Chapter

3

MEDICINE BOW NATIONAL FOREST

Land and Resource Management Plan
Final Environmental Impact Statement

Affected Environment and Consequences

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Chapter 3

Purpose and Organization of this Chapter

This chapter contains a description of the Affected Environment and Environmental Consequences. It describes the physical, biological and social environment on the Forest and the surrounding area and a description of potential effects. These descriptions include such topics as geology, topography, climate, plant and animal life, and current socio-economic conditions. The chapter is divided into five major categories:

- Physical Elements.
- Biological Elements.
- Use and Designation of the Forest.
- Production of Natural Resources.
- Communities.

Each category is further subdivided. For example, Physical Elements is subdivided into four topics: air, aquatic resources, heritage resources, and soil. For each topic, the applicable statutory requirements, key indicators used for comparing alternatives, resource protection measures, and the affected environment and environmental consequences are discussed.

Many additional items were screened out of the analysis process. The 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 help disclose direct or indirect effects to the environment, or compare and contrast alternatives.
- Analysis of the item was not acknowledged or required by law.

Resource Protection Measures

Mitigation measures as defined by 40 CFR 1508.20 include: avoiding the impact altogether by declining to take an action or part of an action; minimizing impacts by limiting the degree or magnitude of an action or its implementation; rectifying the impact by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of an action; and/or compensating for the impact by replacing or providing substitute resources or environments.

Key laws, regulations, and policies are identified in the Revised Plan in Appendices A - C. Applicable standards and guidelines are also found in the Revised Plan. The Final Environmental Impact Statement (FEIS) will discuss key resource mitigation measures, unconstrained effects, and effects constrained by mitigation. Only those key mitigation measures such as laws, regulations, policies, and forest-wide standards will be discussed in each section of environmental effects.

Key resource mitigation measures should be viewed in a programmatic context. Specific mitigation measures will be developed during individual project analysis. Monitoring and evaluation will determine the effectiveness of mitigation measures. Please refer to Chapter 4, Monitoring and Evaluation, in the Revised Plan.

Environmental Consequences

This section describes the direct, indirect, and cumulative effects on the environment resulting from activities. It also describes output levels for the alternatives. If a resource management activity has no direct or indirect effect on a particular environmental element (listed above), under any of the alternatives, there is no discussion.

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. Actions taken to achieve the goals of a particular alternative, along with past, present and foreseeable future activities undertaken by either the Forest Service or other parties, are called cumulative effects to the environment.

To ensure long-term productivity of the land, the environmental consequences of alternatives are limited by management requirements. Many are founded in law, federal regulations, and Forest Service policy. Other requirements to limit the environmental consequences are called forest-wide standards and guidelines. They apply to all desired conditions within each alternative developed. The alternatives considered in detail, with their attending forest-wide and management area standards and guidelines were designed to prevent extreme environmental consequences.

Cumulative Effects

> "Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time.

Cumulative Effects

Table 3-1. Activities of other federal, state, local governments and private entities that may cumulatively effect resources of the Medicine Bow.

Description	Government /Entity	Status (Past, Existing, Proposed or Projected)	Resources that could be effected*	Location
Coalbed methane (3800 – wellheads)	BLM	Proposed	Oil and Gas, Aquatics, Fish, Air, Recreation, Wilderness	West of Sierra Madres
Savery Oil Field	Private	Past, Existing, Proposed	Oil and Gas	West of Sierra Madres
Other Oil Fields	Private	Past, Existing, Proposed	Oil and Gas	Nearby Sierra Madres, Snowies, Sherman Mountain
Coalbed Methane	Fed, Private	Proposed	Oil and Gas, Aquatics, Fish, Air, Recreation, Wilderness	North of Sierra Madres
Ferris Haggerty Mine Reclamation	Private	Existing	Minerals, Aquatics, Fish	North of Sierra Madres
Prescribed burning	State of WY, BLM	Past, Existing, Proposed	Fire and Fuels Management,	Adjacent to and within the boundaries of the four mountain ranges
Sage Creek Road (Rawlins to Battle)	Carbon County	Existing, Proposed	Travel Management, Recreation	West of Sierra Madres
RS2477 Rights-of-way for public highways	Counties	Proposed	Travel Management	Within boundaries of Forest
Spruce Bark Beetle Epidemic/Mountain Pine Beetle Epidemic	Routt NF, State, Private	Past, Existing, Projected	Insects and Disease, Aquatics, Timber, Soil, Fire and Fuels	Sierra Madres, Laramie Peak Unit
Green Mountain Ski Area	Private	Proposed	Recreation, Communities	Sierra Madres
Overland, Cherokee Hills, Oregon Trails	National Park Service	Proposed	Scenic Resource	Snowy Range and Laramie Peak Unit
ORV use on lands adjacent to Forest	BLM	Existing and Projected	Travel Management, Recreation	All units of the forest
Encampment River Study Area north of Encampment River Wilderness	BLM	Existing	Wilderness	North of Encampment River Wilderness outside of forest boundary
Guest Ranch Adjacent to Wilderness (uses on the Forest)	Private	Existing	Recreation, Lands	West of Platte River Wilderness

Description	Government /Entity	Status (Past, Existing, Proposed or Projected)	Resources that could be effected*	Location
Recently enacted state legislation requiring registration of ORVs	State of Wyoming	Existing	Recreation, Travel Management	Forest designated travel routes
Roadless areas and management	Routt NF	Existing	Roadless Areas, timber resources	Forest in general
Range allotments adjacent to Forest boundary	BLM, Private	Existing	Livestock Grazing and Big Game Use, Rangeland Vegetation, Communities	Throughout Forest
Timber Working Circle	Routt and Arapaho Roosevelt NFs	Existing and Proposed	Timber Resources, Communities	
Timberlands within watersheds on the Forest	Private, State	Proposed	Timber Resources, Aquatics, Soil, Scenic Resources	
School Sections Land Exchange	State	Proposed	Lands	Selected sections 16 and 36 throughout the Forest
Large Utility Corridors – Western Utility Group	Private	Proposed	Lands	Laramie Peak Unit
Cheyenne Stage I and II Water Diversions	City	Existing	Aquatics, Travel Management	Sierra Madres and Snowy Range
Two Elks Power Plant	Private	Proposed	Lands, Recreation, Air	Laramie Peak Unit
Ranches converting to subdivisions	Private	Projected	Communities, Livestock Grazing, Wildlife, Aquatics	Snowy Range, Laramie Peak Unit
High Savery Dam	State	Proposed	Aquatics, Recreation	West of Sierra Madres
Big Game Herd Objectives	State	Projected	Wildlife, Livestock Grazing	All units of Forest
Research Natural Areas within ecological sections of Forest	Routt, Arapahoe and White River NFs	Existing	Research Natural Areas	
Animal Damage Control activities	ADC-Fed	Existing and Projected	Livestock Grazing, Wildlife	All Units of Forest
Invasive Species Management adjacent to Forest	Counties	Existing and Proposed	Noxious, Invasive and Non-native species, rangeland vegetation, wildlife, aquatics	All units

Relationship Between Programmatic and Site-Specific Effects Analysis

This FEIS is a programmatic document. It discloses the environmental consequences on a large scale, at the planning level. This is in contrast to analyses for site-specific projects. The FEIS presents a programmatic action at a Forest level of analysis, but does not predict what will happen each time the standards and guidelines are implemented. Environmental consequences for individual, site-specific projects on the Forest are not described. The environmental effects of individual projects will depend on the implementation of each project, the environmental conditions at each project location, and the application of the standards and guidelines in each case.

The affected environment and environmental consequences discussions in Chapter 3 allow a reasonable prediction of consequences for any individual location on the Forest. However, this document does not describe every environmental process or condition.

Budget Levels

Forest Plans provide broad direction, but do not authorize specific actions. Authorization of specific actions is made as the result of site-specific project analyses. As a result, this FEIS is estimating effects that may or may not occur. Because activities, outcomes, and effects are sensitive to budget levels, each alternative has been analyzed at two different budget levels. The full implementation, or desired condition level, has a budget that is relatively unconstrained and reflects the desired level of implementation. The experienced budget level analyzes activities, outcomes, and effects with a budget that is constrained to current, experienced levels. The actual constraint is based on a 3-year average of funds allocated to the Forest for fiscal years 1998, 1999, and 2000. Funding by program area was adjusted by alternative to meet the theme of the alternative.

Incomplete and Unavailable Information

The Council on Environmental Quality (CEQ) established implementing regulations for the National Environmental Policy Act (NEPA, 1969). These provisions (40 CFR 1502.22) require an identification of relevant information that may be incomplete or unavailable for an evaluation of reasonable foreseeable significant adverse effects. If information is essential to a reasoned choice among alternatives, it must be included or addressed in an EIS.

Knowledge and information is and will always be incomplete, particularly with infinitely complex ecosystems considered at various scales. Jack Ward Thomas, former Chief of the Forest Service, aptly commented that ecosystem management is

not only bigger than we think but "bigger than we **can** think." Many components of these ecosystems, such as terrestrial and aquatic species, forest lands, rangelands, local and regional economies, and human use and demands interact in ways that elude definition by even the most complex models. Issues of species viability, sustainable and resilient ecosystems and economies remain clouded with uncertainty and risk. The ecology, inventory, and management of such systems are still developing disciplines.

Fundamental ecological relationships and interactions however, have been well established in the science and a substantial amount of Medicine Bow National Forest-specific data and information have been collected, evaluated, and used in this analysis. The alternatives and their effects were evaluated using the best available scientific information (36 CFR 219.12(d)).

While additional information, data collection, and interpretation can add greater precision or resolution to understanding the ecological, social, and economic relationships with Medicine Bow National Forest management strategies, new information is unlikely to significantly change the basic understanding of these relationships and concepts that form the basis of the evaluation of effects.

Physical Elements

Air

Introduction –The Medicine Bow National Forest is located within the Medicine Bow airshed. The criteria to determine the airshed boundary include topography, upper-level airflow, and political/civil boundaries where physical boundaries aren't apparent. The Medicine Bow airshed entirely encompasses the Forest. The airshed could be affected by off-site pollution sources as well as pollution from Forest Service management on the Forest.

Legal and Administrative Framework

The Federal Clean Air Act, amended 1977 and 1990 – this act designates wilderness over 5,000 acres and in existence as of August 7, 1977 (including later expansions) as Class I areas. Section 169(A) of the act requires "the prevention of any future and the remedying of any existing impairment of visibility in mandatory Class I areas …" Within Class I areas, the act protects air-quality-related values (AQRVs) from adverse impacts due to air pollution. AQRVs are features or properties that can be changed by human-caused air pollution: plants; animals; water; visibility; odor; and cultural, archaeological, and paleontological resources. Under the Clean Air Act, the Forest Service is required to comply with all federal, state, and local air quality regulations and to ensure that all management actions conform to the State Implementation Plan (SIP). To comply with recently developed regulations under the Clean Air Act, the Forest Service must evaluate all management activities to ensure they will not:

- Cause or contribute to any violations of ambient air quality standards.
- Increase the frequency of existing violations.
- Impede a state's progress toward meeting their air quality goals.

The Clean Air Act, Section 169 (A), required the federal Environmental Protection Agency (EPA) to produce regulations to ensure reasonable progress toward meeting the national visibility goal for Class I areas where EPA determined that visibility was an important value. Section 109 gave the EPA the authority to establish national ambient air quality standards. The Wyoming Department of Environmental Quality is the state regulatory agency responsible for air quality and is primarily responsible for enforcing EPA's air quality standards

The Wilderness Act of 1964 – this act, and the Code of Federal Regulations (CFR) developed to implement it, give the Forest Service the responsibility and direction to manage Congressionally designated Wilderness Areas to preserve, protect, and restore, as necessary, natural wilderness condition.

