Present net value was calculated using a spreadsheet and estimated costs and values for goods and services for each alternative. Present net value combines benefits and costs that occur at different times and discounts them into an amount that is equivalent to all economic activity in a single year. Costs and values for anticipated activities, goods, and services over the next 50 years for each alternative were derived by resource specialists.

Spatial and Temporal Context for Effects Analysis

The relationship between the Shoshone and the local economy and lifestyle in the surrounding region is highly integrated and complex. Outdoor recreation, tourism, livestock grazing, and timber are all important aspects of the Shoshone to the surrounding region. This analysis examines the present economic and social conditions and forecasts for the counties that both influence and are influenced by the Shoshone. Estimates for potential economic or social impacts are considered in this analysis over the 15-year period that is the anticipated "life of the plan."

Generally, the economic and social impacts are considered indirect as they are a result of a direct result of a direct resource action taking place on NFS lands (timber sale, outfitter and guide permit, grazing permit, etc.). Cumulative effects are greatly influenced by economic and social trends and conditions occurring outside Forest Service control (gas prices, timber imports, beef industry conditions, new recreational equipment, etc.), but these trends and conditions have an effect on local communities within the study area.

The Shoshone National Forest's 2.4 million acres are located in portions of five Wyoming counties (table 165) including: Fremont, Hot Springs, Park, Sublette, and Teton. Due to the small amount of the Forest located in Teton (0.1 percent) and Sublette (0.3 percent), only Fremont, Hot Springs, and Park were considered in this analysis. Figure 29 highlights the portion of each county that includes NFS land.

Table 165. National Forest System land within counties encompassing the Shoshone National Forest, 2011

County	Total acres	Total NFS acres	Shoshone NFS acres	Percentage of county within Shoshone NF
Fremont	5,877,760	981,433	846,261	14%
Hot Springs	1,282,560	54,386	54,386	4%
Park	4,442,880	1,700,158	1,524,705	34%
Sublette	3,127,680	1,169,415	9,697	0.3%
Teton	2,556,800	1,370,507	2,682	0.1%

Source: USDA Forest Service, Lands 2011 Report. U.S. Census Bureau 2010.

The three-county area covers 18,129 square miles in northwestern Wyoming and was home to a population of 71,285 in 2009. The area's population resides in 28,564 households with an average household income of $98,924. The total personal income for the area was $2.8 billion in 2009. The area's economy contains 189 different industries that generated $4.7 billion of output in 2009. This economic activity supported 44,675 jobs and $1.7 billion in labor income (MIG 2010).

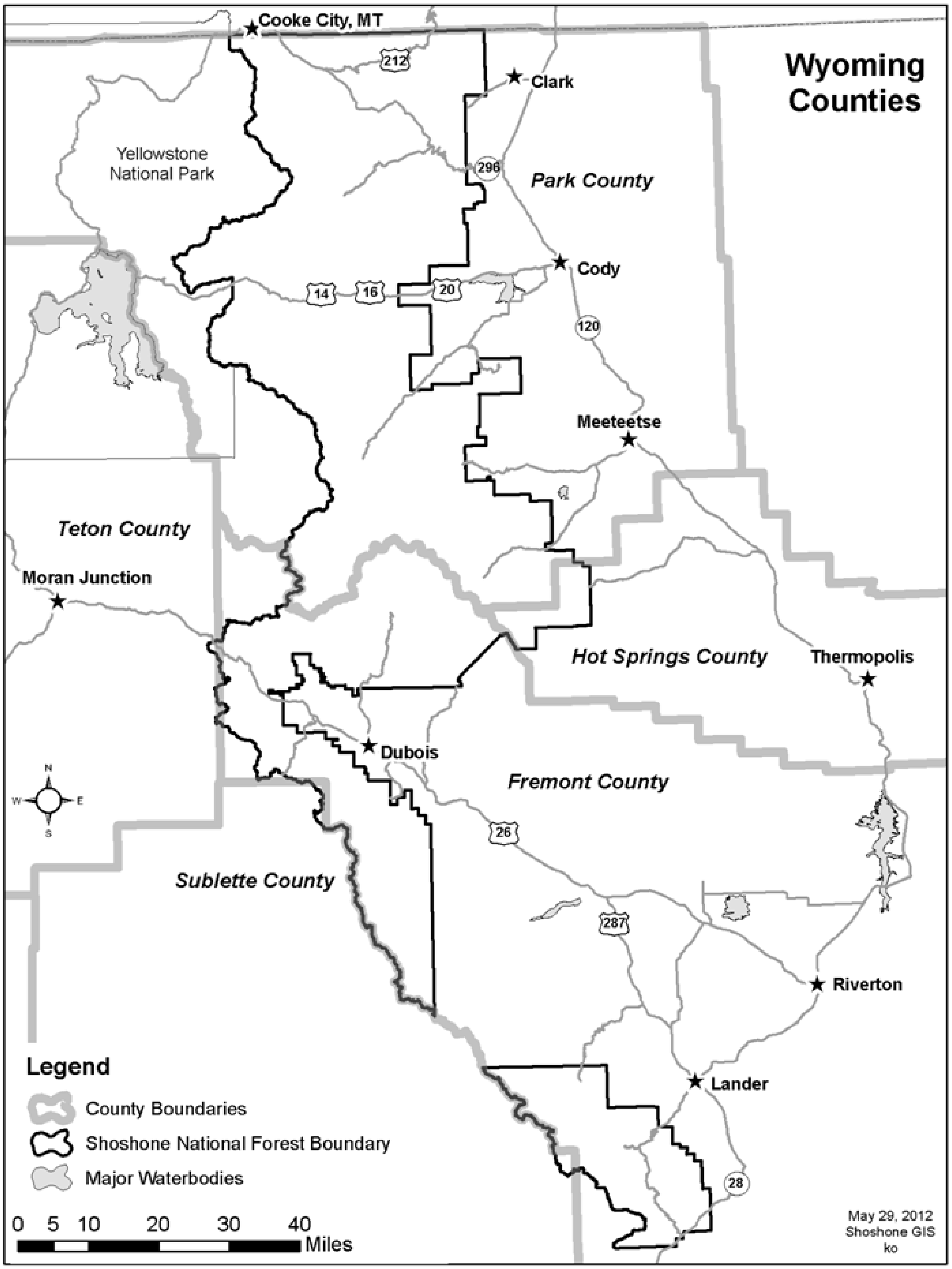


Figure 29. Counties within the Shoshone National Forest boundary

In terms of total output, the largest sectors in the three-county economy were, in order, extraction of oil and gas, public education, state and local government, drilling oil and gas wells, support activities for oil and gas operations, real estate establishments, food services and drinking places, and construction of new nonresidential structures. In terms of employment, the largest sectors in the three-county economy were, in order (largest to smallest), public education, state and local government, food service and drinking places, real estate establishments, construction of new nonresidential structures, and general merchandise (MIG 2010).

Incomplete and Unavailable Information

Economic data available for analysis has a 2-year time lag. So the most recent data available when the analysis began were for 2009, in some cases, data were updated to 2010 where available. But, for modeling, a 2009 model is used. This can create some concerns if the study area economy is changing quickly and the 2-year time lag does not reflect an accurate picture of what is happening on the ground in the communities. For use in Forest planning analysis, the model is used to show relative differences between alternatives, so the time lag in data should not create a problem, despite the recession and recovery taking place during the time lag.

Some interest groups have requested to have economic analysis by specific areas of the Shoshone or communities or for specific activities or uses. For the most part, the economic analysis considers the Forest as a whole and the counties surrounding it to be the impact area. Smaller areas are not broken out, as it is difficult to assign outputs or outcomes from one part of the Shoshone to a specific community or location. As for activities or uses, the basic forest industries are considered separately (wood products, grazing, recreation, etc.).

Recreation is not broken down by activities because the survey used to estimate visitor use (National Visitor Use Monitoring (NVUM) survey) results in a small subset of the sample with visitor expenditure information by activity. This small sample size will not produce estimates that are statistically valid. Some interest groups felt the economic analysis should include an analysis of motorized and non-motorized uses to highlight to economic benefits of the two types of uses. The Forest Service provides both motorized and non-motorized opportunities as part of the multiple-use mandate. The Shoshone is not required to manage for the highest dollar activities, but for a range of multiple uses. The use by recreational types is described in detail in the recreation section of this document.

Conflicting Science

Several recreational or tourism interest groups were interested in having specific economic studies from various sources used within this economic analysis. The Forest Service uses the NVUM survey for all recreation- and tourism-related information used for use and economic analysis. The Data Quality Act requires that Federal agencies ensure the “quality, objectivity, utility, and integrity” of information disseminated to the public. With these requirements for data used in the economic analysis, the Forest Service focuses on the NVUM survey that the methodology and results can be documented and repeated as needed. The interest group surveys completed use a variety of methodologies to complete their analyses. To be used within this economic analysis, all data would need to be collected using similar methods and assumptions. Without such consistencies, comparisons between interest group surveys or results are not possible in this analysis.

Affected Environment

In describing the social and economic environment that may be affected by the Shoshone forest plan, we draw directly from the economic (Taylor et al. 2012) and social (Clement and Cheng 2008) assessments conducted for the revision process. The following analysis highlights the conditions and trends found in the study area that will influence and be influenced by the revised Forest Plan.

Elements of the analysis include demographics, land ownership and use, lifestyle, attitudes, values, and beliefs, employment and income, payments to counties, and forest contributions.

Population Demographics

Population is an important variable to consider because the ability to attract and retain individuals to live and work within an area is critical to the survival of a community and its economy. Population statistics only account for permanent residents. However, seasonal workers, who are often missed in the April census count, and second home owners who are not counted, are temporary residents that are also important to the local economy and community.

Overall, the study area’s population increased by 10 percent from 2000 to 2010 (see table 166). Fremont County was the fastest growing with a 12 percent increase, followed by Park County with a 9 percent increase. Hot Springs County was estimated to have lost about 1 percent of its population between 2000 and 2010. Population growth in the study area was similar to the national rate between 2000 and 2010 (10 percent). The study area’s population growth rate was relatively modest comparable to that for Wyoming (14 percent). Wyoming ranked 12th out of the 50 states in population growth between 2000 and 2010. On an annual basis, the study area’s average population growth rate increased from 0.8 percent per year between 1990 and 2000 to 1.0 percent per year from 2000 to 2010.

Table 166. Population by county in Shoshone National Forest study area, 1990 to 2040

Year	Fremont	Hot Springs	Park	Study area
1990[a]	33,662	4,809	23,178	61,649
2000[a]	35,804	4,882	25,786	66,472
2010[a]	40,123	4,812	28,205	73,140
2020[b]	*42,170*	*4,875*	*29,510*	*76,555*
2030[b]	*45,490*	*4,957*	*31,030*	*81,477*
2040[b]	*48,840*	*5,052*	*32,570*	*86,462*
Change 1990 to 2000	6.4%	1.5%	11.3%	7.8%
Change 2000 to 2010	12.1%	-1.4%	9.4%	10.0%
Change 2010 to 2040	21.7%	5.0%	15.5%	18.2%

Sources: Woods and Poole Economics 2010, Wyoming Department of Administration and Information, Economic Analysis Division 2011.

[a] Reported from U.S. Census Bureau

[b] Forecasted from Woods and Poole Economics

Age of Study Area Population: Historically, all three counties in the study area have populations that are older than either Wyoming or U.S. average (table 167). In 1990, the percent of the region’s population 65 and over was 13 percent compared to 10 percent for Wyoming and 13 percent for the United States. The oldest population was in Hot Springs County where 19 percent of the population was 65 and over. The youngest population was in Fremont County where 12 percent of the population was 65 and over. In Park County, 13 percent of the population was 65 and over in 1990.

Table 167. Share of population age 65 and over in Shoshone National Forest study area, 1990 to 2040

Year	Fremont	Hot Springs	Park	Study area	Wyoming	U.S.
1990[a]	11.6	18.9	13.3	12.8	10.4	12.6
2000[a]	13.3	20.0	14.5	14.2	11.7	12.4
2010[a]	14.5	22.6	17.5	16.2	12.4	13.0
2020[b]	*18.5*	*28.2*	*24.1*	*21.2*	*16.4*	*16.1*
2030[b]	*21.6*	*30.2*	*28.7*	*24.8*	*19.4*	*19.4*
2040[b]	*20.8*	*26.1*	*28.3*	*24.0*	*18.8*	*20.2*

Sources: Woods and Poole Economics 2010. Wyoming Department of Administration and Information, Economic Analysis Division 2011.