The EPA's Interim Air Quality Policy on Wildland and Prescribed Fires provides guidance on mitigating air pollution impacts caused by wildland and prescribed fires while recognizing the current role of fire in wildland management.

The Wyoming Air Quality Standards and Regulations – these standards and regulations are revised in an ongoing effort by the Wyoming Department of Environmental Quality, Air Quality Division to implement mandated Federal environmental programs in a manner that best meets the needs of the State of Wyoming.

Key Indicators

- Potential amount of dust from unpaved roads and trails.
- Potential acres of controlled fires and wildfires.
- Potential emissions from oil and gas development on the forest.

Resource Protection Measures

The Forest Service is responsible for protecting Class I area ARQVs from adverse effects due to air pollution. This responsibility is implemented using the Prevention of Significant Deterioration (PSD) permit process and includes:

- Identifying sensitive receptors, if any, for each AQRV.
- Determining the potential effects, if any, on sensitive receptors from a potential new air pollution source.
- Determining if a potential effect is adverse.

The Forest Service will review and comment on any PSD applications for sources that may have a potential impact on Forest Service lands following the Federal Land Managers Air Quality Related Values (FLAG) policy.

The Forest Service will conduct monitoring for AQRVs.

To comply with federal Clean Air Act regulations, the Forest Service will evaluate all of its activities and those allowed activities by the public on National Forest System land that might impact the Medicine Bow air-shed and will mitigate emissions where necessary.

The Forest Service manages smoke from prescribed fires through the Wyoming Air Quality Division. The Division currently operates an open burning permit program under Wyoming Air Quality Standards and Regulations Chapter 10, Section 2 Open burning restrictions which includes the permitting of prescribed fires occuring on Federal lands. This program requires Federal land managers to perform modeling to determine meteorological conditions under which burning can occur and maintain compliance with ambient air qualilty standards.

The Forest Service will evaluate road dust on all projects if there is an air quality issue. Mitigation measures could include modifying type of road surface, season of use, daily time use restrictions, road closures, and use of dust abatement products or road watering

AFFECTED ENVIRONMENT

Forestwide

Emissions from fire, including prescribed fire, wildfire, and recreational campfires, are the largest source of air pollution on the Forest. From 1976 to 1996, there was an average of 31 wildfires per year on the Forest. These fires burned approximately 800 acres per year. Slash disposal from timber harvest activities has generally been done by pushing the logging residue into piles and burning them when the fire hazard on the Forest is low. The Medicine Bow National Forest has burned an average of 50 slash piles per year.

The Forest annually burns approximately 2,000 acres using prescribed fire. This is a relatively small prescribed fire program compared to other forests in the West. Prescribed fire is an intermittent source of particulates that can cause significant short-term visibility problems. The state of Wyoming must give prior approval before the Forest can conduct prescribed fires. Prior to burning, emissions are estimated and a burn plan is submitted for approval.

Based on Medicine Bow National Forest fuelwood records, the amount of firewood removed from the Forest has been relatively stable for the last 3 years. Records indicate that approximately 2,500 cords of firewood are removed annually. This number probably won't increase significantly in the near future.

Road dust from vehicle traffic on the 2,151 miles of unpaved Forest roads also adds particulates to the air. In general, these emissions have only caused forest wide air quality concerns in localized areas. During dry periods of the year, traffic on some roads can generate localized dust, which is generally viewed as a traffic hazard and a social issue. Some private landowners with property adjacent to the Forest are concerned about road dust from recreational and logging vehicles entering the Forest via private lands.

Medicine Bow Airshed

This airshed covers parts of both Colorado and Wyoming and includes the Medicine Bow and Routt National Forests and a portion of the Roosevelt National Forest. All of the Medicine Bow National Forest is within this airshed. There are 4 wilderness areas in the airshed: Platte River, Huston Park, Encampment River, and Savage Run. The Huston Park, Encampment River, and Platte River wilderness areas are Class II air quality areas; the Savage Run Wilderness is a state-designated Class I area. The

airshed also includes the Glacier Lakes Ecosystem Experiment Site (GLEES), a long-term research facility operated by the Rocky Mountain Experiment Station.

A review of 1996 actual emissions from counties within 100 km of the northern, central, and southern portions of the Forest shows the major stationary sources that are the largest contributors of air pollutants near the Forest. In the northern portion, electric sources and petroleum refining produce the largest SO_2 emissions. The greatest NO_X emissions come from electric services and oil and gas production or distribution. Oil and gas production/distribution and petroleum refining produce the most VOC emissions. The greatest amounts of particulate matter are from coal and lignite mining.

In the central portion of the Forest, electric services and petroleum refining produce the most SO_2 emissions. The largest contributions of NO_X come from electric services, oil and gas production/distribution, petroleum refining, nitrogen fertilizer production, and cement plants. Petroleum refining oil and gas production/distribution, and electric services produce the greatest VOC emissions.

In the southern part of the Forest, the greatest SO_2 emissions are from electric services, chemical and mineral production, and petroleum refining. Electric services also produce the most NO_X, followed by chemical and mineral production, and oil and gas production/distribution. Chemical and mineral production produces the most VOC emissions, followed by petroleum refining and oil and gas production/distribution.

ENVIRONMENTAL CONSEQUENCES

General Effects

None of the alternatives considered is expected to substantially change existing air quality on the forest. Transient reductions in visibility and increases of fine particulate matter may occur in population centers downwind from sizeable wildland burns. Long-term air quality impacts to the forest will likely come from upwind regional sources, such as fossil-fuel burning power plants and large metropolitan areas.

Direct and Indirect Effects

Forest management activities that can directly affect air resources include prescribed fires, use of travelways, developed recreation, mining, and oil and gas development. Indirect impacts to air quality can occur from management decisions: for example, issuance of a special use permit to expand a ski resort which results in increased vehicle emissions from additional people driving to the ski area to work or recreate.

Effects from Travel Management

Air quality impacts from forest travelways are associated with vehicle emissions and dust from traffic on unpaved roads. These effects typically are localized and temporary, and their extent depends on the amount of traffic. Dust from unpaved roads increases with dryness as well as vehicle weight.

Travelways on the forest typically are unpaved. They are used both for recreational purposes (e.g., all-terrain vehicle (ATV) and four-wheel-drive use) and for resource management purposes related to timber harvesting, mining, and oil and gas development. Motorized recreation occurs year-round. Summer use includes off-road, two-wheel, and four-wheel drive vehicles. Travel on unpaved surfaces by these vehicles can stir up dust. To date, these localized impacts have not adversely affected air quality in sensitive areas, such as important scenic vistas. As use of forest transportation system roads increases, road dust impacts to sensitive areas may need to be addressed.

Alternatives A and B propose the most new road construction or reconstruction of existing roads. Alternatives F and E will decommission or close the most system and non-system roads. Therefore, Alternatives A and B have the highest potential to affect air quality and Alternatives F and E have the lowest potential to affect ambient air quality when compared to other alternatives. Ranking all of the alternatives when comparing the amount of road construction, road reconstruction, and road decommissioning is listed from the highest potential to the lowest; B, A, C, D DEIS, D FEIS, E, F.

Winter motorized recreation use includes snowmobiles and snowcats. Emissions from these vehicles include carbon monoxide, oxides of nitrogen, and particulate matter. Most of the effects of motorized recreation are localized and temporary. A pilot study was conducted by the Rocky Mountain Research Station at a snowmobile staging area to examine air quality at the Medicine Bow NF Green Rock Picnic Area west of Laramie. The study examined air quality at the site. Nitrogen oxides, carbon monoxide and particulate matter were monitored. Weekend and weekday data was compared. Automated counters were examined as a method to quantify snowmobiles present at the site. Water chemistry was determined from snow samples collected under and away from a snowmobile trail. Vegetation and soils was also examined across snowmobile trails. The results of the study did not determine any adverse impacts to air quality, vegetation, or water chemistry.

Snowmobiling is primarily limited to designated roads and trails where permitted under Alternative F. Therefore, this alternative has the lowest percentage of the forest available for winter motorized recreation opportunities and the lowest potential to affect air quality. Alternatives B, A, and C have the highest percentage of the forest available for winter motorized recreation opportunities and the greatest potential to affect air quality. Ranking all of the alternatives for winter motorized recreation from the highest potential to the lowest; B, A, C, D DEIS, D FEIS, E, F.

Because the emissions from snowmobiles are localized, none of the alternatives are expected to produce a measurable effect on air quality.

Effects from Fire and Fuels Management

Both wildfires and prescribed fires generate smoke and particulates which can temporarily degrade visibility and ambient air quality conditions in downwind sensitive areas. The Wyoming Department of Environmental Quality (WYDEQ) requires the Forest to model the emissions from each prescribed burn or management-ignited fire and demonstrate that they will not violate ambient particulate standards. Computer modeling is used to evaluate particulate matter (PM) emissions less than 10 and 2.5 microns in size (PM10 and PM2.5) from fire and their effects on air quality. The Simple Approach Smoke Estimation Model (SASEM) is currently the required model; the results are submitted to the WYDEQ before a burn permit is issued. SASEM can estimate the number of acres that could be burned at one time without exceeding the national ambient air quality standards (NAAQS). The Forest Service must conduct its management-ignited fires according to the conditions outlined in burn plans submitted and approved by the WYDEQ Air Quality Division. In addition, the Forest Service must coordinate its planned burns with local health agencies. Prescribed burns that present a potential for significant smoke impacts must have a plan that addresses nighttime smoke impacts. Also required is coordination with the National Weather Service to mitigate these impacts. Although management-ignited fires may increase emissions in the short term, these burns could help to decrease the emissions from catastrophic wildfires by reducing the fuel loading over the long term. The risk of adverse air quality impacts from fires increases with the acres burned, intensity and local fuel characteristics. Those alternatives with the most fuel treatment acres proposed are Alternatives D, and E, with Alternative F proposing the least fuel treatment acres. Ranking all of the alternatives with respect to fuel treatment from the highest potential to the lowest; D DEIS, D FEIS, E (6,000 acres fuel treatment), B, C (5,250 acres fuel treatment), A, F.

Those alternatives which have the highest percentage of allowing natural processes to affect the vegetation on the forest also have the highest potential for the number of wildfires and the most acreage potentially impacted by wildfire. Because of the particulates released from wildfire then those alternatives also have the greatest potential to affect air quality. The following ranking by alternative is listed from the highest percentage of allowing natural processes to the lowest; Alternative F, D DEIS, E, D FEIS, C, B, and A.

Effects from Oil and Gas Development

Air quality is affected by oil and gas development activities that include road and drill pad construction, development-related vehicle traffic, well drilling, well testing, and gas compression. Air pollutants of concern include particulate matter from dust during well site construction and from vehicle traffic on unpaved roads, carbon

monoxide and nitrogen oxides from gasoline and diesel engines (including both vehicle and stationary engines such as generators), and hydrocarbons released during natural gas extraction.

The Medicine Bow National Forest in southeastern Wyoming includes four non-contiguous areas on Precambrian crystalline uplifts. Limited areas of the Forest on the flanks of these uplifts have medium and low potential for oil and gas resources based on geologic factors necessary for oil and gas accumulations to exist. Most of the Forest has no known potential for oil and gas resources due to the presence of crystalline rocks at the surface and at depth. A number of wells drilled on and adjacent to the Forest have been unsuccessful in establishing production, and only a few have had indications of oil or gas. Minimal exploratory activity is expected on the Forest in the next 10 years based on inconclusive geologic evidence of the presence of reservoirs and/or traps on the forest, along with discouraging results from drilling. One exploratory well in the eastern Medicine Bow area and one exploratory well in the western Sierra Madre area is expected to be drilled on the Forest in the next 10 years. Both of these wells most likely will be dry holes (Holm and Dersch 1995).

If leasing for oil and gas exploration would occur on the Forest, Alternative F has the most acreage of the no surface occupancy leasing stipulation designed to minimize disturbance. Alternative B has the most acreage with standard stipulations and Alternative A has no acreage administratively available for leasing. The following ranking by alternative is listed from the greatest potential impact upon the air resource to the least; Alternative B, E, C, D DEIS, D FEIS, F, and A.

Cumulative Effects

The potential area of cumulative effects is limited to the Medicine Bow airshed described in the Affected Environment section. All areas of the Medicine Bow National Forest including all the wilderness areas on the Forest currently meet air quality standards and show no degradation to visibility or other air-quality-related values. Compliance with local, state, and federal air quality regulations will ensure that future forest management activities under any of the alternatives will continue to protect air resources on the forest and not contribute to air quality degradation off the forest. Planned activities will be mitigated to prevent cumulative effects from having unacceptable impacts to air resources. The State of Wyoming has the regulatory authority for controlling emissions throughout the State of Wyoming, including those emissions with the potential to adversely impact resources on the Forest.

The future cumulative emission effects from large wildfires does have the potential to adversely affect air quality. The timing, size, and location of large wildfires is impossible to predict with any certainty. Smoke from wildfires off the forest can travel with the prevailing winds and affect the visibility and air quality on the forest. The magnitude of the future wildlife cannot be estimated with any reliability. Cumulative effects from large wildfires by alternative have the following ranking

listed from the highest percentage of allowing natural processes to the lowest; Alternative F, D DEIS, E, D FEIS, C, B, and A.

Another future cumulative effect which may occur off the forest is the development of coalbed methane wells under Bureau of Land Management jurisdiction or on private land. Road access to develop the fields can produce fugitive dust. There are also nitrogen oxides produced at the compressor stations. The geographic location of these wells are west and north of the Sierra Madres mountains which might effect air quality in the western part of the forest. The extent and the timing of this future energy development is unknown. Until more specifics are known about where and when this development might occur it is difficult to estimate effects on air quality on the forest.

One other cumulative effect which may occur off forest is the proposed Two Elks Power Plant on private land near the Laramie Peak administrative unit of the forest. This power plant has been proposed for many years and if the planning continues the forest will be involved in evaluating the air quality effect on the forest. It is currently unknown the potential effects of this power plant on the forest's air quality. These effects do not vary by alternative.

Aquatic Resources

Introduction – There are a variety of aquatic and riparian ecosystems on the Medicine Bow National Forest: 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, and fish can be found in many of these Forest habitats. In addition, forest aquatic, riparian, and wetland habitats support a variety of submerged and emergent aquatic plants.

Historically, humans have used Forest aquatic ecosystems for many purposes. Examples of the common utilitarian uses of aquatic ecosystems by humans include: water development facilities for agricultural and municipal uses; and, water dependent recreational uses. Clearly, the human demand for Forest water resources is increasing. Meeting these demands is a material challenge for Forest resource managers.

Forest management activities can affect the physical, chemical, and biological characteristics and functions of aquatic ecosystems. The challenge to Forest resource managers is to implement multiple-use activities that protect, maintain, and restore aquatic biodiversity, watershed/stream health, and riparian/wetland condition. In-depth analyses of aquatic resource conditions have been completed for the Forest Plan revision; the results of these analyses provide supporting information for this section (Von Ahlefeldt and Speas 1996; Eaglin 2001; Gloss 2001b).

Legal and Administrative Framework

The 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.

Laws

The Organic Administration Act of 1897 recognized watersheds as systems to be managed with care to sustain their hydrologic function.

The 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:

1. Compliance with state and other federal pollution control rules.
2. No degradation of instream water quality needed to support designated uses.
3. Control of non-point source water pollution by using conservation or "best management practices."

4. Federal agency leadership in controlling non-point sources pollution from managed lands.
5. Rigorous criteria for controlling discharge of pollutants into the nation's waters.

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 supply.

The Forest and Rangeland Renewable Resources Planning Act (RPA) 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 (including monitoring, inventories, condition, and trends, and support services) on national forests.

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 Endangered Species Act of 1973 requires federal agencies to conserve threatened and endangered species and their ecosystems.

The 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.

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, avoid direct or indirect support of new construction (e.g. campgrounds) in wetlands. Federal agencies are required to preserve and enhance the natural and beneficial values of wetlands. Other laws pertinent to

watershed management of NFS lands can be found in Forest Service Manual (FSM) 2501.1.

Regulations 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).
- Watershed analysis as part of all planning activities (36 CFR 219, FSM 2500).
- Limitations of resource use to protect watershed condition. FSM 2500 and Forest Service Handbooks (FSH) 2500 state policy and direction regarding watershed management.

Key Indicators

- Total estimated miles of proposed system roads.
- Miles of road proposed for construction/reconstruction.
- Miles of road proposed for decommissioning.
- Harvest acres per year, desired condition level.
- Number of active grazing allotments.

Changes Between Draft and Final

- The Watershed Condition Assessment and Priority Watershed discussions and maps were updated to include the newest interagency watershed boundaries, names and codes (Hydrologic Unit Code).
- Additional analysis was conducted to identify and protect public water supplies that may be affected by management activities on the Forest. These changes are summarized in the water uses sections below as well as the Geographic Area discussions.
- Estimates of water yield due to vegetation management were updated based on modifications to the SPECTRUM model.
- Areas on the Forest with adequate reservoir storage to capture and utilize potential increases in water yield from vegetation management were identified. Desired condition statements were identified for these areas to maintain long-term water quality and quantity, while reducing the risk of catastrophic wildfire and insects and diseases.
- Primary discussions related to riparian and wetland areas have been incorporated into the Biological Diversity section as well as the Biological

Assessment and Biological Evaluation and are no longer included in this section.

Resource Protection Measures

Region 2 of the Forest Service developed a Watershed Conservation Practices (WCP) handbook (FSH 2509.25) which provides resource managers with guidance in the context of existing laws, regulations, and policies. In addition, the WCP handbook lists standards and design criteria that aim to protect, maintain, and enhance the chemical, physical, and biological integrity of forest aquatic ecosystems. Standards from the WCP have been incorporated as Forest Plan standards. Design criteria carry the same weight and must be followed to the same degree as Forest Plan guidelines upon adoption of the revised Plan. Design criteria or guidelines can be found in the WCP, but with a few exceptions are not listed in the Forest Plan. According to the handbook, streams and watersheds with the following conditions are in dynamic equilibrium:

Integrity of streamflow – 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 streamflow.

Integrity of the fluvial 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.

A Non-point Source Management Strategy is also included in the WCP handbook (FSH 2509.25 Chapter 20). The strategy addresses how the Forest Service will apply Watershed Conservation Practices, monitor their implementation and effectiveness and adjust land management activities, WCPs or recommend changes to state water quality standards as needed to meet state water quality standards. The WCP handbook and other documents have been written to protect aquatic resources and to address the potential and actual effects of federal and nonfederal actions (range, timber, water development, engineering, recreation, etc.) on Forest aquatic resources.

AFFECTED ENVIRONMENT

This section gives an overview of Forest surface water, ground water, and aquatic biota. Riparian and wetland areas are addressed in the Biological Diversity section

and the Biological Assessment and Biological Evaluation. The natural disturbance processes and human influences that affect aquatic resources are also discussed. The physical, chemical, and biological integrity of Forest aquatic systems are assessed and key risks to aquatic resources are identified.

Surface Water

Quantity and Distribution

There are approximately 1,600 miles of perennial streams in public lands within the Medicine Bow National Forest. Water originating on the Forest contributes to flow in both the Platte and Green River basins. The majority of the Forest is in the Platte River drainage. Rob Roy (640 acres) and Hog Park (520 acres) are the two largest reservoirs on the Forest. Lake Owen, Turpin Reservoir, and Sand Lake are each approximately 100 acres in size. There are also hundreds of smaller lakes, reservoirs, and ponds distributed across the Forest; the northern half of the Snowy Range has the largest concentration.

Surface water on the Forest comes predominantly from snowmelt runoff and is critical both on and downstream of the Forest. Even though the Forest occupies less than 20 percent of the North Platte River basin, over two-thirds of the flow in the North Platte River may be generated on the Medicine Bow National Forest (USFS, 1985). Similarly nearly 90 percent of the flow in the Little Laramie River may be generated on the Medicine Bow National Forest, which is approximately 70 percent of the basin area. Existing water yield for the entire Forest was estimated at approximately 1,017,000 acre feet in 1981 (USDA Forest Service, 1985) and provides a reasonable estimate of the magnitude of average annual streamflow coming off the Forest. Natural streamflows for the North Platte River at the Wyoming/Nebraska state line were estimated to average 1,687,600 acre feet. Existing water yield from the Encampment River above Hog Park Reservoir, a watershed of similar size to many of the streams as they leave the Forest, averages 82,118 acre feet per year.

Water Quality

Surface water quality on the Forest is good overall, although there are two stream reaches that are on the state of Wyoming 303(d) list of impaired water bodies (Wyoming Department of Environmental Quality 2000). Wyoming Department of Environmental Quality (WYDEQ) updates the 303(d) list periodically and stream segments may be added to or removed from the impairment list. The following streams are on the 2002 list (see next map):

- Haggarty Creek from Ferris-Haggarty mine to West Fork of Battle Creek (copper is the pollutant).
- West Fork of Battle Creek from Haggarty Creek to Battle Creek (pollutants are copper, cadmium, and silver).

These stream segments are listed because of metals from the Ferris-Haggarty mine and possibly from background levels of metals in this highly mineralized area. On-going WYDEQ monitoring is focused on determining the extent of the impairment and the natural levels of natural metal concentration. An abandoned mine lands project is addressing the leachate from the mine and the preliminary results have been promising.

Uses

Surface water from the Forest 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 (stock 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. Management of NFS lands has the greatest potential to affect the quality of municipal water supplies required to supply the town of Encampment, and to a lesser degree water supplies for the City of Cheyenne.

Map 3-1. Waterbodies with water quality impairments on the Medicine Bow National Forest

Groundwater

The quantity, distribution, quality, and uses of groundwater on the Forest are described below. Groundwater affects hydrologic, chemical, and thermal properties of surface water and can be developed for human uses.

Quantity and Distribution

Most of the Forest is located in the Western Ranges groundwater region (Heath 1984). The majority of the Forest, portions over 7,500 feet elevation, is underlain by Precambrian aquifers. Lower elevation portions of the Forest are underlain by Pennsylvanian/Cambrian aquifers on the west side of the Laramie Range and Valley and Terrace Alluvium aquifers on the north edges of the Snowy Range (Marston, Ostresh L.M. et al. 1990). Precambrian rocks are not a major aquifer; therefore, groundwater storage across most of the Forest is localized and limited. Development of groundwater resources on the Forest tends to only occur in shallow alluvial aquifers.

Quality

Groundwater quality information for the Forest is limited, although there is extensive off Forest data available for the more extensive aquifers (Kuhn, P.B. et al. 1983). Campground wells on the Forest have been tested for baseline water quality. Results of those tests indicate that primary drinking water standards (e.g., iron) are occasionally exceeded. Bacteriological and nitrate sampling is conducted periodically while the campgrounds are operating. Results of these tests generally meet state drinking water standards. However, because the wells are in shallow alluvial aquifers, they sometimes become contaminated from surface sources (e.g., storm runoff) and the standards are exceeded for short periods. Based on this limited information, we believe the existing groundwater quality on the Forest is good, though surface contamination and bacteriological and nitrate contamination can be a concern.