[a] Reported from U.S. Census Bureau

[b] Forecasted from Woods and Poole Economics

By 2010, the percent of the study area's population 65 and over had increased to 16 percent, compared to 12 percent in Wyoming and 13 percent in the United States. Hot Springs County again had the oldest population with 23 percent of its population being 65 and over. Fremont County had the youngest population with 14 percent being 65 and over. In Park County, 17 percent of the population was 65 and over.

In 2010, Hot Springs had the oldest median age, 48.6 years, of any county in Wyoming. The median ages for Fremont, 38.5 years, and Park, 43.6 years, were also above the median for Wyoming (36.8) and the United States (37.2).

By 2040, it is projected that 24 percent of the study area's population will be 65 and over. This shift toward an older population will manifest itself in many ways, from preferred outdoor recreation activities on public lands, to the services locals demand from their local government, and the business mix of retail and services offered on Main Street.

Ethnicity of Study Area Population: Population changes relate not only to the number of residents in the region, but also to their ethnicity. Table 168 highlights the ethnic components of the counties in the analysis area. Except for the American Indian population, the area is not very ethnically diverse with 84 percent of the population being classified as white in 2010. Due to the presence of the Wind River Indian Reservation, 21 percent of the population in the Fremont County was classified as American Indian in 2010. As a result, the three-county area has a higher percentage of American Indian population than the State as a whole (12 percent versus 2 percent). The percentage of the population for every other non-white racial component is less than the State average. The racial composition of the region did not change dramatically between 2000 and 2010, although the percentage of the population classified as white decreased slightly and the percentage of the population for other groups increased slightly.

School Enrollment: Demographic changes in any region are often first detected in local schools. With an aging population, school enrollments in the three-county study area have generally declined over time. Table 169 displays the total school enrollment in the study area between 2001 and 2010. Hot Springs County had the largest decrease with a 14 percent decline, followed by Park County (-6 percent), and Fremont County (-2 percent). These declines compare to a 0.3 percent increase in school enrollment statewide between 2001 and 2010. All eight school districts in Fremont County had declining enrollments, except for the Fort Washakie and Arapahoe Districts. All three of the Park County school districts and the one Hot Springs County school district also had declining enrollments. However, all three counties have experienced slight upturns in school enrollment since 2007.

Table 168. Racial component of study area population by county, 2010

Area	Total population	White	Black	American Indian	Asian or Pacific Islander	Other/ multi-race	Hispanic, any race
Fremont	40,123	74.3%	0.3%	21.2%	0.4%	3.8%	5.6%
Hot Springs	4,812	95.8%	0.2%	1.5%	0.5%	2.0%	2.2%
Park	28,205	95.6%	0.2%	0.6%	0.7%	3.0%	4.8%
Study Area	73,140	83.9%	0.2%	11.9%	0.5%	3.4%	5.1%
Wyoming	563,626	90.7%	0.8%	2.4%	0.9%	5.2%	8.9%

Source: Wyoming Economic Analysis Division

Table 169. School enrollments by county in Shoshone National Forest study area, 2001 to 2010

Year	Fremont	Hot Springs	Park	Study area	Wyoming
2001	6,639	752	4,226	11,617	87,897
2002	6,504	702	4,055	11,261	86,116
2003	6,344	699	3,941	10,984	84,739
2004	6,299	679	3,893	10,871	83,772
2005	6,373	634	3,896	10,903	83,705
2006	6,362	623	3,938	10,923	84,629
2007	6,280	642	3,935	10,857	85,578
2008	6,342	655	3,952	10,949	86,519
2009	6,329	652	3,970	10,951	87,420
2010	6,493	650	3,973	11,116	88,165
Pct. Change 2001-2010	*-2.2%*	*-13.6%*	*-6.0%*	*-4.3%*	*0.3%*

Source: Wyoming Department of Education

School enrollment in kindergarten classes can provide some indication of future enrollment in local schools. Unlike total enrollment, kindergarten enrollment in the study area was 29 percent higher in 2010 than it was in 2001 (table 170). Fremont County had the largest growth with a 38 percent increase, followed by Park County (+29 percent). Kindergarten enrollment in Hot Springs County was the exception to this trend with a 35 percent decline between 2001 and 2010. Statewide kindergarten enrollment was 27 percent higher in 2010 than it was in 2001. Except for Hot Springs County, these trends may bode well for future school enrollments in the study area.

Table 170. Kindergarten enrollments by county in Shoshone National Forest study area, 2001–2010

Year	Fremont	Hot Springs	Park	Study area	Wyoming
2001	442	57	269	768	6,002
2002	464	44	291	799	6,165
2003	469	43	309	821	6,224
2004	473	51	259	783	6,263
2005	474	55	270	799	6,381
2006	464	54	285	803	6,576
2007	498	54	308	860	6,891
2008	514	39	303	856	7,215
2009	533	44	312	889	7,422
2010	609	37	348	994	7,611
Pct. Change 2001-2010	*37.8%*	*-35.1%*	*29.4%*	*29.4%*	*26.8%*

Source: Wyoming Department of Education

Land Ownership and Use

The three-county area covers 11.7 million acres with 51 percent in Fremont County, 38 percent in Park County, and 11 percent in Hot Springs County (Wyoming Department of Administration and Information 2010). Approximately 17 percent of the land area is in private ownership. This ranges from 14 percent in Fremont County to 17 percent in Park County, and 31 percent in Hot Springs County. About 62 percent of the land area is under Federal management. This ranges from 43 percent in Hot Springs County to 54 percent in Fremont County, and 79 percent in Park County. Tribal lands represent 16 percent of the land in the area. This ranges from 19 percent in Hot Springs County to 26 percent in Fremont County. There is no tribal land in Park County.

The Forest Service is the second largest Federal land manager in the area, after the BLM, accounting for 23 percent of the total land area. This ranges from 4 percent in Hot Springs County to 16 percent in Fremont County, and 38 percent in Park County. Sixty percent of the NFS land in the area is managed as wilderness. This ranges from 48 percent in Hot Springs County to 54 percent in Fremont County, and 63 percent in Park County.

Nearly 90 percent of the private land in the area is in agricultural use. This ranges from 86 percent in Park County to 90 percent in Fremont County, and 96 percent in Hot Springs. Approximately 111,200 acres of land in the area were in residential development in 2000 with 94 percent in exurban areas where the average lot size was between 1.7 and 40 acres. Between 1980 and 2000, the acres of residential development in the area increased by 32 percent, while the population increased by less than 1 percent. Nearly 98 percent of the increase was in exurban development. In the individual counties, the increase in acres of residential development ranged from 1 percent in Hot Springs County to 14 percent in Fremont County, and 73 percent in Park County.

Social – Values, Attitudes, Lifestyle

The State of Wyoming funded a study in 2007 of the residents around the Shoshone to find out about their values and preferences, and what forest management issues were important to them. The Study of Preferences and Values on the Shoshone National Forest final report was completed in 2008, and the results are summarized here.

The majority of survey respondents were interested in the management of the Shoshone. Of the residents surveyed, about 60 percent participated in motorized recreation on the Forest, and about 40 percent did not. The majority of those surveyed were satisfied with their summer recreation experience (80 percent) and their winter recreation experience (66 percent) on the Shoshone. The majority of those sampled (72 percent) would like to maintain the current level of outfitter and guide use on the Forest.

In terms of management on the Shoshone, there was limited support of those surveyed for construction of new road access (20 percent), the majority of people felt the Shoshone had enough roads (39 percent) or should construct a new road only if needed for another resource purpose (30 percent). The majority of those surveyed (84 percent) would like to see the same/current level or more active vegetation management, about 10 percent would like to see less or no active management of the vegetation.

Those surveyed were fairly evenly split on the question of designating additional roadless areas to wilderness, or leaving roadless areas undesignated.

People living around the Shoshone use the Forest throughout the year, with over 40 percent of those surveyed going into the Forest more than 10 times a year, with fewer visits during the winter. Figure 30 displays the level of use from residents over a 12-month period, and figure 31 shows the seasons of the year most used by the residents surveyed.

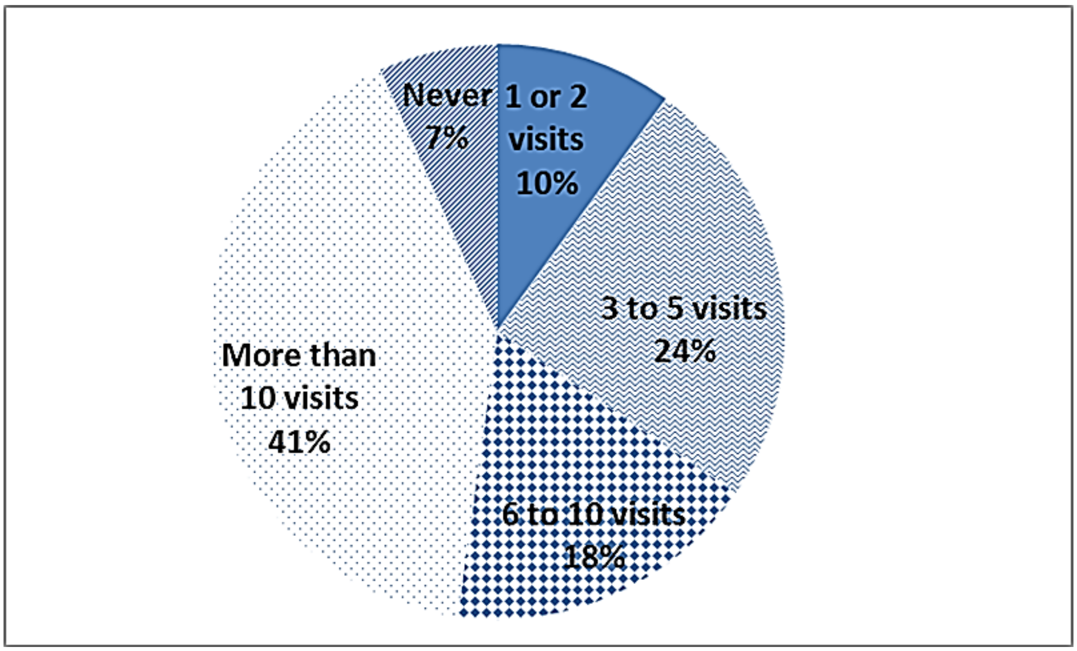


Figure 30. Level of Forest use by residents during a 12-month period

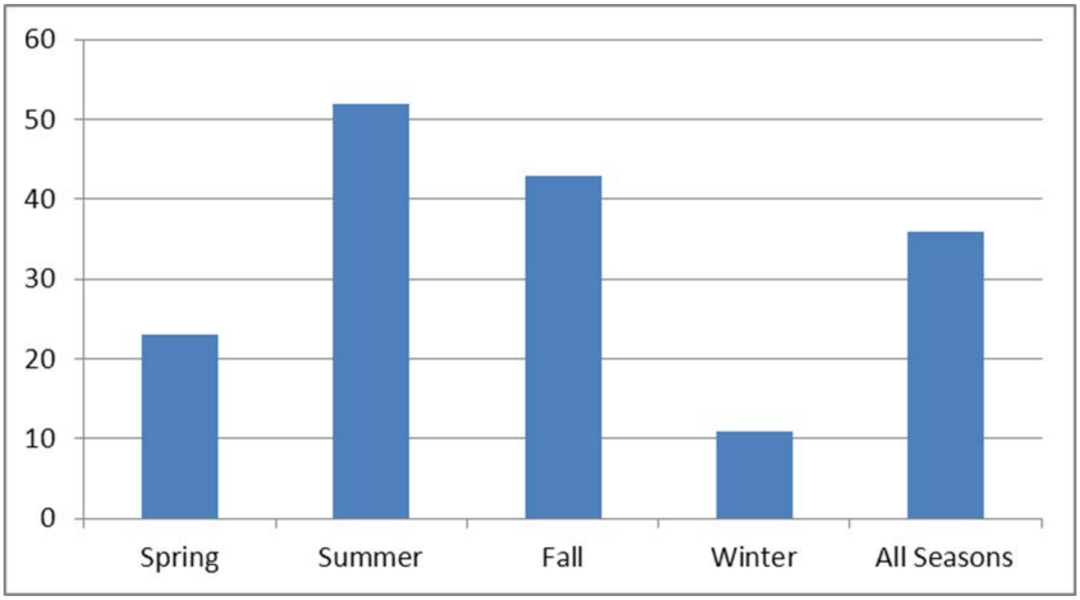


Figure 31. Survey results, what seasons do you visit the Shoshone National Forest?