Past management on the Forest has not had any known significant adverse effects on groundwater quality. Activities such as oil and gas exploration and development can impact groundwater but those activities have been minimal. Other potential adverse effects from wastewater treatment and chemical spills, such as diesel fuel, have also been minimal. Groundwater contamination due to human waste has been reduced because modern pump vault outhouses that better contain potential contaminants are replacing old, pit type outhouses.

Uses

Due to the limited supply and lack of development opportunities, beneficial use of Forest groundwater is low. Consumption is limited to stock water facilities, special

use permits, and Forest Service campgrounds and administrative sites with domestic wells. Two communities (Centennial and Elk Mountain) adjacent to the Forest utilize groundwater for part or all of their municipal water supplies; the aquifers are recharged on Forest. The community of Elk Mountain has enacted a Sole Source Aquifer Protection Program to designate aquifer recharge areas for special protection. Since water from the Forest is part of the recharge system, municipal supply water should be considered when evaluating the effects of proposed management activities. Many other communities also derive their municipal supply water from wells adjacent to or downstream of the Forest. Forest land management activities have less potential to affect these supplies, due to a variety of factors including the distance the wells are located off Forest.

Aquatic Biota

The Medicine Bow National Forest supports a variety of aquatic, biotic communities in its lotic (flowing water) and lentic (still water) ecosystems. In general, the most common aquatic biota in the Forest can be broadly categorized as fishes, aquatic plants, aquatic insects, and the embryonic and larval stages of amphibians. Less obvious and less well understood biota includes the phytoplankton, zooplankton, and microbes associated with aquatic environments. Undoubtedly, these organisms play important roles in ecosystem processes such as nutrient cycling, energy fluxes, and in comprising aquatic food chains.

Most aquatic insect communities on the Forest are dominated by taxonomic orders that require in clean water. Aquatic insects such as mayflies, stoneflies, and caddisflies are abundant in many forest streams; their species richness, distribution, and abundance are often indicative of water quality conditions in their environments.

There are twelve native fish species and at least nine, non-native fish species found in the Forest. Although non-native fish introductions have increased fish diversity in the Forest, they have had negative impacts on native fish populations. Colorado River cutthroat trout, for example, whose name refers to its historical range in the upper Colorado River Basin, have diminished populations and habitats because of competition and hybridization with introduced brook and rainbow trout. Brook trout tend to exhibit competitive advantages over Colorado River cutthroat trout where they compete for food and other resources. Rainbow trout compete with Colorado River cutthroat trout for resources, but more importantly, they will hybridize with Colorado River cutthroat trout, the result of which is a loss of genetic integrity in the species.

High Mountain Lakes

Phytoplankton: Most of the phytoplankton studies conducted in the Forest have occurred in the Snowy Range as part of the Glacier Lakes Ecosystem Experiments Site, GLEES (Musselman 1992). Subalpine lakes studied within the GLEES project are high elevation (> 10,000 feet) lakes of glacial origin. The biotic composition of

these lakes includes: phytoplankton, diatoms, green algae, golden-brown algae, cryptophytes, blue-green algae, euglenoids, and dinoflagellates. Phytoplankton abundance in the Snowy Range lakes varies seasonally; green algae and blue-green algae production typically peaks in late summer and early fall as average water temperatures and average day length change. Phytoplankton and algal species that have been collected in these subalpine lakes are typical of those species that are found in cold, oligotrophic conditions. A list of phytoplankton and algae sampled in GLEES can be found in Musselman (1994). Giles and Simon provide additional information about Forest phytoplankton (Giles 1933; Simon 1938).

Zooplankton: Much of the zooplankton studies conducted in the Forest have also been associated with GLEES (Musselman 1994). In Forest lakes, zooplankton populations are typically less abundant in montane and subalpine lakes than in lower elevation lakes and ponds. Relatively common zooplankton that have been collected in the Snowy Range lakes include: Rotaria (*Kellicottia longispina, Polyartha dolichopter, Keratella sp.,* and *Lecane sp*.); and Entomostraca (*Diacyclops thomasi, Ceriodalphinia sp.,* and *Daphnia ambigua*).

Macroinvertebrates: Several aquatic macroinvertebrate studies have been conducted in the Snowy Range lakes (Giles 1933; Simon 1938; Blake 1945; Hepworth 1959; Royer 1960; Payne 1983). Most of these studies were conducted in conjunction with investigations of trout diets in the Snowy Range lakes. Examples of aquatic macroinvertebrate groups collected during the aforementioned studies include: aquatic worms, mayflies, caddisflies, stoneflies, true flies, and clams.

Fish: Historically, there were no fish extant in the Snowy Range lakes. Fishes indigenous to the Snowy Range are found in Forest streams and include species such as the white sucker and longnose dace (Baxter and Stone 1995). The Wyoming Game and Fish Department introduced brook trout into Snowy Range lakes in the 1920s and 1930s. Later, other non-native species such as brown trout, rainbow trout, golden trout, splake, and Arctic grayling were stocked into Snowy Range lakes by the Department (see table below). Many of the introduced, non-native trout populations were able to successfully reproduce in the Snowy Range lakes because, in part, they were adapted to spawning in montane and subalpine streams (Snigg 1989); most of the suitable spawning habitats in these lakes occur in inlet and outlet channels. In Snowy Range lakes, non-native trout may have adversely affected the abundance and distribution of native amphibians due to predation on tadpoles, juveniles, and adults.

Table 3-2. Native and non-native trout and char in the Medicine Bow National Forest lakes and reservoirs.

Non-native Trout and Char	Hybrid Char
Brook trout	Splake (brook trout/lake trout cross)
Brown trout	
Rainbow trout (various strains)	
Golden trout	
Cutthroat trout (various strains)	

Of the 97 high mountain lakes in the Snowy Range, 55 contain naturally reproducing populations of brook trout (Snigg 1989). Also, these 55 lakes support populations of other gamefish such as golden trout, splake (a hybrid lake trout-brook trout cross), rainbow trout, and cutthroat trout (various subspecies). Several Snowy Range lakes can't support fish populations or they are prone to winterkill and require periodic stocking to maintain a recreational fishery.

Moraine-pond communities (kettle ponds): There are dated and some recent studies that describe aquatic insect communities associated with moraine or kettle ponds in the Forest (Medicine Bow Mountains). Blake sampled and identified various aquatic invertebrates such as fairy shrimp, copepods, damselflies, water striders, aquatic beetles, caddisflies, and mosquito larvae in the ponds he examined (Blake 1945). Wood frogs and boreal chorus frogs are often found in ponds at this elevation. Blake also reported seeing numerous western boreal toads in the areas he examined in his study.

A much more recent study of aquatic macroinvertebrate communities in kettle ponds in the Snowy Range was conducted by a University of Wyoming graduate student in 1996 (Reyes 1997).

Stream Communities

Macroinvertebrates: The following table provides a representative list of macroinvertebrates collected in Forest streams. Many of the aquatic organisms listed in the table are reliable indicators of water quality condition because they are typically found in streams and lakes that have a narrow range of environmental conditions that is suitable to support them: low water temperature, high water quality, high dissolved oxygen concentrations, and diverse aquatic habitat (Hynes 1970). The exception to this association is the presence of true flies (Order Diptera). True flies, as a taxonomic group, are generally tolerant of a wide range of environmental conditions, including higher water temperatures, lower dissolved oxygen concentrations, and less habitat diversity.

Table 3-3. A short list of aquatic insects found on the Medicine Bow National Forest.

Drainage	Ephemeroptera (May flies)	Plecoptera (stoneflies)	Tricoptera (caddisflies)
Little Snake River	*Baetis sp.*	*Megarcys sp.*	*Hydropsyche sp.*
	Ephemerella sp.	*Hesperoperla sp.*	*Lemnephilidae sp.*
	Heptegenia sp.	*Isoperla sp.*	*Polycentropus sp.*
North Platte River	*Ameletus sp.*	*Acroneuria sp.*	*Arcotopsyche sp.*
	Centroptilum sp.	*Arcynopteryx sp.*	*Rhycophila sp.*
	Tricorythodes sp.	*Nemoura sp.*	*Hydroptila sp.*

Blake (1945) described the condition of small and large montane and subalpine streams at elevations above 9,700 feet in the Medicine Bow Mountains. Water samples collected from the small streams was slightly alkaline (pH values between 7.0 and 8.0). In addition, average summer water temperatures were usually less than 50^{o}F. Planaria (*Polycelis coronata*) is the predominant macroinvertebrate in these subalpine stream habitats; these macroinvertebrate were well distributed and abundant in substrates. Typically, mayflies and stoneflies were found in stream habitats, in addition to planaria.

Recent studies have described macroinvertebrate communities in the Medicine Bow National Forest. From 1985 to 1987, DeBrey and Lockwood investigated the effects of fine sediment and flow regimes on the relative abundance of five orders of aquatic insects in the North Fork of the Little Snake River in the Sierra Madre Range, west of the Continental Divide (DeBrey and Lockwood 1990). In the unimpacted stream reaches, abundance from the most to least was as follows: stoneflies, caddisflies, mayflies, black flies, and aquatic diving beetles. In 1994 and 1995, Reyes examined the effects of clearcutting on the community structure of aquatic macroinvertebrates in kettle ponds in the Medicine Bow Mountains near Turpin reservoir (Reyes 1997). Although her study was inconclusive about the effects of clearcutting on community structure, it did provide valuable baseline data on species composition in disturbed and undisturbed kettle pond ecosystems. Reyes (1997) found 51 aquatic insect taxa in the benthos and in the water column of kettle ponds. The predominant functional feeding groups found in undisturbed and disturbed sites were filter feeders and collectors.

Fish: Before fish management activities of the last century, the Green River and North Platte basins had distinct native fish assemblages. Eight native fishes are considered indigenous or native to the Little Snake River drainage (tributary to the Green River) in Wyoming (see following table). Of the eight native fish species, all have been found within the Forest boundary. Also, the Wyoming Game and Fish Department categorizes streams according to their ability to support a coldwater fishery (e.g. Class 1 = blue-ribbon trout fishery); this classification system should not be confused with the Wyoming Department of Water Quality classification system

that rates streams according to water quality condition (e.g. Class I = pristine waters).

Table 3-4**.** Native and non-native fishes that exist or could exist in the Little Snake River drainage on the Medicine Bow National Forest.

	Little Snake River Drainage	
Fish Species	**Native**	**Non-native**
Brook trout		X
Brown trout		X
Rainbow trout		X
Colorado River cutthroat trout	X	
Creek chub	X	
Flannelmouth sucker	X	
Mottled sculpin	X	
Mountain sucker	X	
Mountain whitefish	X	
Roundtail chub	X	
Speckled dace	X	

Thirty-five fish species are considered native to the North Platte River drainage; 25 species have been collected in Wyoming (see the following table). Nineteen fish species, including all extant trout, have been introduced to the North Platte River drainage; 8 of these species have been found on the Forest.

Table 3-5. Native and non-native fish species that are extant or likely extant in the North Platte River drainage on the Medicine Bow National Forest.