A wide variety of recreational activities take place on the Shoshone throughout the year. Figure 32 displays those activities in which survey respondents participated on the Shoshone; each respondent was able to select more than one activity. The results are similar to national use trends on NFS lands.

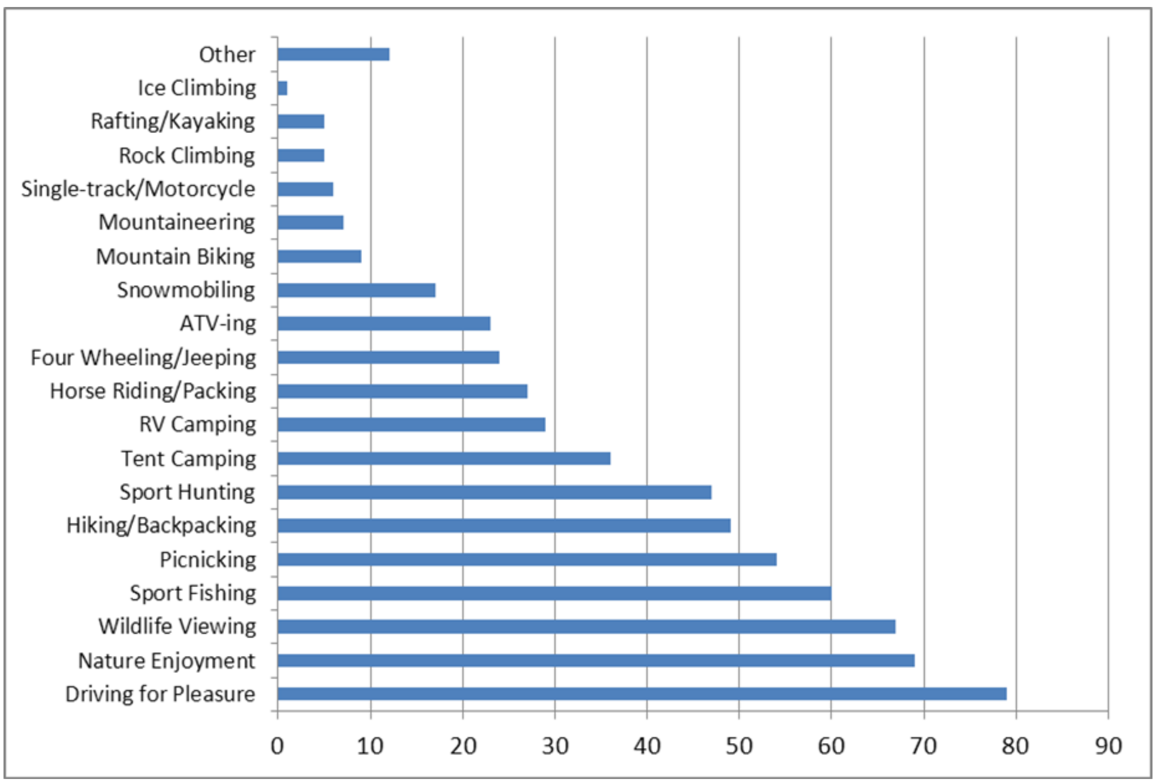


Figure 32. Survey results, what activities do you participate in on the Shoshone National Forest?

Social concerns are broad and complex enough that they do not constitute a single issue that can be easily measured and addressed. Generally, the values people hold toward forest resources is the measure used to assess if alternatives will have positive or negative impacts to various individuals or groups. There are many definitions of value, for this analysis it is assumed that we can understand forest values by understanding what is important to people (Kroger p. 156).

Forest values represent the importance and worth that people have assigned to NFS lands. Table 171 lists, in alphabetical order, major categories of forest values that individuals may hold for any forest resource or opportunity. People can hold multiple values for the same resource, or may hold very separate values for specific places or experiences. The same place or area will have different values to different people.

Table 171. Forest values that people may hold

Forest value	Description of why people hold this value
Aesthetic	Value the Shoshone because of the scenery, sights, sounds, smells, etc.
Biological diversity	Value the Shoshone because it provides a variety of fish, wildlife, plant life, etc.
Cultural	Value the Shoshone because it is a place to practice, and pass down wisdom and knowledge and traditions
Economic	Value the Shoshone because it provides timber, minerals, oil/gas/coal, and tourism opportunities (outfitter/guides)
Future	Value the Shoshone because it allows future generations to experience the Forest as it is now.
Historic	Value the Shoshone because it has places and things of natural and human history that are important
Intrinsic	Value the Shoshone in and of itself, just to know it exists, no use is needed to gain value
Learning	Value the Shoshone because one can learn about the environment through scientific observation or experimentation
Life sustaining	Value the Shoshone to produce, preserve, clean and renew air, soil and water
Recreation	Value the Shoshone because it provides a place for outdoor recreation activities
Spiritual	Value the Shoshone for sacred, religious, or spiritually special places, and for providing a feeling of reverence and respect for nature
Subsistence	Value the Shoshone because it provides necessary food and supplies to sustain life for individuals
Therapeutic	Value the Shoshone for physical and/or mental health

Source: Brown and Reed 2000, page 243

Conflicts occur when individuals or groups hold different forest values for the same resource or place. It is difficult to measure these forest values, so specific information is limited, and yet it is these differences in values that create resource management conflicts. Resolving conflicts among forest values is a political problem and would not be corrected by simply counting or measuring the values better (Challenges 1995, No 2). But understanding conflicts and the different preferences people have can be helpful for all involved in forest planning efforts.

Figure 33 displays the survey results of respondents when asked if they favor (solid bar) or oppose (cross hatch bar) different types of uses, recreational and commercial, on the Shoshone. The vast majority (98 percent) of respondents are in favor of wildlife viewing/observing as a use on the Shoshone, with no responses opposing that use. Similarly, sightseeing and fish/wildlife habitat use of the Shoshone received 96 percent favorable response with no opposing responses. Oil and gas drilling and commercial mining received the largest percentage of opposing responses, 55 percent of respondents felt those uses should not be occurring on the Shoshone.

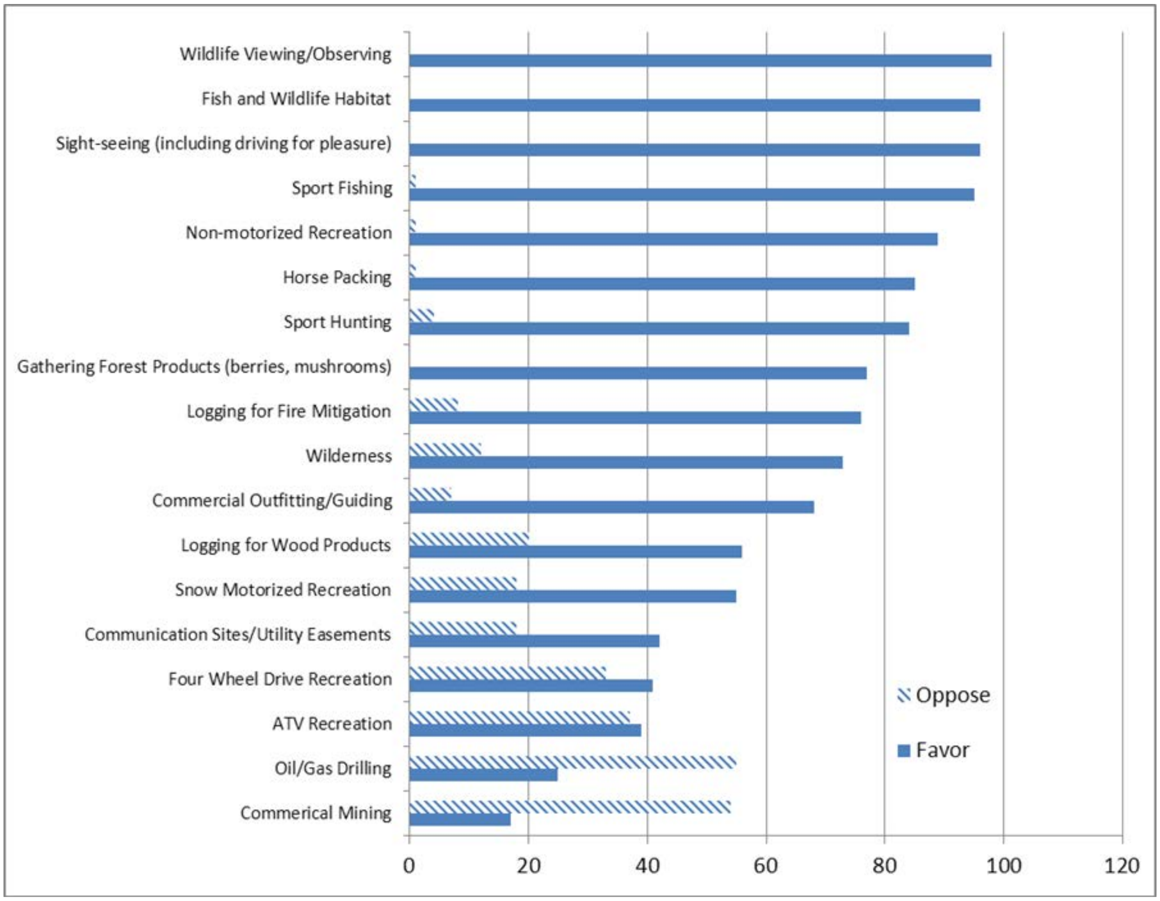


Figure 33. Survey results, respondents favor or oppose activities on Shoshone National Forest

The survey also asked residents about their values (as defined in table 171) of the Shoshone in general. Figure 34 highlights the results of respondents' values, with aesthetic, recreation, and biodiversity having the highest value scores. Subsistence, cultural, and spiritual had the lowest value scores; they are still positively valued, but may not hold as high a priority as some of the other values respondents were selecting between.

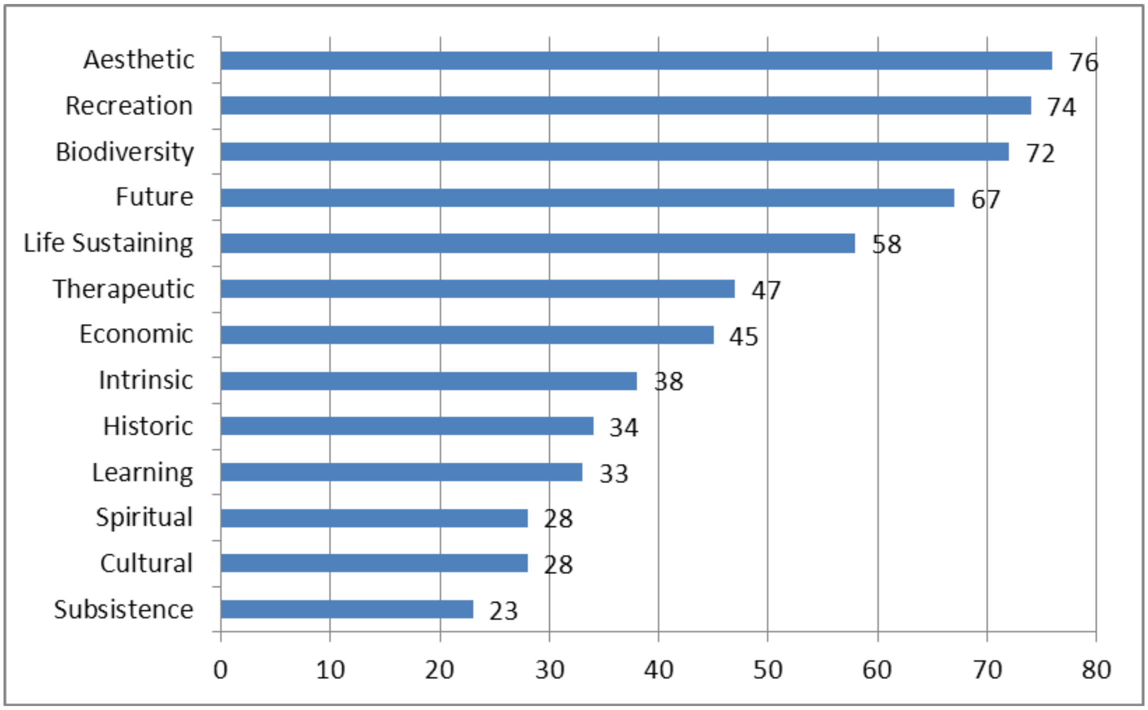


Figure 34. Survey results, what do you value about the Shoshone National Forest?