	North Platte River Drainage	
Fish Species	**Native**	**Non-native**
Brook trout*		X
Brown trout*		X
Rainbow trout*		X
Cuttbow* (cutthroat trout/rainbow trout hybrid)		X
White sucker	X	
Longnose sucker	X	
Longnose dace	X	
Creek chub	X	
Stonecat	X	
Horneyhead Chub	X	
Common Shiner	X	
Brook stickleback		X
Colorado River cutthroat trout*		X

	North Platte River Drainage	
Fish Species	**Native**	**Non-native**
* No trout are native to the North Platte River basin. All species of trout that exist in the North Platte River basin have been stocked there by the Wyoming Game and Fish Department and by others.		

Sixteen fish species are considered native to the portion of the South Platte River drainage that is located in Wyoming. Of the 16, only greenback cutthroat trout and longnose sucker may have occurred in the Pole Mountain portion (Laramie Range) of the Forest. Seven fish species have been introduced into the South Platte River drainage; three of these species have been found on the Forest: brook trout; brown trout; and rainbow trout.

Current Aquatic Conditions

Current aquatic conditions on the Forest vary depending on the magnitude and type of natural and human disturbances in each watershed and the inherent resistance and resiliency of the aquatic systems. The natural disturbance processes and human influences that define current aquatic conditions on the Forest are discussed below, followed by an assessment of the current watershed conditions on the Forest.

Natural Disturbance Processes

Although natural disturbances such as landslides and wildfire are important components of healthy ecosystems, they can alter the hydrology, water chemistry, and geomorphology of watersheds and disrupt, at least temporarily, aquatic ecosystems (Schullery and Varley 1994). For example, wildfire can cause landslides and alter vegetation composition and structure—alterations that can cause watershed recovery to take hundreds of years (Swanston 1991). Often, human activities directly or indirectly alter natural ecosystem processes and the frequency, magnitude, and duration of catastrophic, disturbance events.

The effects of these disturbance processes on habitat quantity, quality and productivity depend on the intensity, magnitude, and timing of disturbance events. Some disturbances recur regularly and are generally easy to anticipate—seasonal and annual precipitation, bankfull flows, etc. Other disturbance events recur less frequently and their recurrence is more difficult to accurately predict. These unpredictable events are usually triggered by major storms, large-scale vegetation disturbances (fire, windthrow, insects and disease) or changes in the earth's crust (earthquakes, volcanic activity) (Swanston 1991). All of these disturbance events can alter watershed processes, local channel form and function, and the abundance, distribution, and species richness in aquatic communities.

The magnitude of a disturbance will often determine the amount of change that occurs in a watershed. For example, during extreme (50 years +) flood events,

organisms tend to seek refuge from swift currents and debris in places such as undercut banks, logjams and other woody debris, and inundated vegetation. This behavioral adaptation to seek refuge from extreme environmental conditions has been documented in high elevation streams in the Snowy Range (Kimble and Wesche 1975). Extreme flood events, though relatively infrequent, can alter the habitats and behavior of aquatic organisms. Bozak and Young and Gibbons and Salo documented the impact of large area wildfires (e.g., Yellowstone National Park, 1988) on stream channels (Gibbons and Salo 1973; Bozak and Young 1994). Sudden changes in channel morphology occurred because of increases in flow, sediment, and debris. Increases in sediment concentrations have lethal effects on fish populations (Bozak and Young 1994). However, over time, these impacts may be beneficial if they increase the amount of nutrients in sterile streams and increase the available food supply for fish and macroinvertebrates (Gibbons and Salo 1973).

A given watershed's response to disturbance is widely variable. Some watersheds are very sensitive to disturbance because they may have steep slopes and highly erodible soils. Other watersheds are more resilient to disturbance and are capable of accommodating severe weather and climatic events such as wind microbursts and drought or intense ground disturbing events such as landslides.

Human Influences on Aquatic Ecosystems

Roads, water development, fire suppression, timber harvest, mining, grazing, and recreation have been the major human caused agents of change for Forest water resources.

Roads: The Forest is responsible for management of more than 2,500 miles of classified roads and 800 miles of unclassified roads on the Forest. In addition, there are numerous other roads managed by other entities within the Forest boundary, including Interstate 80, State Highways 130, 230 and 70, and a variety of county roads. There are also approximately 415 miles of trails on the Forest. These travelways provide a background level of disturbance that contributes to direct and indirect effects on aquatic and riparian resources.

Most roads on the Forest were built to facilitate timber management although these roads now support a variety of other uses. User created trails and off-road vehicle (ORV) use are also common throughout the Forest. Many roads and trails are adjacent to streams and segments are located in floodplains. The impacts to water resources include sedimentation and alterations in streamflow (magnitude, timing, and duration). Sediment fills pools, reducing habitat for fish, and fills the interstitial spaces of the streambed, reducing habitat for invertebrates and spawning fish. Roads, trails, and associated human travel have also caused reductions, disturbances, and interruptions of riparian habitat on the Forest. Duration and intensity of these effects vary, depending on various site, climate, and management variables. In recent years, the amount of timber management activity, and associated road

building, has decreased. Conversely, recreation use has increased, with a corresponding increase in illegal, user created roads and trails.

The Medicine Bow National Forest Roads Analysis Report (2002) contains an analysis of sixth-level watersheds on the Forest that reveals that twenty-one percent of those watersheds are classified as having "high" or "extreme" road densities. In addition, twenty percent of the sixth-level watersheds were deemed to have "high" surface, soil erosion potential. Sixteen percent of sixth-level watersheds were classified as having "high" or "extreme" road densities that are located within 200 feet of streams.

Water development: Development and use of Forest water resources has affected water quality and quantity. The majority of water development on the Forest is associated with agricultural and municipal uses. Agricultural uses include stock watering and irrigation. Stock watering facilities are common on the Forest and are usually small wells or spring developments. Irrigation water diversions tend to be simple headgate designs and open, earthen canals to transmit water for use off Forest. Most irrigation facilities were constructed in the early 1900s. Agricultural water users tend to divert water only during the summer months. Municipal water development largely occurred off Forest in the early 1900s. Since the 1960s, municipal water development on the Forest has increased, and we expect that trend to continue as population increases. The Town of Encampment diverts water from the North Fork Encampment River for municipal use only a few miles below the Forest boundary. The City of Cheyenne initiated a trans-basin diversion system for municipal water in the 1960s. Municipal water diversions tend to be sophisticated, with multiple diversion structures feeding into larger and larger canals and pipelines. They also include use of reservoirs to store the water. Municipal water diversions often take place all year long.

Water quality has been impacted from construction or operation of water use facilities such as pipelines or diversion ditches. Von Ahlefeldt and Speas summarized periodic and large sediment discharges from construction or use of municipal water development facilities on the Forest (Von Ahlefeldt and Speas 1996). Agricultural diversions have also introduced both periodic and long-term sediment into downstream aquatic systems. For example, Billie Creek Ditch has overtopped, created gullies, and introduced sediment into Billie Creek numerous times, including a 2,300 cubic yard sediment discharge in the late 1990s (Snook 1999). Historic construction practices commonly brought water to a drainage divide in a ditch then allowed the water to form its own channel as it entered the receiving watershed. This practice resulted in the formation of gullies on the Forest (e.g., Carlson Ditch, Billie Ditch); many of these are still actively eroding and contributing sediment to the receiving waters. Water quantity has also been affected by both depletion and augmentation. Channel effects from augmentation become less pronounced as drainage area and stream size of the receiving waters increase. Over

time, water depletions and augmentation have changed the physical habitat of stream channels and adversely impact aquatic biota.

Fire: Modern fire suppression, beginning in the 1950s, may be changing the natural fire regime and ecological processes it influences. With the advent of fire suppression, less forest is burned on a yearly basis. As fuel loads increase, potential for larger, more intense fires increases. Fire regimes are within the historical range on most of the Forest, but some lower elevation vegetation types (e.g. Ponderosa pine, aspen and shrublands) have likely been moderately altered from their historical fire regime (See Fire and Fuels Management section). This change in fire intensity may produce different effects in aquatic and riparian ecosystems than what was previously experienced.

Timber harvest: Water resources have been influenced by historic tie drives and timber removal for other commodity uses. Timber harvest started in earnest with the advent of railroad tie drives in the mid to late 1800s. The log drives damaged stream banks, and simplified channel structure. A complete description of effects can be found in Young et al. (1989), along with others. The culmination of the tie drives in the early 1900s (the last tie drive was in 1940 on Douglas Creek) allowed stream recovery to begin and it continues to this day.

The amount and timing of past timber harvest are discussed in the Timber Resources section. Effects of past timber harvest to aquatic resources have been concentrated in the following drainages: Medicine Bow River, Pass Creek, Brush Creek, French Creek, Douglas Creek Big Creek, and Spring Creek. Aquatic effects from timber harvest are primarily associated with construction and maintenance of a transportation system (see Roads section above). There are no known documented cases of stream channel alterations on the Forest as a result of water yield from reductions in forest canopy. In a study of Medicine Bow National Forest streams, including watersheds with up to 23% of the basin harvested, Marston and Wick found no evidence to suggest channel morphology was outside of the range of natural variation due to water yield increases (Marston and Wick 1993). Susceptibility to channel morphology changes is dependent on stream characteristics (Rosgen 1996). The majority of streams on the Forest are not highly susceptible to changes in streamflow, since they are well armored and often enlarged due to historic tie drives. Harvest levels necessary to produce measurable increases in streamflow (i.e. greater than 20-25% of a watershed harvested) are uncommon on the Forest.

Mining: Mining generally has had two effects on water resources. First, the physical changes produced in the riparian landscape vary with the type of mining operation. Hand panning and shoveling have had minimal effects; hydraulic operations have dramatically altered the landscape. Placer mining conducted earlier in this century entirely disrupted some riparian and aquatic ecosystems as fluvial deposits were literally turned upside down as miners searched the gravels for gold. Lasting effects have totally changed channel structure and processes, reduced instream cover and

habitat diversity for fish, and removed original riparian vegetation from the areas. The Forest had seen moderate amounts of in-stream mining, generally concentrated in specific drainages like Douglas Creek and Lincoln Gulch (Medicine Bow Mountains) and Spring Creek (Sierra Madre Mountains). While some areas have recovered substantially, others still have unnatural drainage patterns and poor channel shape.

The second major impact is from hard rock mining. Newly fractured rock and altered subsurface flow have produced metal contamination in nearby streams. This effect has persisted for decades. Hardrock mining has had considerable impact on water resources in localized areas on the Forest. Haggerty and West Fork Battle Creek are water quality impaired due to heavy metals from mining operations. Stream fisheries have been essentially eliminated in some watersheds with acid mine drainage (e.g. Haggerty Creek).

Grazing: Grazing impacts in the analysis area have varied with the timing, distribution, and numbers of domestic and wild animals. Before forest reserves were established in the early 1900s, livestock numbers and grazing periods were essentially uncontrolled. This caused widespread riparian damage, including changes in stream morphology, water temperatures, and water quality. With the establishment of allotments and the reduction in livestock numbers, riparian areas received less use and conditions generally improved. Forage in many allotments is concentrated in wet meadows, and these areas have received the highest use and greatest grazing impact. Compared to pre-settlement periods, grazing management has improved, although recovery of aquatic resources has varied depending on watershed characteristics and specific rangeland management. Many sheep allotments are now vacant and show little historic impact. Other allotments have long-term riparian problem spots caused by sustained heavy overgrazing, but in general riparian conditions on the Forest are good.

Some grazing practices have also degraded water quality by introducing bacteria and pathogens into water bodies along with fecal material (e.g. Gray, et al, 1983). Although this impact has occurred in some streams on the Forest, it has not significantly impaired designated uses of stream water, according to the State 305(b) and 303(d) report (Wyoming Department of Environmental Quality 2002).

Recreation: Recreation impacts to water resources on the Forest have been caused by streamside recreation use, water based recreation, and indirect effects from upland recreation activities. Motorized off-road recreation travel has caused riparian area degradation and adverse water quality impacts. Horse, bike, and foot traffic have caused localized damage to streambanks and riparian vegetation. Water based recreation has increased and caused water quality degradation from bacterial contamination and localized damage to streambanks and riparian vegetation. Dispersed campsite use has caused removal of and damage to riparian vegetation, soil compaction in riparian zones, streambank erosion, and increased nutrient loading and pathogen levels due to human waste contaminating streams and lakes.

Fishing is, for some Forest users, the primary reason to visit the Medicine Bow National Forest; fishing is often an important, though subordinate activity associated with other recreational activities such as backpacking, camping, and horseback riding. Easy access to streams, lakes and reservoirs located within the Forest provides a variety of angling opportunities situated in locales that range from developed sites with amenities to subalpine wilderness areas.

The Wyoming Game and Fish Department (2001) publishes annual, statewide data about angler preferences in recreational fishing opportunities in Wyoming. Given the amount of public land in Wyoming administered by the Forest Service, much of the recreational fishing that occurs in the state occurs in national forests. Also, given that the Medicine Bow National Forest is accessible via two Interstate Highways, two Scenic Byways, and several state and county roads, a substantial amount of fishing in Wyoming occurs in the Forest. Finally, almost all of the subalpine and montane streams (perennial and intermittent) in southeast Wyoming are situated in the Medicine Bow National Forest (see table below).

Table 3-6. Perennial stream miles (subalpine and montane) located in and adjacent to the Medicine Bow National Forest, by mountain range.

Pole Mountain	Laramie Peak	Sierra Madre	Snowy Range	Total NFS Ownership
72	548	480	998	1,618

Source: GIS

Table 3-7. Recreational fishing data (angler-preference queries) from Wyoming in 2001 (2000 data).

Angler Days	Average days fishing and water preference: residents	Average days fishing and water preference: nonresidents
4,667,000.00	28; 40% streams and 60% lakes, reservoirs, etc.	28; 45% streams and 55% lakes, reservoirs, etc.

Introduction of species: Since the 1880s, the introductions of many non-native gamefish into native fish habitats (streams, primarily) along with the introductions of both native and non-native species into lakes that were once fishless, have significantly changed the composition and diversity of aquatic ecosystems in the Forest and in Wyoming (Baxter and Stone 1995). For example, two reservoirs constructed on the Forest (Douglas Ranger District) were stocked with non-native gamefish. The aforementioned projects have increased aquatic biodiversity in the Forest, albeit through artificial means. Of the 196 6th level watersheds on the Forest, brook trout have been introduced into 162 of them while rainbow trout have been introduced into 111 watersheds, and brown trout have been introduced into 100. The present composition and diversity of aquatic ecosystems on most of the Forest are materially different from historic conditions.

Watershed Condition Assessment

Watershed condition includes physical, chemical, and biotic factors in a watershed. Cumulative effects from human disturbance and effects due to variations in ecological processes were evaluated to determine current physical, chemical, and biological watershed conditions, relative to their natural condition (Gloss 2001a). The following definitions apply to this watershed condition assessment (FSM 2521.1):

- Watershed condition – the state of a watershed based on physical and biological characteristics and processes affecting hydrologic and soil functions.
- Class I Condition –watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. The drainage network is generally stable. Physical, chemical, and biologic conditions suggest that soil, aquatic, and riparian systems are predominantly functional in terms of supporting beneficial uses.
- Class II Condition – watersheds exhibit moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. Portions of the watershed may have an unstable drainage network. Physical, chemical, and biologic conditions suggest that soil, aquatic, and riparian systems are at risk and may not be able to support beneficial uses.
- Class III Condition – watersheds exhibit low geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. The majority of the drainage network may be unstable. Physical, chemical, and biologic conditions suggest that soil, aquatic, and riparian systems do not support beneficial uses.

The Wyoming Department of Environmental Quality (WDEQ) has assessed and determined whether beneficial uses are supported in water bodies in Wyoming (see Surface Water: Water Quality section above). Therefore, this watershed condition assessment focused on estimating watershed condition relative to natural potential conditions. The following map (Watershed condition) shows the estimated watershed conditions on the Forest. Results of this assessment suggest that the cumulative effects of human disturbances and ecological processes have significantly altered the physical, chemical, and/or biological conditions from their natural conditions on the majority of the Forest. Of the 39 watersheds evaluated, none were rated Class I, 35 were rated Class II, and 4 were rated Class III. Given the high degree of human modifications to the Forest, this result is reasonable. Similar findings have been documented in watersheds and streams in along the Colorado Front Range (Wohl 2001). These nearby streams have also been significantly altered from their historic conditions since Euro-American settlement.

Map 3-2. Watershed condition.

Alterations in the natural or expected ranges of three broad, aquatic ecosystem categories - the physical, chemical, and biological integrity of aquatic ecosystems - have all played a role in defining watershed conditions on the Forest. Shifts in biological integrity of aquatic systems are the most pervasive, with the introductions of non-native trout which now occupy most watersheds on the Forest (Von Ahlefeldt and Speas 1996). Historic (tie drives and dredge mining) and current (water development, road construction, timber harvest) activities have also altered the physical and geomorphic integrity of aquatic systems. Direct physical and geomorphic changes to streams and riparian areas have had greater effects on aquatic systems than have indirect effects to upland watershed health. Chemical contamination of aquatic systems on the Forest has dramatic effects but tends to be limited to a few streams. Individually or cumulatively, changes in physical, chemical, and biological integrity have altered most Forest aquatic systems.

Aquatic Protection and Restoration Priorities

Priority watersheds are defined in the *Unified Federal Policy for a Watershed Approach to Federal Land Management*:

"Priority watersheds: Watersheds selected for focusing of Federal funds and personnel for the purpose of accelerating improvements in water quality and watershed condition." (65 CFR 62566, 10/18/00)

The *Unified Federal Policy for a Watershed Approach to Federal Land Management* suggests identifying watersheds that may have "significant human health, public use, or aquatic ecosystem values." In addition watersheds that are vulnerable to or currently have "water quality impairment, impacts to aquatic resources, and/or changes to flow regime" should be considered for identification as a Priority Watershed. Aquatic personnel on the Forest utilized existing data sources and professional knowledge to identify watersheds where significant aquatic values exist and there are opportunities to restore or improve water quality, aquatic habitat, and watershed conditions (Wolff, Schnackenberg et al. 2002). Watersheds where these criteria were met were identified as Priority Watersheds.

The following table and map show the recommended 5th level Priority Watersheds on the Forest. Of the 39 fifth-level watersheds on the Forest, five have been identified as Priority Watersheds for protection and/or restoration. Protection and restoration opportunities exist in all these Priority Watersheds. Portions of the watersheds currently have conditions and values that are desirable to protect, but portions of each watershed would also benefit from restoration. Not all watersheds identified as Watershed Condition Class III are designated as priority watersheds due to the lack of significant aquatic values in some of the Class III watersheds. The majority of the Medicine Bow National Forest located in the Green River basin is a Priority Watershed because it contains nearly half of the remaining Colorado River cutthroat trout populations in the world. Conversely, Laramie Peak contains no

Priority Watersheds due to the lack of outstanding water resource values in the area. Areas that contain no priority watersheds may also have significant watershed and fisheries values that are important to protect and/or enhance. Protection and enhancement in these areas should be pursued opportunistically and in response to project proposals from other resource areas.

Table 3-8. Priority watersheds recommended for protection and restoration.

Watershed Name (HUC code)	Restoration Reason & Opportunity	Protection Value – Aquatic Resources
South Platte River Basin		
Crow Creek (1019000901)	Recreation, roads, grazing	Public water supply
North Platte River Basin		
North Platte River and Douglas Creek (1018000201)	Roads, timber harvest, tie drives, dredge mining, recreation	Outstanding fishery and North Platte River is recommended wild and scenic river
Encampment River (1018000205)	Tie drives, grazing, roads	Recommended wild and scenic river and public water supply
Green River Basin		
Little Snake River (1405000301)	Introduced fish species, water diversion, mine drainage, timber harvest, roads, grazing, recreation	Colorado River cutthroat trout
Savery Creek (1405000304)	Introduced fish species, grazing, roads	Colorado River cutthroat trout

While the majority of the watersheds on the Forest have been modified from their natural conditions (see Current Aquatic Conditions section above), only a few watersheds are recommended as Priority Watersheds in need of special protection, restoration, and focus of federal funds and personnel to improve or protect water quality and watershed conditions. Protection, maintenance and restoration of watersheds that are not designated as Priority Watersheds should be pursued opportunistically.

Map 3-3. Recommended 5th-level priority watersheds on the Medicine Bow National Forest.

ENVIRONMENTAL CONSEQUENCES

Almost all of the multiple-use activities conducted in the Forest and described in this analysis have the potential to affect aquatic and riparian resources. Based on the assessment of current aquatic conditions, it appears the most significant risks to aquatic resources are from management activities with direct impacts on streams, riparian areas, and aquatic community composition. The uplands of watersheds appear to be more resilient and management activities that directly impact the uplands pose a smaller risk because management activities have improved. Environmental consequences due to multiple-use activities are expected to be proportional to the magnitude and extent of activities that occur.

In this analysis, two budget levels are considered to provide context for the levels of activities likely to be experienced: experienced budget levels and full implementation budgets. This aquatic and riparian resource analysis focuses on environmental effects associated with levels of activities funded at the experienced budget levels. Any reference to specific, quantitative levels of activities suggests recently experienced budget levels that fund aquatic resource management. Typically, the environmental effects due to oil and gas leasing, mining, livestock grazing, and water development are not tied to Forest Service budgets. Effects are more likely to increase with full implementation budgets for activities such as recreation, road and facility construction, and timber harvest. Under full implementation budgets, prescribed fire treatments would likely increase over those implemented at experienced levels; this difference could lead to a long-term reduction in environmental effects due to wildfire. With the exception of fire, effects from full implementation budget levels are expected to be equal or greater than experienced levels.

Direct and Indirect Effects

Surface water, ground water, floodplains, riparian areas, wetlands, and aquatic habitats for indicator species and other organisms are all closely related. Discussion of effects on these resources will be dealt with together since the pathways of effects that influence all of them are similar. Effects to riparian areas and wetlands are also discussed in the Biological Diversity, Biological Assessment and Biological Evaluation sections. When various aquatic ecosystem components are impacted differently, it will be specifically noted and described.

Watershed conservation practices and Forest Plan standards and guidelines prescribe extensive measures to protect soil, riparian, and aquatic resources. When applicable mitigation measures are implemented and are effective, adverse effects to the aforementioned resources due to management activities are expected to be minimal. However, as the intensities and the extent of activities increase, there is increased risk that conservation practices will not be adequately implemented or that they will

not be cumulatively effective. Therefore, it is reasonable to presume that those alternatives that prescribe greater levels of multiple-use activities than other alternatives generally tend to pose greater risks to aquatic and riparian ecosystems.

Implementation and effectiveness monitoring of Best Management Practices are typically carried out as an administrative review and does not involve water quality measurements (MacDonald, Smart et al. 1991). Implementation and effectiveness monitoring of watershed conservation practices, and Forest Plan standards and guidelines on the Forest 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 can include field notes, memos, contract daily diaries or monitoring reports (e.g., USDA Forest Service, 2002; Wyoming Timber Industry Association, 2002). Systematic monitoring and adjustment of land management activities, where necessary, will ensure the highest possible level of Best Management Practice implementation and effectiveness.