Values and Interests

The values and interests included in this analysis are based on responses to comments the public has provided to previous planning documents, and to survey results. The identified values and interests are not based entirely on a random sample; the survey conducted was a random sample, but people who chose to respond to a Forest Service comment period are self-selected. By focusing on those who commented, the analysis focuses on those people who hold strong values regarding forest resource management on the Shoshone.

This analysis centers on six broad categories of forest values/interests, based on the survey and comments received. The categories, defined in table 172, are used to display the differences between alternatives, and do not define specific individuals or groups, and do not represent a complete analysis of all possible interests people have for the Shoshone.

Several assumptions underlie this analysis:

- People make choices or reflect their preferences based on what is important to them (Kleindorfer et al. 1993).
- An individual may hold one or more of the values or interests for the forest resources described in this section. Consequently, the impacts of the alternatives on specific individuals may be cumulative, mixed, or singular, depending on how many different values the individual holds. For example, a person may hold values similar to those of the preservation category when considering wildlife habitat, but may hold values similar to the non-motorized recreation category when considering access to recreational opportunities.
- Management actions within the Shoshone that are inconsistent with people’s forest values are perceived by them as threatening and undermining to their values.

- The ability of Shoshone users to continue to engage in current or future use of the NFS lands and to maintain the quality of their experience is tied to the ecological health of the natural resources found there.

Table 172. Forest value/interest categories used for Shoshone analysis

Value or interest category	Defined for Shoshone National Forest analysis
Preservation	Values the Shoshone for the natural processes and opportunities provided without additional management or infrastructure development. Much of the value is in knowing that the Forest exists and that it is protected from future development, rather than associated with actual use, visitation, restoration, or management.
Recreational use – non-motorized	Values maintaining or expanding non-motorized opportunities on the Shoshone. There is some division in this category between those interested in mechanized use (mountain bikes) and those who would like to limit access to hiking and horses. Overall, the desire is for quiet/non-motorized experiences within the national forest.
Recreational use – motorized	Values gaining access via roads to the Shoshone, as well as maintaining current motorized use for recreational opportunities. For some, driven by need or disability, the desire for roaded access is due to the inability to get into the Forest without the road system. For others, desire for additional roaded access is the preferred method of travel, the travel itself is the recreational experience. Others value, where appropriate, increasing back country motorized trails/singletrack (summer and winter use) rather than roads.
Wildlife and fish – hunting/fishing	Values maintaining habitat conditions for healthy populations of wildlife on the Shoshone. Great interest in hunting, fishing and wildlife viewing. Values access to non-motorized experiences as well as management activities that would restore or improve habitat for wildlife and fish.
Tourism – non-motorized	This category is commercial interest, capitalizing on the natural amenities that attract customers to the area for leisure activities. Scenery is of concern to this category, but most importantly is the value of access to non-motorized opportunities on the Shoshone to provide wilderness experiences.
Resource economic opportunities	Values commercial activities on the Shoshone such as timber, grazing, oil and gas development, mining, utilities, and other uses where appropriate. Values future access as needed to facilitate continued resource development and support of local resource jobs and income.

Employment and Income

The employment data presented here was obtained from the U.S. Department of Commerce; Bureau of Economic Analysis's Regional Economic Information System (REIS) and represents the latest data that are currently available for counties in the United States (2009). REIS data was used because it provides estimates of all employment in a region, including those individuals who are self-employed. In some cases employment for an individual industry is not reported by REIS due to confidentiality requirements. In these cases the industry employment was estimated based on information from Woods and Poole Economics.

Economic Contribution of the Shoshone National Forest to the Economic Study Area

Management of national forests contributes to the local economies by the products (e.g., timber, livestock grazing, minerals, etc.) that are produced on the national forests and processed in the local economy; by uses (e.g., recreation visits, etc.) that occur on the national forests; and by the service provided by employees of the national forests.

An IMPLAN input-output model was constructed to estimate the economic contribution of the national forests to the analysis area economy. The IMPLAN model was constructed using 2009 IMPLAN data (the most recent IMPLAN data available).

Table 165, table 173, and table 174 provide a summary of the study area's economy and the contribution of the Shoshone on the region's economy. Table 174 highlights the study area's totals for all employment and earnings within the three-county area. Fremont County supports the highest number of jobs, but Park County has the highest average earnings per job. Hot Springs County has average earnings per job that is about $3,500 less than the study area average.

Table 173. Economic impact summary for the Shoshone National Forest, 2009 (2009 Dollars)

County	***Employment (Jobs)***	**Labor** ***Earnings (000$)***	**Average** ***Earnings Per Job***
Fremont	24,752	$876,813	$35,424
Hot Springs	3,304	$106,532	$32,243
Park	20,698	$760,895	$36,762
Study Area Total	48,754	$1,744,240	$35,776

Sources: 1) U.S. Department of Commerce
2) U.S. Department of Commerce, University of Montana, Dean Runyan Associates

Table 174. Shoshone National Forest – forest-related industries

	Fremont	**Hot Springs**	**Park**	**Study area**
Industry	(Jobs)	(Jobs)	(Jobs)	(Jobs)
Agriculture	1,481	188	928	2,597
Wood Products	58	0	125	183
Travel	1,580	360	3,540	5,480
NLI+	448	63	585	1,113
Totals	3,567	611	5,178	9,373
Industry	**Fremont** (Earnings) (000$)	**Hot Springs** (Earnings) (000$)	**Park** (Earnings) (000$)	**Study area** (Earnings) (000$)
Agriculture	-$2,007	$1,013	$8,702	$7,708
Wood Products	$2,106	$0	$4,577	$6,683
Travel	$41,100	$7,600	$75,000	$123,700
NLI+	$13,876	$1,670	$16,840	$32,387
Totals	$55,075	$10,283	$105,119	$170,477
Average Earnings/Job	$15,440	$16,830	$20,301	$18,188

Sources: 1) U.S. Department of Commerce
2) U.S. Department of Commerce, University of Montana, Dean Runyan Associates
NLI+ = Non Labor Income above the state average (used a proxy for amenity residents)

The contribution analysis considers the impact of the Shoshone on the economy of the three-county region through the forest-related industries. Forest-related industries are at least partially dependent on national forest resources. In other words, a portion of the economic activity associated with these industries is dependent on the use of natural resources within the Shoshone. For this analysis, forest-related industries were defined as Agriculture, Wood Products Manufacturing, Travel (outdoor recreation and tourism), and proportion of non-labor income above the State average (NLI+). In this section the proportion of non-labor income above the State average was used as a proxy for the income of amenity residents. Amenity residents are residents who live in the region specifically because of the region's amenities. Some unknown portion of the attractiveness of the region to amenity residents is likely associated with the Shoshone.

Table 174 displays the importance of forest-related industries on the economy of the three-county study area. Total direct regional employment for forest-related industries was 9,373 jobs in 2009. This represented nearly 20 percent of the total employment in the three-county region. Travel was the largest forest-related industry in terms of employment (58 percent), followed by agriculture (28 percent), NLI+ (12 percent), and wood products manufacturing (2 percent). Among individual counties, the percentage of total employment from forest-related industries ranged from 14 percent in Fremont County to 25 percent in Park County, with Hot Springs County at 18 percent. In all three counties, the largest forest-related industries in terms of employment were travel and agriculture.

Total direct regional labor earning for the forest-related industries was $170.5 million in 2009. This represented 10 percent of total labor earnings in the three-county region. Travel was the largest forest-related industry in terms of labor earnings (73 percent), followed by NLI+ (19 percent), agriculture (5 percent), and wood Products Manufacturing (4 percent). Among individual counties, the percent of total labor earnings from forest-related industries ranged from 6 percent in Fremont County to 14 percent in Park County, with Hot Springs County at 10 percent.

Average earnings per job for forest-related industries-related employment were below the regional average. In 2009, average earnings per job for forest-related industries were $18,188, which was 50 percent below the region's average ($35,776). Much of this difference was due to the low labor earnings in agriculture in 2009, although average earnings per job for the other three industries were also below the study area average in 2009. Among individual counties, average earnings per job for forest-related industries ranged from 56 percent below the study area average for Fremont County to 45 percent below for Park County. For Hot Springs County average earnings per job for forest-related industries were 48 percent below the study area average.

For some forest-related industries, it was possible to estimate the contribution of the Shoshone on the three-county study area economy. For those industries, summarized in table 175, it is estimated that economic activity on the Shoshone generated 1,260 jobs in the study area economy. This estimate is based on the IMPLAN model for the region and includes both direct and secondary jobs. The total jobs from the Forest represent 3 percent of the total jobs and 13 percent of the total forest-related industries jobs in the region. Approximately 31 percent of the forest-related jobs was associated with general visitation to the Shoshone with 28 percent from commercial recreation, 16 percent from livestock grazing, 7 percent from timber, and 19 percent from Forest Service employment. It was not possible to estimate the proportion of NLI+ that was strictly related to the Shoshone National Forest activity.

Table 175. Shoshone National Forest economic contribution

	Study Area *Employment* *(Jobs)*	Study Area *Earnings* *(000$)*	Average *Earnings* *Per Job*
Livestock grazing	200.7	$6,467	$32,220
Timber	82.6	$1,893	$22,918
Forest visitors	388.4	$10,234	$26,350
Commercial recreation	353.0	$7,539	$21,358
Shoshone National Forest	235.7	$10,578	$44,879
Totals	1,260.4	$36,711	$29,127

Forest-related employment was estimated to generate $36.7 million in labor earnings in the region. These labor earnings represented 2 percent of total labor earnings and 21 percent of total forest-related industries labor earnings in the study area. Average earnings per job for forest-related employment was $29,127, which was 18 percent below the study area average.

While the economic impacts of the Shoshone are not a large percentage of total employment and labor earnings in the study area, they are not insignificant. At the national level, the economic impact of the Shoshone would be equivalent to 3.7 million jobs and $130.9 billion in labor earnings in 2009. To put this in perspective, 3.7 million jobs represent 60 percent of the total number of jobs lost nationally during the recent recession. Thus, relatively small percentage changes can have important implications for the economies at both the national and regional level.

Although ranches in the region are typically only dependent on Federal land grazing for forage during certain times of the year, this forage source can be a critical part of their livestock operation. Greer (1994) and Taylor et al. (1992) both found that while the reliance of ranchers on forage from Federal land grazing can appear relatively unimportant when calculated on an acreage or AUM basis, they become quite important when calculated on a seasonal dependency basis. The rigidity of seasonal forage availability means that the optimal use of other forages and resources are impacted when Federal AUMs are not available, Torell et al. (2002). Bartlett (1983), Gee (1983), Hahn et al.(1989), Bartlett et al.(1979), Gee (1981), Perryman and Olson (1975), Rowe and Bartlett (2001), Torell et al.(1981), and Van Tassell and Richardson (1998) have all found that potential reductions in income and net ranch returns are greater than just the direct economic loss from reductions in Federal grazing. The economic assessment (Taylor et al. 2011) completes a methodology and documents potential impacts to ranch profitability or viability based on changes to Federal grazing.

Based on the fact that the Shoshone has had little or no mineral activity for the last 25 years, that we project a low probability of any development during the planning period, and that we project that any development that did occur would be the same in all alternatives no economic analysis of minerals was conducted. Specific information about mineral activity is included in the minerals section of this chapter.

Regional Totals

In terms of regional data, table 173 indicates there were a total of 48,754 jobs in the three-county region in 2009. Fifty-one percent of this employment was in Fremont County with 42 percent in Park, and 7 percent in Hot Springs. Labor earnings for the three-county region totaled $1.7 billion in 2009. Forty-nine percent of this income was in Fremont County with 45 percent in Park County, and

6 percent in Hot Springs County. Average earnings per job for the region was $35,776. County averages ranged from $32,243 in Hot Springs County to $36,762 in Park County, with Fremont County at $35,424.

Payments to Counties

State and local government cannot tax federally owned lands the way they would if the land were privately owned. A number of Federal programs exist to compensate county governments for the presence of Federal lands. These programs can represent a significant portion of local government revenue in rural counties with large Federal land holdings.

Before 1976, all Federal payments were linked directly to receipts generated on public lands. Congress funded the Payments in Lieu of Taxes (PILT) program with appropriations beginning in 1977 in recognition of the volatility and inadequacy of Federal revenue sharing programs. PILT was intended to stabilize and increase Federal land payments to county governments. PILT payments are also important because they are not restricted to particular local government services, but can be used at the discretion of county commissioners to fund any local government needs. The annual payment by county is based on a maximum per-acre payment reduced by the sum of all revenue sharing payments and subject to a population cap. PILT is permanently authorized, but Congress must appropriate funding on an annual basis. PILT was typically not fully funded until FY 2008 when counties received a guarantee of 5 years at full payment amounts (FY 2008 to FY 2012 payments).