For each of the resource areas described below, the environmental consequences for aquatic resources are compared by alternative, based on key indicators of disturbance for each type of activity.

Effects from Timber Management

Timber harvest can affect aquatic resources in a variety of ways. Timber harvest in or proximate to riparian zones reduces the abundance of streamside vegetation. A reduction in streamside vegetation can increase average annual and average daily stream temperature, reduce overhanging vegetation, and decrease the recruitment of large woody debris in streams (Salo and Cundy 1987). Conversely, logging slash and debris can be introduced into streams, degrade habitat and alter channel morphology. Major increases in erosion from harvested areas themselves are unusual, but the road and skid trail network associated with timber sales (see Effects from Travel Management section) can increase the risk of erosion and sedimentation (e.g. Rice, et al, 1972).

Timber harvest can produce water yield increases in local streams (Troendle, Wilcox et al. 1998). If 20-30% of the basal area is removed from a forested watershed, flow volume, peaks, and timing may change. This is due to reduced interception loss from tree crowns and reduced transpiration loss from growing trees. Flow volume and peak flows tend to increase, and annual peak flows can be moved ahead several weeks. As vegetation grows back after harvest, water yield declines.

Changes to natural streamflow regimes as a result of modifications to forest cover could alter stream channel morphology. Bankfull discharges have been found to mobilize and transport the majority of annual sediment loads over a period of years (Andrews, 1980). Troendle and Olsen found that the duration of bankfull discharge increased after timber harvest (Troendle and Olsen 1994). Forest canopy changes can alter flow and sediment transport characteristics, which in turn can cause channel

morphology changes. Forest Plan standards provide a means to protect stream channels against increased flows from vegetation management. Channel instability due to water yield from vegetation management is possible, but not expected to be a significant issue in most areas on the Forest due to the harvest levels in individual watersheds and the channel conditions present on most of the Forest. Project specific analysis and mitigation practices should address channel instability due to water yield from vegetation management in the few cases where there may be concerns.

Changes in riparian vegetation and impacts to streambanks from logging operations all have the potential to alter fish habitat in streams on the Forest in watersheds where timber harvest occurs. Direct effects to riparian conditions and aquatic habitat conditions due to vegetation removal can result in reductions in overhanging vegetation. Overhanging vegetation provides hiding cover (shading) for fish and it helps to cool stream temperatures. Indirect effects of streamside timber harvest to aquatic ecosystems could include changes to thermal buffering that could increase average 24-hour stream temperatures in summer or decrease average 24-hour temperatures in winter to sub-optimal levels. Alterations of typical seasonal 24-hour temperatures can cause material physiological stress in fish, especially during spawning and embryonic development. Other indirect effects of streamside timber harvest to aquatic ecosystems could be changes in community composition and relative abundance of aquatic biota and reductions in the abundance, distribution, and quality of spawning habitat and hiding cover due to sedimentation, embeddedness, and loss of streamside vegetation.

Aquatic resources will be protected under all alternatives, but risk of adverse consequences to watersheds and fisheries increases with higher harvest levels. The potential for impacts to water resources is estimated to be proportional to the harvest acres per year, desired condition level, and is shown below. Alternative A has the highest risk of potential adverse effects to aquatic resources from timber harvesting followed in order by alternatives B, C, D DEIS, D FEIS, E, and F. In reality, risk and consequence is dependant on a variety of factors including the type of harvest and location relative to water resources.

Table 3-9. Comparison of potential for aquatic impacts between alternatives, based on land allocated to timber management areas.

Alternative	A	B	C	D DEIS	D FEIS	E	F
Harvest acres per year, desired condition level	3245	3123	2975	2814	2735	2561	167

Effective implementation of watershed conservation practices is key to avoiding or minimizing impacts to aquatic species and potentially affected streams under any alternative. Implementation and effectiveness of forestry watershed conservation practices was rated at 91 and 93 percent respectively, in a recent field audit which

included two timber sales on the Forest (Wyoming Timber Industry Association 2002). The number of acres harvested and the degree to which effective watershed conservation practices are implemented varies annually depending on the alternative in question and on experienced budget levels. Site-specific impacts to aquatic and riparian ecosystems due to timber harvest can occur because of a variety of factors including the number of acres harvested, the location of harvest units in the watershed, silvicultural prescriptions (e.g. clearcut, etc.), and the implementation of effective watershed conservation practices.

Effects from Travel Management

There are economic and ecological consequences that ensue from construction and operation of a road and trail system on the Forest. Increased sediment derived from roads is the major concern for aquatic resources. Because channels are interconnected via networks, even sediment delivered to ephemeral channels is eventually transported to perennial channels during storms or during spring runoff. Heavy sediment loads can impact stream ecosystems if sediment deposition reduces pool depths, inundates stream substrates, adheres to the gills of fish and aquatic insects, alters channel form and function, and results in other forms of habitat degradation. Unlike many other disturbances that increase erosion, sedimentation from travelways tends to last as long as the travelways exist, which can create chronic impacts on aquatic habitat. Roads, trails, and associated human travel can also reduce, disturb, and interrupt riparian habitat on the Forest.

Compliance with revised Forest Plan standards and guidelines, including watershed conservation practices and improved road designs, are expected to minimize environmental impacts due to new road construction and road reconstruction. However, bringing existing roads into compliance with new protection measures is a major challenge because of the associated costs. Future road management assessments will consider the feasibility of relocating and/or obliterating existing roads to reduce their impacts to other resources. Future assessments will also consider ways to reduce impacts to Forest ecosystems due to roads, such as reconsidering road location and road design. Proper road location should avoid proximity to vulnerable areas such as stream channels, riparian areas, wetlands, steep slopes, and highly erodible and unstable soils. Proper road design and location includes stable cut and fill slopes and effective road drainage. Effective road drainage features allow road surface water to filter through vegetation buffers or flow through sediment traps before it enters a stream or lake. Proper road designs and location also includes routes that intersect streams and riparian areas perpendicularly to minimize disturbance in critical aquatic habitats. This prescription could lessen the extent of road impacts on streams, riparian areas, and wetlands. If road relocation is not possible, then seasonal travel restrictions could reduce road surface erosion and associated sedimentation in vulnerable ecosystems.

For comparison, the prescriptions for each alternative relevant to road construction and reconstruction, and road decommissioning are shown in the table below. Road decommissioning can include a range of actions from simple, road closures by posting road closure signs to road obliterations. In addition, the table shows the percentage of roads that are to be maintained to national standards, by alternative. Overall risks of impacts to aquatic, riparian, and wetland ecosystems due to roads tend to increase with new road construction. Conversely, risks of impacts to the aforementioned ecosystems tend to decrease with road obliterations. Interestingly, road maintenance and road reconstruction tend to cause short-term increases in soil erosion. But, routine road maintenance provides opportunities to stabilize road features and improve road drainage. The relative impacts of roads on aquatic resources are based on the net change (miles of road construction minus miles of road decommissioning) in road miles for each alternative. Total miles of Forest roads are expected to decrease under all alternatives during the planning period. If these expectations are realized, then a reduction in road miles can benefit aquatic, riparian, and wetland ecosystems. Among alternatives, alternatives E and F prescribe the greatest reduction in road miles that could result in less adverse impacts and the greatest potential benefits to aquatic, riparian, and wetland ecosystems. The remaining alternatives reduce the risks to the aforementioned ecosystems due to reductions in road miles in ascending order: alternatives D FEIS, D DEIS, C, B, and A. The potential impacts to aquatic, riparian, and wetland ecosystems due to miles of trail are considered negligible relative to the potential impacts due to roads; miles of trails by alternative does not change the comparison among alternatives by miles of roads.

Relative to the existing road network, the effects of proposed road construction under the various alternatives are minimal, because impacts are dominated by the existing transportation system. Maintenance, reconstruction and decommissioning all address the existing travel system on the Forest and are expected to influence aquatic resources more than road construction over the planning period. The total miles of road greatly exceed the Forest's fiscal ability to maintain all the roads to national standards. Roads that are not maintained to national standards will produce more sediment than roads that are maintained to standard. The percent of roads maintained to national standards is expected to increase over existing conditions in all alternatives except B, and should reduce water quality impacts. The Forest has initiated a travel management planning process to address issues related to the transportation system on the Forest. This process provides the opportunity to identify and mitigate portions of the transportation system that have the greatest adverse aquatic affects.

Table 3-10. Relative impacts of miles of roads between alternatives at experienced budget levels.

Alternative	A	B	C	D DEIS	D FEIS	E	F
Road Construction (Miles/Yr)	4	2	2	2	2	2	0
Road Reconstruction (Miles/Yr)	4	5	4	4	4	3	1
Road Decommissioning (Miles/Yr)	18	18	18	18	18	75	121
Percentage of roads maintained to national standards	53	53	54	56	56	42	38

Effects from Fire and Fuels Management:

Wildfire and prescribed fires and their associated suppression activities have the potential to impact aquatic and riparian resources. Most fire effects influence surface water and not ground water. Despite the limited research on effects of fire on ground water quality, "[i]t is reasonable to expect that fire will have little effect on ground water quality." (Dissmeyer, 2000, p132).

Fire effects are directly related to fire severity. Effects to aquatic resources from high severity fires can be significant, while effects from moderate and low severity fires are less significant. Fires expected to occur on the majority of the Forest over the next planning cycle can be expected to be within the historic range of natural variability (See Fire and Fuels Management). Even though fire regimes are expected to be largely within historic ranges, effects to aquatic ecosystems may be significantly greater since some aquatic conditions are outside of the historic range of conditions. For example, the consequences of a fire in the now limited habitat of Colorado River Cutthroat may be far greater than in the past, due to the reduced ability of species to re-populate a watershed which may lose all or a portion of its population as the result of a fire.

By burning vegetation and organic matter on the soil surface, wildfire can greatly increase erosion rates and adversely affect water quality. Erosion and sedimentation following high severity wildfires tends to be very heavy, overwhelming other erosion sources, including timber harvest and roads, until the land revegetates. The removal of vegetation also increases the speed with which overland flow reaches the channel network and the amount of water added to the streamflow. The combination of these effects can greatly increase peak flows in burned watersheds and result in major channel cutting. When fires burn through riparian areas, buffering vegetation is lost and effects on aquatic ecosystems can be even more severe. Adverse impacts can persist for many years.

The effects of prescribed fire can be considerably less severe. 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. Rarely, do entire watersheds burn as a result of prescribed fire treatments; these treatments can reduce the effects of changes in water yield and peak flow due to conditions such as drought. Furthermore, the judicious use of prescribe fire can help to reduce the risk of uncontrolled wildfires that would otherwise burn through and severely damage watersheds and riparian areas.

Fire suppression tactics can also affect aquatic resources. Fire retardants, an important tool in modern firefighting, can have deleterious effects on aquatic biota (Dissmeyer 2000). To reduce the corrosive effects of certain retardant formulations (Firetrol) on storage and dispersing equipment, ferro-cyanide compounds are added to the mix. If fire retardants containing cyanide compounds are inadvertently sprayed into aquatic environments that have a pH of less than 9.0, then free cyanide can be produced, a substance that is materially toxic to aquatic biota (Wireman 2000). Fire suppression efforts can also considerably increase erosion potential from fire lines or staging areas constructed by heavy equipment.

Frequency, size, and severity of wildfires are difficult to predict over the planning period. Smaller wildfires occur relatively frequently, while larger wildfires occur infrequently (See Fire and Fuels Management section). Severe wildfire can have devastating consequences to aquatic ecosystems. Management response to wildfire varies between alternatives and will likely affect the size and severity of wildfire expected under each alternative.