The 25 percent Fund, established in 1908, shares revenue generated from the sale of commodities produced on public land with the county where the activities take place. Twenty-five percent of the value of public land receipts are distributed directly to counties and must be used to fund roads and schools. States determine how to allocate receipts between these two local services. The Secure Rural Schools and Community Self-Determination Act of 2000 (SRS), or Public Law 106-393 was enacted to provide 5 years of transitional assistance to rural counties affected by the decline in revenue from timber harvests on Federal lands. SRS was reauthorized for a single year in 2007, and again in 2008 for a period of 4 years.

The SRS Act has three titles that allocate payments for specific purposes.

- Title I – these payments to counties make up 80 to 85 percent of the total SRS payments and must be dedicated to funding roads and schools. States determine the split between these two services, and some states let the counties decide.
- Title II – these funds are retained by the Federal Treasury to be used for special projects on Federal land. Resource advisory committees at the community level help make spending determinations and monitor project progress.
- Title III – these payments may be used to carry out activities under the Firewise Communities program, to reimburse the county for search and rescue and other emergency services, and to develop community wildfire protection plans.

Figure 35 displays the revenue sharing for fiscal years 1986 through 2010.

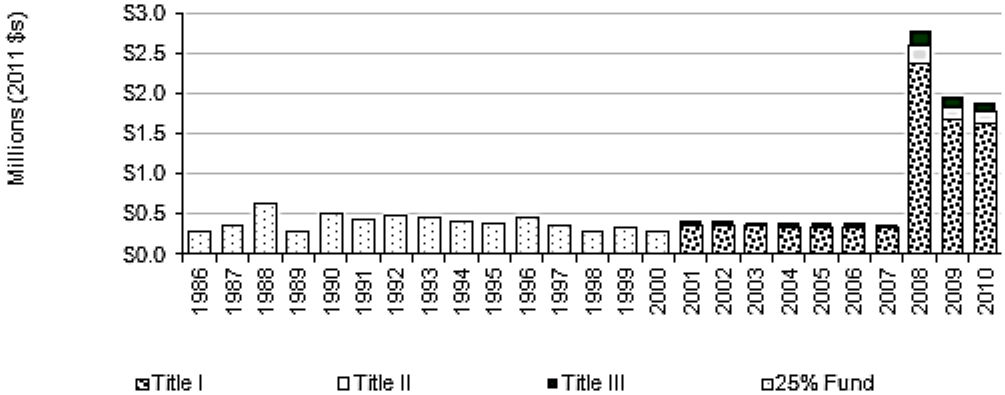


Figure 35. Forest Service revenue sharing within study area, fiscal years 1986 to 2010

SRS received broad support because it addressed several major concerns around receipt-based programs: volatility, the payment level, and the incentives provided to counties by linking Federal land payments directly to extractive uses of public lands.

Table 176 displays fiscal year 2010 Federal payments within the study area counties by type of payment.

Table 176. Components of Federal land payments to State and local governments by geography of origin, FY 2010 (2011 Dollars)

	Fremont County	Hot Springs County	Park County	Study Area
Total Federal land payments by geography of origin	$3,008,686	$829,800	$2,315,136	$6,153,622
PILT	$1,907,983	$713,956	$1,221,349	$3,843,287
Forest Service payments	$829,437	$37,328	$1,026,606	$1,893,370
BLM payments	$271,266	$78,517	$67,182	$416,965
Percent of Total				
PILT	63.4%	86.0%	52.8%	62.5%
Forest Service payments	27.6%	4.5%	44.3%	30.8%
BLM payments	9.0%	9.5%	2.9%	6.8%

BLM Payments: The BLM shares a portion of receipts generated on public lands with state and local governments, including grazing fees through the Taylor Grazing Act and timber receipts generated on Oregon and California (O & C) grant lands.

PILT and SRS each received a significant increase in Federal appropriations in FY 2008 through the Emergency Economic Stabilization Act of 2008. Despite the increased appropriations, SRS is authorized only through FY 2011, PILT only through FY 2012, and Federal budget concerns are creating uncertainty for the future of both. Figure 36 highlights the overall trend in Federal payments within the study area between 1986 and 2010.

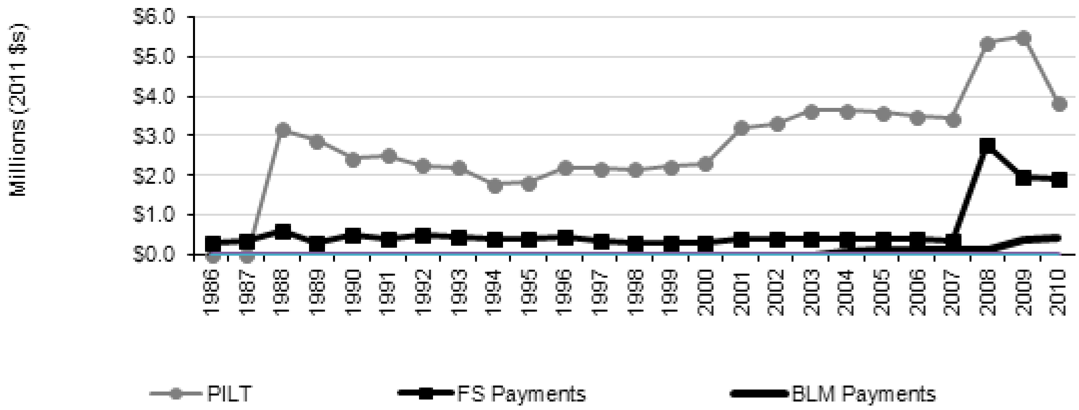


Figure 36. Components of Federal land payments within study area by fiscal year, 1986 to 2010

Desired Condition

The Shoshone contributes to the social and economic well-being of local communities by promoting sustainable use of renewable natural resources. Timber is provided for commercial harvest, forage for livestock grazing, exploration and development opportunities for mineral resources, and settings for recreation are consistent with goals for watershed health, sustainable ecosystems, biodiversity and viability, and scenic or recreation opportunities.

Environmental Consequences

The Shoshone provides a variety of uses, values, benefits, products, services, and visitor opportunities (termed “outputs and values”). Under all alternatives, these outputs and values will be provided in a sustainable manner, supplying outputs and values for current and future generations. These outputs and values contribute to the sustainability of the social and economic systems within the analysis area.

While the analysis area is affected by the management activities, uses, and outputs of the Shoshone, there are also many external factors that affect local counties and communities. These external factors include national and regional population trends, national trade agreements, state and national laws and regulations, technological advances in manufacturing, technological advances in recreation equipment, cultural trends, and changes in societal values. These external factors often have a larger impact on the social and economic environment than does management of the Forest. This section addresses the potential effects from Shoshone management decisions from the alternatives.

Direct and Indirect Effects

Population

Population is not expected to vary by alternative. Current trends are expected to continue over the life of the revised Forest Plan.

Land Ownership and Use

Land ownership is not expected to change under any alternative. There may be some land exchanges in the future, but it is not expected to result in any net increase in lands administered by the Shoshone. Any future land exchanges or sales would be assessed to determine specific impacts.

Lifestyles, Attitudes, Values, and Beliefs

Each of the seven alternatives differs in the balance point between key conflicting values. Effects on values and interests are described in terms of the six key categories outlined in table 172. The analysis presented by alternative below uses public comments and information from the social survey completed on the Shoshone to describe the potential effects of and differences among the alternatives.

Preservation

The existing plan (alternative A) has much to offer those who value preservation. Over 50 percent of the forest is currently designated wilderness. Another 30 percent is inventoried roadless areas that have many characteristics that are similar to wilderness. Much of the inventoried roadless area has rarely seen any type of motorized recreation or vegetation management. None of these additional lands would be recommended for wilderness in alternative A.

Alternative C would be the preferred alternative for those with preservation interests/values. Alternative C recommends an additional 25 percent of the forest for wilderness designation. In inventoried roadless area not recommended for wilderness, motorized recreation would be prohibited. Miles of open road, motorized trails, and snowmobile trails would all be reduced in this alternative. For people interested in allowing nature to take its course and with a strong preference for non-motorized opportunities, this alternative best meets those interests/values.

Alternative D would be preferred over alternative A by those with preservation interests/values. It recommends an additional 8 percent of the forest for wilderness designation. Like alternative C, it would prohibit motorized recreation within most inventoried roadless areas. Unlike alternative C, it would not reduce the miles of existing open roads, motorized trails, or snowmobile trails. For these items, alternative D would be the same as alternative A.

Alternative F would be the least favored alternative for those with preservation interests/values. It does not propose any new wilderness. It opens most inventoried roadless areas to some motorized recreation and would increase the area of the forest that would be open to active vegetation management. Alternative E is similar to alternative F, but it would be slightly less impactful to preservation values. It would not open as much of the inventoried roadless areas to motorized activity and less of the forest is open to active vegetation management. But overall, both alternatives E and F would be less valued by persons with preservation interests/values than alternative A.

Persons with preservation interests/values would likely consider alternatives B and G similar. Neither alternative proposes additional wilderness designations. Both alternatives would manage inventoried roadless areas according to the 2001 Roadless Conservation Rule. This prohibits the construction of new permanent roads except under certain conditions and it limits the use of vegetation treatments to specific situations within inventoried roadless. Large areas of inventoried roadless areas would be managed to prohibit motorized activities. Though not as restrictive as alternatives C and D, many of these lands would be maintained in a manner that is consistent with those with preservation interests/values. The portion of the forest that would be actively managed in alternatives B and G is similar to the area in alternative A.

Recreation non-motorized

All the alternatives will provide some opportunity to those persons who value non-motorized recreation in a quiet environment; given that over 50 percent of the forest is designated wilderness under all alternatives. There is variation among the alternatives on how much additional opportunity for non-motorized recreation would be provided on the areas outside of designated wilderness.

In alternative A, there are large areas that provide an exclusive summer non-motorized experience. This is provided on over 75 percent of the forest. In the winter, most of the area outside of wilderness allows some level of winter motorized experience. Exclusive non-motorized recreation is provided on just over 60 percent of the forest. This is contrary to those who would desire a quiet non-motorized experience in the winter. Despite the area being open to motorized use, use is normally low in many of these areas.

The comparison of the alternatives for those that value non-motorized recreation is similar to the comparison to those that value preservation. The main difference is that that those that value non-motorized recreation are not as tied to the designation of wilderness. Their values can be met through management that emphasizes non-motorized recreation with or without the wilderness designation.

Alternative C would be the preferred alternative for those with non-motorized recreation interests/values. Over 80 percent of the forest would provide an exclusively non-motorized experience in the summer and over 90 percent would provide an exclusively non-motorized experience in the winter. Alternative D would be similar to C, providing non-motorized experiences on over 80 percent in both the summer and winter.

Alternative F would be the least favored alternative for those with non-motorized recreation interests/values. This alternative would provide exclusive non-motorized experience on just under 70 percent of the forest in both the summer and winter. For those who value non-motorized recreation, this alternative would be worse that alternative A in the summer, but better in the winter. Alternative E provides more non-motorized experiences than alternative F, around 75 percent of the forest is exclusively non-motorized in the summer, which would still be less than alternative A. And in the winter, around 80 percent of the forest would be exclusively non-motorized—more than alternative A.

For those persons who favor non-motorized recreation experiences, alternatives B and G would be more favorable than alternative A. In alternative B, the area for summer exclusive non-motorized use would be similar to alternative A, while in alternative G it would be slightly higher than alternative A. The area of exclusive non-motorized use in the winter for both alternatives B and G would be around 80 percent and 75 percent, respectively. For those persons who favor non-motorized recreation, this would be much better than the 60 percent in alternative A.

Recreation motorized

All the alternatives provide some value to those persons who value motorized recreation. Over 50 percent of the forest is already designated wilderness, and does not provide motorized recreation opportunities in any of the alternatives. There is variation among the alternatives on the level of opportunity that would be provided on the areas outside of designated wilderness. Summer motorized use is only allowed on designated roads and trails in all alternatives. When we discuss the area of the forest that could be open to motorized use, we are referring to that area where motorized roads and trails could be designated. In many cases, those acres may not provide those motorized opportunities now, because the environmental analysis to designate the route will not occur until the plan is implemented after a final decision is made on the plan.

In alternative A, less than 25 percent of the forest is available for summer motorized experiences. In the winter most of the area outside of wilderness, about 35 percent, allows some level of winter motorized experience.

The comparison of the alternatives for those who value motorized recreation is the converse of those who value non-motorized recreation.

Alternative C would be the least favored alternative for those with motorized recreation interests/values. Less than 15 percent of the forest would provide a motorized experience in the summer and less than 5 percent in the winter. In addition, Alternative C would result in the closure of existing open roads (10 percent) and snowmobile trails (60 percent). Alternative D is similar to alternative C in that it would provide motorized experiences on less than 15 percent of the forest in the summer and winter. Alternative D would not result in the closure of any existing roads or snowmobile trails.

Alternative F would be the most favored alternative for those with motorized recreation interests/values. This alternative would provide motorized experience on over 30 percent of the forest in both the summer and winter. For those who value motorized recreation, this alternative is better than alternative A in the summer, but slightly worse in the winter. Alternative E would provide slightly less exclusive motorized experiences than alternative F. Under alterative E, 25 percent of the forest would be motorized in the summer (more than alternative A), and around 20 percent in the winter, which is less than alternative A.

For those persons who favor motorized recreation experiences, alternatives B and G would provide fewer opportunities than alternative F. The area for summer motorized use in alternative B would be similar to alternative A, while in alternative G it would be slightly lower than alternative A. Though G would be lower than B, it does try and locate those areas available for summer motorized use in areas that do not conflict with grizzly bear management that would restrict motorized use. As a result of this shifting, it is possible that alternative G may provide more opportunity than alternative B in the long term. The area of motorized use in the winter for both alternatives B and G would be around 20 percent and 25 percent, respectively. For those persons who favor motorized recreation, this is less than the 35 percent in alternative A.

Wildlife and Fish

All the alternatives provide some value to those persons with values/interest in wildlife and wildlife habitat. Persons with these values include those who engage in wildlife viewing and those who like to hunt and fish. There are some value differences from viewers of wildlife and those who hunt or fish. For the most part, those value differences are not impacted by forest management, since all segments generally favor high quality habitat. Some individuals believe that any management actions are a negative impact to wildlife populations and would not favor any active management. For the purposes of this discussion, those individuals are included with those persons who value preservation. In this group we are addressing those individuals who value wildlife and wildlife habitat and are also supportive of management actions that are focused on benefiting wildlife.

Alternative A includes direction that supports the recovery of threatened and endangered species, grizzly bear and Canada lynx. This alternative recognizes the need to protect big game critical winter range, but does not always allocate winter range to management prescriptions that would provide that protection. The alternative includes a temporary restriction on recreation pack goat use to protect bighorn sheep in core habitat that would be allowed to expire. The alternative is implemented in a manner to protect Region 2 sensitive species, but does not always contain specific direction on that protection.

Generally, persons who value wildlife are not as supportive of alternatives that have a strong focus on other resource values such as timber harvest or mineral extraction. Those alternatives do contain direction to protect wildlife because there would be impact on wildlife even if that impact is mitigated.

Alternative F would be the alternative least favored by persons that value wildlife and wildlife habitat. The alternative focuses large areas of the forest on commercial timber harvest, livestock grazing, oil and gas development, and motorized recreation. Some of the vegetation treatments would improve limited habitats such as aspen, sagebrush, and whitebark pine. Protection would likely be reduced for grizzly bear and Canada lynx, with no timing restrictions for winter motorized use on crucial winter range, no priority given to big game use of forage on crucial winter range, crucial winter range would be open to oil and gas development, and recreation pack goat use would be allowed to continue in bighorn sheep core habitat.

Alternative E would also not be favored by persons with values/interest in wildlife, but it would be slightly more favored than alternative F. Alternative E focuses less on the forest resource extraction than alternative F. Some of the vegetation treatments would improve limited habitats such as aspen, sagebrush, and whitebark pine. It would include protection for grizzly bear and Canada lynx. It would not prioritizing forage for big game, but it would limit winter motorized use on most of the crucial winter range. Large areas of the forest would still be open for oil and gas development, but much less than in alternative F. Recreational pack goat use would be allowed in bighorn sheep habitat.

Alternatives C and D would be the most favored alternatives by persons who value wildlife and wildlife habitat. They focus much less of the forest on resource extraction. A larger percentage of the vegetation treatments to be conducted would be for the benefit of wildlife. For persons who want more vegetation management for wildlife, alternative D may be preferred over alternative C. The wilderness recommendation in alternative C results in fewer acres on the forest being available for conducting vegetation treatment that would improve wildlife habitat. Alternative C would eliminate all winter motorized use on all big game winter range. Alternative D would eliminate motorized use on all crucial big game winter range. Alternative C would also eliminate livestock grazing on big game winter range. Under both alternatives much less of the forest would be open to summer and winter motorized use. Alternative C would eliminate recreational pack goat use throughout the forest, while alternative D would eliminate pack goat use just within bighorn sheep core habitat. Both alternatives would include protections for grizzly bear and Canada lynx.

Alternatives B and G would be less favored than C and D, but more favored than alternatives E and F. All protections for grizzly bear and Canada lynx would be included. Both would eliminate recreational pack goat use in bighorn sheep core habitat. Both would prioritize forage in crucial winter range for big game. Some crucial winter range would remain open for winter motorized use in both alternatives, although less than what would be open in alternative E. Alternative B would have less open than alternative G. Both would have fewer acres available for oil and gas development than alternative A or F. Alternative B would have more available oil and gas acres than alternatives C and D. Alternative G would have fewer acres than alternative B and only slightly more than Alternative C. Vegetation management activities would be available to improve wildlife habitat in both alternatives.

Tourism non-motorized

This interest group favors alternatives that increase the natural amenities that attract customers to the area for leisure activities. Scenery is important but most important is the access to areas that provide wilderness-like non-motorized experiences. An important aspect of this is somewhat at odds in that there needs to be sufficient development (trails, parking, roads) to facilitate access to support the activities.

Alternative A provides both the natural amenities and key development that this group would favor. It does not increase the acres of wilderness that could be used by this group to increase marketing.

Alternative D would be most favored by these persons. It provides increased wilderness areas, while still maintaining the existing infrastructure needed to access those areas. Alternative C would provide more wilderness, but would decrease the existing infrastructure for motorized access that would be needed to transport customers to the areas.

Alternative F would not be favored by this group. It would focus on resource extraction on much of the forest and while the existing wilderness would still provide existing opportunities for this group, the lands that would need to be traversed would be in greater contrast than what exists now. This alternative would provide more infrastructure for accessing lands, but unlikely that would be greatly beneficial to many of the current tourism groups operating on the Shoshone.

Alternatives B, G, and E would be similarly favored by this group. There would be no additional wilderness designated, but existing infrastructure would be maintained for access. Much of the lands outside of wilderness would provide opportunities for wilderness-like experiences, alternative E less so than alternatives B and G.

Resource economic opportunities

This group values commercial activities that can capitalize on the timber harvest, livestock forage, and mineral resources on the forest. They value the contribution that commercial activity makes to local communities as jobs and incomes. Roads are valued because of how they facilitate access for resource development opportunities. Alternative A maintains existing levels of commercial grazing and suitable timber lands.

Alternative F would be most favored by this group. It would provide the highest level of suitable timber acres, most acres of commercial livestock grazing, and most area open to mineral development. Alternative E would be less favored than alternative F, but more favored than the remaining alternatives. Of the action alternatives, alternative E would have the second highest opportunities for timber harvest, livestock grazing and mineral development. Of which, all but mineral development would be greater than alternative A.

Alternative C would be least favored by this group. It would have the lowest acres suitable for timber harvest, livestock grazing, and mineral development. It would eliminate existing roads and recommends additional wilderness areas that would limit future commercial resource development. Alternative D would be slightly more favored over alternative C, because it recommends less wilderness acres and maintains existing roads.

Alternative B and G would be similarly preferred. They would provide fewer opportunities than alternatives E and F, but more than alternatives C and D. The timber and livestock opportunities would be the same under alternatives B and G. Timber harvest would be greater than alternative A, while livestock grazing would be the same as alternative A. For mineral development, alternative B would be greater than C and D. Alternative G would be less than B and only slightly greater than alternative C.

Employment and Income

Local employment and income is affected by changes in outputs and uses on the Shoshone. As described in the Methodologies section above, the IMPLAN modeling system was used to estimate levels of jobs and income from expected resource output and use levels for each alternative.

Economic effects include an estimate of future payments to counties in the study area using a four year average of past county payments under the Secure Rural Schools and Community Self-Determination Act and Payments in Lieu of Taxes (fiscal year 09–12).

Although the differences among the alternatives for the study area in many cases are relatively small, the impacts may be considerable to individuals, families, or businesses. In small communities, the loss of a single job may be important, yet negligible across the study area.

Table 177 displays the employment and table 178 the income associated with Shoshone management for the three-county study area by alternative. These tables compare the alternatives to current levels (alternative A) of employment and income.

Table 177. Employment by program for current management and by alternative (average annual jobs, decade 1)

Resource	Alt. A no action	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
	- - - - - - - - - - - - - - *annual average jobs* - - - - - - - - - - - - - - -						
Recreation: Forest visitors	388	388	388	388	388	388	388
Recreation: Commercial	353	353	353	353	353	353	353
Grazing	179	179	100	179	215	225	179
Timber	85	83	75	80	111	153	83
Payments to states/counties	42	42	42	42	42	42	42
Forest Service expenditures	236	236	234	235	242	253	236
Total Forest Management	**1,283**	**1,281**	**1,192**	**1,277**	**1,351**	**1,414**	**1,281**
Percent change from current		-0.2%	- 7.1%	-0.5%	5.3%	10.2%	-0.2%

No analysis of minerals or oil/gas was completed. Outputs for these resources are marginal under all alternatives and show limited impact to the study area.

The additional levels of grazing and timber outputs in alternatives E and F result in increases in employment and labor income as compared to the current situation. Although these are fairly small increases, a 5 percent increase in alternative E and a 10 percent increase alternative F. The other alternatives have some minor decreases as the resource output levels are decreased to adjust for additional Wilderness recommendations and other more primitive or non-motorized uses. Alternative C shows the greatest decrease with almost 8 percent decline from the current situation due to the largest decrease in resource outputs and increase in wilderness recommendations. For all alternatives, the Recreation Visitors and Recreation Commercial show the largest contribution of the resource programs, constant across all alternatives, providing a consistent source of economic activity to the local study area economy.

Table 178. Labor income by program for current management and by alternative (average annual, decade 1; thousands of dollars)

Resource	Alt. A no action	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
	- - - - - - - - - - - - - *annual average labor income (1,000 $s)* - - - - - - - - - - -						
Recreation: Forest visitors	$10,234	$10,234	$10,234	$10,234	$10,234	$10,234	$10,234
Recreation: Commercial	$7,539	$7,539	$7,539	$7,539	$7,539	$7,539	$7,539
Grazing	$5,794	$5,794	$3,246	$5,794	$6,953	$7,280	$5,794
Timber	$2,487	$2,422	$2,178	$2,324	$3,239	$4,463	$2,422
Payments to states/counties	$1,693	$1,693	$1,693	$1,693	$1,693	$1,693	$1,693
Forest Service expenditures	$10,578	$10,578	$10,493	$10,539	$10,864	$11,370	$10,578
Total Forest Management	**$38,325**	**$38,260**	**$35,383**	**$38,123**	**$40,522**	**$ 42,579**	**$38,260**
Percent change from current		-0.2%	- 7.7%	-0.5%	5.7%	11.1%	-0.2%

No analysis of minerals or oil/gas was completed. Outputs for these resources are marginal under all alternatives and show limited impact to the study area

The largest difference between the alternatives and the current amounts is based on changes to timber. The timber output for current management is an average of the amount that was harvested in fiscal years 2007, 2008, and 2009. Timber harvest during this time period was very low because of poor market conditions following the decline in the housing market. For the alternatives, the timber output is the average annual first decade timber sold as modeled in Spectrum. The timber sold level for the alternatives is similar to the amount of timber sold over the last 5 years. However, timber harvest levels have been greatly reduced based on market conditions. See the Timber section in this chapter and appendix B for more information on the modeling and results for predicted timber volume sold.

Because over 85 percent of forecasted Shoshone timber volume was sawtimber, and there are currently no major sawmills open in the three-county study area, the timber analysis assumed that the regional economic impact of timber harvest from the Forest was limited to forestry and logging with all lumber processing being completed outside the area, and not accounted for in the numbers in table 177 and table 178. The University of Montana's Bureau of Business and Economic Research has estimated that direct employment for forestry and logging in the Central and Southern Rockies region (which includes Wyoming) is 23 workers per million cubic feet of timber. This estimate served as the basis for estimating the economic impact of the timber harvest from the Shoshone. If, in the future, major lumber processing were to reopen in the three-county study area, the estimated employment for lumber processing for the central and southern Rockies would be 32 workers per million cubic feet of timber.

Livestock grazing, similar to timber outputs, increases under alternatives E and F, increasing the economic contribution within the study area in terms of potential jobs and income. In the case of alternative C, outputs and contributions would decline as fewer allotments would be available for livestock grazing. There is some probability that this decline in available forage could affect some ranches' economic viability. In addition to the social, cultural, and environmental implications of the conversion of "prime" ranchland in the region, there would be significant economic implications beyond food and fiber production. Studies in Colorado have found that ranchland provides important economic benefits to both residents and visitors. Magnan et al. (2005) found that the natural environment, ranchlands, and western historical preservation were the three most important contributors to local quality of life in Routt County. Ellingson et al. (2005) found that the natural environment, ranch open space, western historical preservation, and recreational amenities are local assets that strongly add to the summer visitors' experience.

Recreation and tourism outputs are constant for all alternatives. Levels may increase over current levels based on expected population growth over the next 10 years in the western United States (2000 U.S. Census Bureau data, Population Projections table 6), but there is no available study or information from the recreation section to indicate that such growth will create different levels of demand for the different levels of opportunities offered by the different themes of the alternatives, so it is assumed use will remain constant. Types of use may change, with one activity substituting for another, but overall use numbers will be similar across the alternatives. The potential impact from recreation and tourism is the largest impact across the resource sector in both jobs and labor income, highlighting the importance of the Shoshone as a destination for recreation activities. The commercial tourism sector provides about the same level of employment as the recreation sector, but the labor income impact from the commercial tourism sector is smaller than the recreation sector. This may highlight the higher level of local spending (in the three-county study area) within the recreation sector versus the commercial tourism sector. Forest Service expenditures vary slightly based on the level of timber output by alternatives assuming that additional budgets would be needed to produce additional timber outputs.

Payments to states and counties remain constant for current management and all alternatives based on expected continuation of the Secure Rural Schools and Community Self-Determination Act. Under this act, forest management does not affect Federal payments to states and counties. An analysis was conducted to determine the effect if this act was not extended and payments reverted to the 25 percent Payments. If this were to occur, employment would decrease by approximately 20 jobs and labor income would decrease by about $841,000 in all alternatives.

Payments to states and counties remain constant for current management and all alternatives based on expected continuation of the Secure Rural Schools and Community Self-Determination Act. Under this act, forest management does not affect Federal payments to states and counties. . However, if this act expires and no other act replaces it, payments would revert to 25 percent Payments (as under the National Forest Revenue Act of 1908). If this were the case, payments to counties would be greatly diminished from current levels. Alternatives providing the highest level of receipts (alternatives E and F) would provide the highest amount of payments to counties. The 25 percent Payments for the three-county area are estimated to range from a high of $597,000 under alternative F to a low of $340,000 under alternative C. The FY12 level of payments associated with the Shoshone for the three-county area is about $1,410,000 under the Secure Rural Schools and Community Self-Determination Act. A return to 25 percent Payments would result in a large reduction in payments to counties. Affects would be greatest in those counties where Federal payments are a larger portion of the county budget.

Payments from payment in lieu of taxes may increase under reduced Forest Service payments to counties, depending on appropriations from Congress. The amount of increase is unknown, but would generally be insufficient to offset the reduction in Forest Service payments under the 25 percent payments.

Economic Efficiency

Economic efficiency examines the broader definition of benefits provided by alternatives, valuing public land uses that are not captured in the market place as well as market costs and revenues associated with each alternative's outputs. The main criterion used in assessing economic efficiency is present net value, which is defined as the value of discounted benefits minus discounted costs. A present net value analysis includes all outputs, including timber, grazing, recreation, and minerals, to which monetary values are assigned. The monetary values include both market and nonmarket values. See appendix B for a description of these values and the economic analysis.

Many non-market, non-use values are excluded from this economic efficiency analysis. Some outcomes or impacts – like those related to biological diversity, wildlife habitat, ecosystem function, water quality, climate change, visual amenities, bequest values, or existence values – have no monetary values or costs that have been established by the Forest Service. Academic research studies have explored the monetary expression of such values and preferences in a variety of physical and social settings. However, it is also reasonable and consistent with the Council on Environmental Quality regulations (40 CFR 1502.23) to consider these values in a non-monetary/qualitative discussion. This has been included in other sections of this FEIS document under the other resource sections. Net public benefit (NPB) is an important concept for carrying out a land management plan revision. NPB is defined as the overall value to the nation of all outputs and positive impacts (benefits), minus all the associated inputs and adverse impacts (costs) for producing those primary benefits, whether than can be quantitatively valued or not. Conceptually, NPB are the sum of the economic analysis, plus the net value of non-priced outputs and costs. It is not the result of an economic analysis alone. This concept is the basis upon which the decision –maker selects an alternative for implementation and outlines in the record of decision.

Table 179 shows estimated benefits, costs, and cumulative present net value by alternative. All monetary values are expressed in constant dollars with no allowance for inflation. A 4 percent discount rate was used over a 50-year period (2012 to 2061). The reduction in present net value in any alternative as compared to the most economically efficient solution is the economic trade-off, or opportunity cost, of implementing that alternative.

Table 179. Economic efficiency by alternative (in millions of dollars)

	Alt. A no action	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
Present net value	6,683,721	6,683,717	6,682,701	6,683,789	6,683,246	6,682,454	6,683,717

A level for an annual Forest Service budget was estimated for all alternatives. The amount of change in benefits by alternative is based on the amount and type of grazing AUMs and timber/salvage that was projected over the next 50 years. The majority of other activities are estimated to remain the same across the alternatives. The present net value is positive for all alternatives, indicating the alternatives are economically efficient. The alternative with the highest present net value is Alternative D and the alternative with the lowest present net value is Alternative F. However, as table 179 indicates, differences among alternatives for present net value are slight, society would benefit from the implementation of any of the alternatives considered.

Cumulative Effects

Many factors influence and affect the local social and economic environment. National, state, and county policies affect population growth, demographics, and land uses. Following is a brief description of some items that are changing or may change in the future, adding to the effects on local communities from the alternatives.

Population Growth

The West has been the fastest growing region in the country, and this trend is expected to continue for the next 20 years (U.S. Census 2010 data and projections). With this increased growth rate comes an increased diversification of the population. More new residents are migrating in, while the adult children of families living in the region are moving out of the area to find employment. This change in population composition has added to the diversity of attitudes, lifestyles, and values of the population within the planning area.

Development of Forestlands

There has also been increased housing density adjacent to and within national forest boundaries, and this trend is expected to continue over the next several decades. Moderate and high increases in residential development are projected around national forests located in Wyoming (Stein et al. 2007). While local urban, county, and regional planners and the public are making progress in defining desirable development and recognizing the inherent costs and effects associated with subdivision sprawl, growth will continue in some form and overall density will increase. This development would likely add pressure on adjacent NFS lands. Pressure would include increased demand for potentially conflicting recreation opportunities, services such as road maintenance, demand for undeveloped and semi-primitive settings, and increased fire management problems.

Future Mining or Wood Products Development

The overall estimates for low development on the Shoshone are similar to those made 25 years ago (USDA Forest Service 1992). As discussed in the minerals section, the potential for any oil and gas development in the planning period is very low.

A report developed by the University of Montana estimated that 7,955 thousand board feet of timber was harvested in the three-county area in 2005. This represented 13 percent of the total timber harvest in Wyoming. Approximately 60 percent of the area’s timber harvest came from national forests. The University of Montana report also estimates that there were 19 primary wood products facilities in the three-county area including 7 sawmills, 1 post and pole, 8 house logs, and 3 log furniture operations in 2005. All these facilities are presumably small-scale operations.

Other Required Disclosures

Environmental Justice

Executive Order (EO) 12898 (Environmental Justice in Minority Populations and Low-Income Populations) directs all Federal agencies to focus attention on the human health and environmental conditions in minority and low-income populations. The purpose of EO 12898 is to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority or low-income populations that may be associated with a plan or project.

The Forest Plan is strategic and programmatic in nature, providing guidance and direction to future site-specific projects and activities. The Plan does not create, authorize, or execute any ground-disturbing activity, although it does provide for the consideration of certain types of activities. Site-specific activities will consider potential disproportionate effects on minority or low-income communities during project planning.

The social assessment for the Shoshone did not identify any minority or low-income populations within the study area that may be disproportionately negatively impacted from the potential forest management activities of the Forest Plan alternatives. In addition, collaboration efforts throughout the study area on the Forest Plan did not identify any concerns regarding disproportionately high or adverse impacts to low-income or minority populations.

Civil Rights Impact Analysis

The Shoshone Forest Planning analysis has been reviewed and analyzed to ensure compliance with Departmental Regulation (DR) 4300-4, Civil Rights Impact Analysis (CRIA); 7 CFR 15d, Nondiscrimination in Programs and Activities Conducted by the United States Department of Agriculture DR 1512-1 Regulatory Decision-Making requirements and to identify actual or potential adverse effects based on race, sex, national origin, age, and disabilities.

The CRIA describes the civil rights implications of policies, actions or decisions that will affect the USDA workforce or federally conducted or assisted programs and activities. The CRIA helps to advise USDA policy makers, managers, and administrators about whether an action or decision will have the effect of unintentionally or otherwise illegally discriminating against USDA customers based on race, sex, national origin, age, and disabilities. Also, the CRIA serves to advise USDA policy makers, managers, and administrators of the effectiveness of decisions as related to ensuring efficient, appropriate allocation or distribution of goods and services in a manner that ensures compliance with all the laws, rules and regulations under which USDA must operate.

Disparate impact, a theory of discrimination, has been applied to the Shoshone planning effort in order to reveal any such negative effects that may unfairly and inequitably impact beneficiaries regarding program development, administration, and delivery. The objectives of this review and analysis are to prevent disparate treatment and minimize adverse Civil Rights impacts that may have caused an effect of discrimination against minorities, women and persons with disabilities and to ensure compliance with all Civil Rights statutes, Federal regulations, and USDA policies and procedures.

The Shoshone Forest Plan CRIA, using USDA Forest Service Civil Rights and Social/Economic direction, Executive Order 12989, Council of Environmental Quality National Environmental Policy Act direction and required analysis within the FEIS, sought to determine whether:

- all minorities, women and persons with disabilities are provided the same opportunities to participate in the Shoshone Forest Planning process;
- all minorities, women and persons with disabilities are provided the same or improved opportunities to access information about or have access to roadless areas as managed under the Shoshone Forest Plan.

The CRIA revealed no adverse effects associated with the Shoshone Forest Plan process to the participation of any persons or groups based on race, sex, national origin, age, and disabilities. The process was open to the participation of any individuals or groups. There were no known barriers at the public meetings;

- all were open to the public,
- all were advertised locally through Forest networks, and
- all meeting facilities were accessible to the public including persons with disabilities.

Under all seven alternatives, there would be no difference in opportunities for women, minorities, or persons with disabilities.

American Indian Religious Freedom Act

Agencies must make a good faith effort to understand how Indian religious practices may come into conflict with other forest uses and consider any adverse impacts on these practices in their decision-making practices. There are 11 federally recognized American Indian nations with cultural affiliation on the Shoshone: the Blackfeet Tribe of the Blackfeet Indian Reservation of Montana, the Confederated Tribes of the Colville Reservation, the Confederated Tribes of the Umatilla Reservation, the Crow Tribe of Montana, the Shoshone Tribe of the Wind River Reservation, the Nez Perce Tribe, the Arapahoe Tribe of the Wind River Reservation, the Northern Cheyenne Tribe of the Northern Cheyenne Indian Reservation, the Northwestern Band of Shoshoni Nation of Utah, the Shoshone-Bannock Tribes of the Fort Hall Reservation of Idaho, and the Shoshone-Paiute Tribes of the Duck Valley Reservation. No effects on American Indian social, economic, or subsistence rights are anticipated as a result of this forest plan revision effort. No matter which alternative is chosen for implementation, the Forest will be required to consult with tribes when management activities may impact treaty rights and/or cultural sites and cultural use, according to the Consultation Protocol. Desired conditions for American Indian Rights and Interests, for all action alternatives, would be for the Shoshone to: recognize and maintain culturally significant species and the habitat necessary to support healthy, sustainable, and harvestable plant and animal populations to ensure that rights reserved by tribes are not significantly impacted or diminished; recognize, ensure, and accommodate tribal member access to the Shoshone for the exercise of treaty rights and cultural uses consistent with law, policy, and regulation; and recognize and protect traditional cultural areas as associated with the traditional beliefs of a tribe about its cultural history.

Potential Conflicts with Goals and Objectives of Other Agencies

Forest Service planning regulations require the agency to consider other Federal, State and local government and tribal land management plans and policies. Meetings and discussions were held between 2011 and 2013 with adjacent and/or interested Federal, State, and local agencies along with tribal representatives regarding the proposed objectives of our revised plan. An adjacency plan analysis was completed comparing the resource management goals in the revised Forest Plan with the goals in the land use plans of adjacent agencies.

In general, all plans reviewed have a consistent theme of multiple resource use and resource protection, consistent with the revised Forest Plan. The Forest has worked closely with the local cooperating agencies and tribes to resolve potential conflicts between the revised Forest Plan and local agency land use plans. The following describes some of the disparate goals identified through the analysis along with potential solutions to concerns of possible conflict during plan implementation:

- Fremont County has a strong focus on motorized access to public land. The revised plan will provide continued and slightly increased motorized access while protecting certain wildlife habitat and special areas.
- Fremont County aspires to bring equal weight to socioeconomic issues and species management when considering Endangered Species Act (ESA) enforcement and the management of other resources. The Forest is required (under the National Environmental Policy Act) to consider input from the County during project planning for resource management projects including projects involving ESA consideration.
- Fremont County states as an objective to have the Shoshone achieve and maintain the timber harvest level prescribed in the 1986 Shoshone Forest Plan. The revised Plan preferred alternative provides 40,000 more acres of lands generally suitable for timber production than the 1986 plan. While the predicted volume sold is 450 Ccf less per year in the preferred alternative of the revised Plan than in the 1986 Plan, the allowable sale quantity increases by 3,000 Ccf per year from the 1986 Plan to the revised Plan. When funding and congressional direction allows, the Forest has the flexibility to increase the volume harvested and sold.
- Hot Springs County has a goal of “No net loss of authorized AUMs.” The revised Forest Plan maintains the same number of acres suitable for livestock grazing and maintains the same number of AUMs. A goal in the revised Plan allows AUMs to range between plus or minus 10 percent of 60,000 AUMs to allow for ecosystem restoration and fire or drought conditions.
- Policy within the Meeteetse Conservation District (MCD) Land Use Plan opposes the restriction of access (including access for mineral production) and any management that might “negatively impact the livelihoods” of their constituents. The MCD views the further restriction of surface occupancy for oil and gas leasing proposed in the preferred alternative of the Shoshone revised plan as being in conflict with their policy. In designating lands available for surface occupancy the forest focused on those lands with a high potential for oil and gas occurrence. No surface occupancy designations were drafted to be consistent with the direction for back country non-motorized management areas, big game crucial winter range and the desire of the public (that commented on the DEIS) to limit oil and gas leasing on the Forest. Economic impacts to the communities within the MCD from restrictions on surface occupancy are not anticipated low potential for oil and gas development during the life of the Forest Plan (10 to 15 years).

Alternatives, associated effects, Forest-wide standards and guidelines, and management area prescriptions are generally compatible and complement the goals and objectives of land management agencies adjacent to or near the Forest. The following summary is provided to help define areas of potential differences between the Forest Service policies, management, and responsibilities and those of other agencies.

- Mining – the U.S. Mining Laws Act of 1872 predates all other laws that govern Forest Service activities. Mitigating effects from mining activities could result in conflicts with Federal mining laws. Conflicts could arise between the mining activities allowed under the act and other resources, such as scenery, water, sensitive plants and animals, or recreation.

- Water resources – Federal requirements and authorities for maintenance and protection of water resources may conflict with the state of Wyoming's administration of water rights.
- Big game hunting – the Forest is cooperating with the Wyoming Game and Fish Department to investigate potential declines in big game hunting opportunities on the Forest.

The Forest intends to continue working closely with Federal, State and local government agencies and American Indian tribes during the implementation of the revised forest plan.

Conformance with the Resource Planning Act

NFMA regulations require development of at least one alternative which incorporates the Resource Planning Act (RPA) Program's tentative objectives for each national forest as displayed in Regional Guides (36 CFR 219.12(f)(6). The last RPA Program was developed in 1995. The USDA Forest Service Strategic Plan 2007–2012, in lieu of an RPA Program, was completed in accordance with the Government Performance Results Act and the Interior and Related Agencies Appropriations Act. The Strategic Plan does not recommend outputs to incorporate in specific forest plans. All alternatives analyzed in detail in this FEIS incorporate the following Government Performance Results Act goals:

1. Restore, sustain, and enhance the Nation's forests and grasslands
2. Provide and sustain benefits to the American people
3. Conserve open space
4. Sustain and enhance outdoor recreation opportunities
5. Maintain basic management capabilities of the Forest Service
6. Engage urban America with Forest Service programs
7. Provide science-based applications and tools for sustainable natural resources management

Unavoidable Adverse Effects

Forest plan revision and forest plans do not produce unavoidable adverse effects because they do not directly implement any management activities that would result in such effects. Forest plans establish management emphasis and direction for implementation of activities that may occur on NFS lands in the planning period. If activities occur, application of Forest-wide standards and guidelines and resource protection measures would limit the extent and duration of any adverse environmental effects. Some adverse effects could still occur, and adverse effects for one source may be a beneficial effect for another. For example, timber harvest may adversely affect the habitat for species that need mature, large trees while at the same time increasing the amount of habitat for species that need early successional habitat. For a detailed discussion of potential effects, including unavoidable adverse effects, see the Environmental Consequences discussions for each resource area: air, biological diversity, recreation, minerals, etc.

Relationship Between Short-term Uses of the Environment and Long-term Productivity

NEPA requires consideration of the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity (40 CFR 1502.16). Short-term uses are those expected to occur on the Forest over the next 10 years. These uses include, but are not limited to, recreation, grazing, mineral development, timber harvest, and prescribed burning. Long-term productivity refers to the capability of the land to provide resource outputs for a period of time beyond the next 10 years.

The minimum management requirement established by regulation 36 CFR 219.27 provides for the maintenance of long-term productivity of the land. Minimum management requirements prescribed by the Forest-wide standards and guidelines will be met under all alternatives. Minimum requirements assure that long-term productivity of the land will not be impaired by short-term uses.

Impacts to air quality are expected to be minimal for most activities and of relatively short duration. Short-term impacts from wildland fires to air quality and related values such as visibility could occur at times, but they would normally occur over relatively small portions of the planning area. Emissions from oil and gas development activities, if these activities occur, would contribute to increasing regional emissions from similar activities occurring outside the planning area. As the amount of oil and gas development activity on the forest is expected to be low, if any, it can be reasonably expected that impacts to air quality from oil and gas extraction on the Forest would be also be low. Emissions from oil and gas development, should any occur, could potentially continue for the duration of the current planning period (15 years).

Commercial livestock grazing would be considered a short-term use particularly on the Shoshone due to the relatively short grazing season and the fact that while Term Grazing Permits are usually for a 10-year period. The actual grazing of livestock must be approved each year. Only through repeated overutilization of the forage plants or physical damage to a resource would impacts from livestock grazing result in a long-term loss of productivity. Such long-term impacts have occurred in some areas in the past due to high stocking rates, long seasons of use, and inadequate management. Because all alternatives implement the same standards and guidelines, BMPs and soil and water conservation practices, there would be no loss of long-term resource productivity.

Monitoring, described in chapter 3 of the revised Forest Plan, applies to all alternatives. One purpose of monitoring is to assure that the long-term productivity of the land is maintained or improved. If monitoring and subsequent evaluation indicates that Forest-wide standards and guidelines are insufficient to protect long-term productivity, the revised Forest Plan will be amended accordingly.

Although all the alternatives were designed to maintain long-term productivity, there are differences among alternatives in the long-term availability or condition of resources. There may also be differences among alternatives in the expenditures necessary to maintain desired conditions.

Irreversible and Irretrievable Commitments of Resources

Irreversible and irretrievable commitments of resources are defined in Forest Service Handbook 1909.15 (2/21/95).

The irreversible commitment of resources means that nonrenewable resources are consumed or destroyed. Examples include mineral extraction, which consumes nonrenewable minerals, and potential destruction of such things as heritage resources by other management activities. These consumptions or destructions are only renewable over extremely long periods of time.

The irretrievable commitments of resources are opportunities foregone. They represent trade-offs in the use and management of forest resources. Irretrievable commitment of resources can include the expenditure of funds, loss of production, or restrictions on resource use.

Decisions made during the forest planning process do not represent actual irreversible or irretrievable commitments of resources. They merely determine the kinds and levels of activities that are appropriate on the Forest. Additionally, a forest plan does not make project- or site-specific decisions. A decision to irreversibly or irretrievably commit resources occurs:

- When the Forest Service makes a project- or site-specific decision.
- At the time Congress acts on a recommendation to establish a new wilderness or to include a river in the Wild and Scenic River System.

Examples of irretrievable resource commitments associated with revised Plan decisions are as follows:

- Commodity outputs and uses (such as motorized recreation) are curtailed or eliminated in areas recommended for, and subsequently designated as, wilderness, wild and scenic rivers, research natural areas, and some special interest areas.
- Opportunities for non-motorized recreation, solitude, and primitive or wilderness experiences are foregone if portions of the Forest are not allocated or recommended for these purposes.
- Timber volume outputs would be foregone on lands determined not suitable or available for harvest.
- Commodity outputs are reduced or foregone on areas allocated to specific uses or purposes, such as developed recreation sites, special interest areas, or botanical areas.
- Non-commodity values such as scenic resources may be reduced or foregone in areas allocated to commodity uses.

Energy Requirements for Implementing the Alternatives

Energy is consumed in the administration and use of natural resources from the Shoshone. For purposes of the revised Forest Plan, energy sources are gasoline, diesel fuel, liquefied petroleum, natural gas, electricity, and wood. Although many activities consume energy, the following are considered important in implementing any alternative:

- Energy consumption related to recreation is the amount required for visitors to get to and around the Forest, and for administrative purposes. The amount used is based on the number of dispersed and developed recreation visitor days, estimated trip lengths, and facility construction.
- Energy consumed in timber harvesting is the amount required for felling, bucking, skidding, loading, hauling; for performing road maintenance; and for the industrial traffic associated with harvest activities.
- Energy consumed in using range vegetation is the amount required for hauling livestock to and from the range and for permittee range improvement activities (watering, salting, and herding).
- Energy consumed in road construction and reconstruction activities is that used by contractors or Forest Service crews in completing road development.
- Energy consumed by Forest Service administrative activities includes vehicle use; lighting and heating of buildings; and fuel used in such equipment as small engines and burners.

Prime Farmland, Rangeland, and Forestland

No prime farmland, rangeland, or forestland has been identified in the planning area. Forest plan revision or the forest plan would not directly affect such lands; although implementation of the revised Forest Plan could have indirect effects. Regardless of the alternative selected for implementation, NFS lands would be managed with sensitivity to the values of any adjacent private or public lands.

Threatened and Endangered Species

Potential effects to species listed under the Endangered Species Act can be found in chapter 3 of this document, as well as in the Wildlife, Water and Soils, Aquatics, Riparian and Fisheries resources, and the Rare Plants specialist reports (project file). The biological assessment and biological evaluation will be finalized for the final forest plan and final EIS. Management direction to protect the threatened, endangered, candidate, and sensitive species, or to provide for their habitats, can be found in the draft forest plan (Forest-wide, management area, desired conditions, standards and guidelines).

Wetlands and Floodplains

Forest plan revision and forest plans do not directly implement any management activities that would result in loss of wetland or floodplains. Revised Forest-wide management direction identifies the need to restore currently degraded wetlands and floodplains, incorporates Forest Service Regional and National BMP Directives, and provides a broad spectrum of standards and guidelines designed to protect soil, water, riparian, and aquatic resources. The goals and intent of Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands) would be met through compliance with this direction. Documentation for this conclusion can be found in this DEIS, chapter 3, Water and Soils, Riparian/Wetlands, and Aquatic, Riparian and Fisheries Resources, and in the draft forest plan (desired condition, standards, and guidelines).