In addition, the area affected annually by fuel management (combination of prescribed fire and mechanical treatment) is expected to vary by alternative as shown below. Additional prescribed burning is intended primarily to improve wildlife habitat or reduce fuel loads. Increased fuel treatment may reduce the risk of severe wildfires and therefore have a positive long-term effect on aquatic conditions. In watersheds where fuel conditions have been substantially altered, long-term benefits of fuel treatment to aquatic resources are estimated to outweigh short-term adverse impacts. All alternatives except F increase fuel treatments over existing levels (see following table). Alternatives E, D FEIS, and D DEIS have the greatest chance of reducing severe wildfire effects to aquatic resources, followed in order by C, B, A, and F.

Table 3-11. Relative amounts of affected acres due to fuels treatments, by alternative.

Alternative	**A**	**B**	**C**	**D DEIS**	**D FEIS**	**E**	**F**
Fuel Treatment (acres/year)	2,500	3,500	3,500	4,000	4,000	4,000	2,200

Effects from Livestock Grazing and Big Game Use

Certain grazing practices can have detrimental effects to aquatic resources, particularly in a few areas of the Forest where much of the usable forage is found only in riparian areas. Impacts to aquatic resources depend on timing of use, duration of use, and frequency of use, as well as intensity. Grazing in riparian areas directly affects vegetative condition and habitat quality in a number of ways. Some grazing practices can also lower water quality by introducing bacteria and pathogens into water bodies along with fecal material (e.g. Gray, et al, 1983). Alternatively, proper livestock, wildlife, and rangeland management can mitigate grazing impacts to riparian areas and wetlands and can be compatible with maintaining desired watershed conditions. Most of the rangeland, including riparian areas is in satisfactory condition (see Livestock and Big Game Use).

Long-term use has changed the vegetation composition of some riparian sites. Loss of willows and deep rooted grasses makes streambanks in these sites more susceptible to natural erosive forces. Also, overgrazing by livestock and wild ungulates can reduce bank stability through vegetation removal and bank trampling; it can compact soil, increase sedimentation, cause stream widening or downcutting, and often changes riparian vegetation, resulting in insufficient overhead cover for fish (e.g. Kauffman and Krueger, 1984). 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 yearly use of the same areas by livestock and big game. Downcutting often leads to channel straightening and reduced stream sinuosity, which eliminates habitat for aquatic indicator species associated with stream bends, such as lateral scour pools and undercut banks.

Alternatives vary slightly in the number and type of animals permitted, as well as overall use, but not in the number of active allotments. Potential livestock grazing impacts are assumed to be proportional to the number of active allotments, as shown below. Alternatives A, B, C, D DEIS, D FEIS, and E maintain the current number of active allotments and aquatic resource impacts from grazing would be similar to the existing conditions and vary little between alternatives. Alternative F slightly decreases the number of active allotments from the current conditions.

Table 3-12. Comparison of impacts between alternatives for livestock grazing.

Alternative	A	B	C	D DEIS	D FEIS	E	F
Active Allotments	104	104	104	104	104	104	97

Livestock grazing under any of the alternatives is assumed to have high potential for direct impact on riparian and aquatic resources, although only eight percent of suitable acres are located in or immediately adjacent to riparian areas. Watershed conservation practices designed to protect water quality and riparian areas, where

needed, will be included in allotment management plans as they are revised and updated. Incorporation of Best Management Practices into project level analysis will minimize the effects of grazing on aquatic resources.

Effects from Mining

One of the most pervasive environmental problems caused by mining is acid mine drainage. Acid mine drainage occurs when iron containing sulfide minerals from adits, shafts or tailings piles are exposed to air and water (Ficklin and Smith 1993). Acid drainage typically carries increased concentrations of dissolved metals, which can be harmful to aquatic biota. Stream fisheries have been essentially eliminated in some watersheds with acid mine drainage (e.g. Haggerty Creek).

At present, much of the mining on the Forest is recreational; recreational mining (suction dredging) is regulated by Forest Plan standards and guidelines. Large increases in mining activity are not anticipated for the future, but cannot be ruled out. The 1866 mining law limits Forest Service authority over mining activities, but allows the setting of terms and conditions to minimize impacts to NFS lands.

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 relatively localized for all alternatives, but alternatives A, B, and C have the greatest risk of adverse affects.

Table 3-13. Comparison of impacts among alternatives for locatable minerals.

Alternative	A	B	C	D DEIS	D FEIS	E	F
Acres of Available – Locatable* Minerals (1000s acres)	993	922	870	765	812	844	636

*Locatable minerals are minerals such as gold, silver, and molybdenum

Effects from Utility Corridors

Three general types of utility corridors have varying potential to affect aquatic and riparian resources. Above –ground power and telecommunications corridors require vegetation clearing, but ground disturbance is limited to access routes and pole or tower locations. Streams and wetlands can often be spanned with no need for disturbance.

Below ground power and telecommunications corridors require ground disturbance along the entire length of the corridor, including crossings of aquatic or riparian ecosystems. However, these corridors require relatively narrow trenches and minimal vegetation clearing. These utility corridors can often be located along other existing corridors such as roadways.

Below ground oil, gas, or water transmission lines are most likely to significantly affect aquatic and riparian resources. These corridors often contain far larger pipelines that require large, deep trenches, and are also more likely to include collection pipeline systems that greatly increase disturbance area and potential for impacts. Potential for leaks or spills that could cause environmental damage exist with these corridors but not with power or telecommunications corridors. To allow for gravity feed, these corridors are often located parallel to natural stream courses. Wide construction and access corridors are sometimes maintained to allow for repairs and cleaning.

Utility corridors of all three types currently exist on the Forest, and they are unlikely to be eliminated in the future. In fact, increasing urbanization makes it likely that there will be an upward trend in utility corridors. There is not likely to be any difference in utility corridor proposals between the alternatives because corridors are instigated and developed by private utilities rather than by Forest management direction.

Effects from Recreation Management

In general, people who recreate in national forests are fond of driving, horseback riding, hiking, fishing and camping near lakes and streams. Protection of water quality, quantity and riparian habitat near these recreationally significant water bodies is achieved through the implementation of Watershed Conservation Practices. Table I-2 in Appendix I of the Revised Plan contains a minimum listing of water bodies on the Forest where water quantity is important for recreational activities and protection should be provided with Forest Plan standards and guidelines.

Recreational activities can degrade aquatic, riparian, and wetland environments in the following ways: damage to and displacement of riparian vegetation; soil compaction and soil erosion; increased rates of overland flow; sedimentation; and pathogenic contamination of potable and non-potable waters (Helgath 1975; Clark and Gibbons 1991; Leung and Marion 1996; Cole 2000). Often, the aforementioned 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.

Motorized and nonmotorized winter recreation activities have relatively low potential to adversely affect aquatic and riparian resources, but are not environmentally benign. Nonmotorized winter uses include cross-country skiing and snowshoeing. Motorized winter uses include snowmobiling and snow cat use for research and maintenance. Clearly, damage to vegetation and soil erosion can occur if there is inadequate snowpack to protect these resources. Also, winter motorized activities can result in compacted snow which can form barriers that alter spring runoff patterns which can result in soil erosion and gullies. Contamination by human waste and by petroleum products such as motor oil and gasoline can also degrade water quality in waters adjacent to areas of concentrated use such as parking lots and

snowmobile staging areas (Hagan and Langeland 1973; Ingersoll, Turk et al. 1997). The likelihood and magnitude of the aforementioned impacts due to these activities are dependent on site-specific factors such as slope, aspect, elevation, vegetation, weather conditions, available facilities, and the amount of use. Because site conditions vary, and because these sites are relatively small in area and widely dispersed, it is reasonable to assume that cumulative impacts will not be measurable at the Forest scale. Appropriately, winter activities that appear to be problematic will be identified and rectified during project level analysis.

Developed winter recreation sites may adversely affect aquatic and riparian resources. The Snowy Range Ski Area is the only ski area that is permitted to operate on the Forest. Ski area development can lead to increased runoff and erosion through timber clearing for lifts, runs and other facilities. Ski areas and snow resorts typically remove forest vegetation from much of the area. Snowmelt runoff is increased, especially when cleared areas are compacted or snowmaking has artificially increased the snow depth. Substantial amounts of such disturbances can increase the size and duration of spring high flows. Stream channel damage can result. Snowmaking that drains water from streams also reduces winter base flows that are limiting to populations of fish and other aquatic biota. Life cycles of such biota can be disrupted. 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. Aquatic habitat can be damaged as a result. In addition, these uses can also degrade wetlands and riparian areas by draining or filling them or by altering their vegetation. Often, ski lift terminals are constructed in valley bottoms, which can cause long stretches of stream to be put in culverts, with a resultant increase in barriers to fish passage and loss of riparian and wetland habitat. These impacts often have adverse effects on aquatic and wildlife habitat. All alternatives would continue to permit the existing ski area. Alternatives B, C, D DEIS and D FEIS include several hundred additional acres of Management Area 8.22 for potential ski expansion of the Snowy Range Ski Area. Therefore potential effects of ski areas on riparian and aquatic resources are higher in alternatives B, C, D DEIS, and D FEIS, but it is important to recognize that overall effects from developed winter recreation are limited to a localized area on the Forest.

Fishing pressure in the Forest is expected to increase in the coming decades under all of the Forest Plan alternatives. In the Medicine Bow National Forest – excepting stocked lakes and reservoirs – fishing is a "supply limited" activity because there is more fishing pressure on easily accessible fisheries than fish populations can support. The Wyoming Game and Fish Department manages the overwhelming majority of streams in the Forest under the "Wild" management concept. This concept dictates that fisheries be naturally reproducing and self-sustaining; the fish populations in these streams are not augmented by stocking.

Recreational fishing may adversely affect existing populations of Colorado River cutthroat trout in the forest, because increased recreational fishing pressure is likely

to result in increased illegal harvest and increased incidental fishing mortality; in Wyoming, the existing creel limit is one fish per day in possession. The aforementioned effects are considered in *Biological Assessment* and in the viability assessment for the Forest Plan.

Watershed improvement projects and fish habitat improvement projects can result in positive outcomes for both fisheries and for recreational anglers. Over the past planning period, a variety of fish habitat improvement projects such as streambank stabilizations, pool forming structure placements, spawning habitat enhancement, and bottomless arch culvert placements have been implemented in the Forest. In addition, Forest Service fisheries crews have assisted the Wyoming Game and Fish Department in conserving genetically pure wild populations of Colorado River cutthroat trout in selected streams in the Sierra Madre, west of the Continental Divide. The aforementioned efforts will continue during the next planning period. Much of the anticipated project work will be conducted in cooperation with the Wyoming Game and Fish Department and non-governmental organizations such as Trout Unlimited.

To reiterate, demand for a variety of recreational opportunities will continue to increase in the Medicine Bow National Forest whether the Forest provides adequate recreational facilities to meet the increased demand, or not. If facilities are insufficient to meet the demand for developed recreation, then recreational use may be shifted to dispersed campsites, the result of which could be additional and unregulated deleterious effects on soils, vegetation, and riparian values at those sites.

Recreational use is expected to increase on the Forest, and be similar between alternatives. The direct impacts to fisheries and fishing experiences are expected to be proportional to use rather than variable by alternative. Ski area effects by alternative are discussed above. Impacts on riparian and aquatic habitats from recreational travel are also discussed in the "Travelways" section that appears earlier in this chapter. The magnitude and extent of motorized recreation trends have a greater effect on aquatic resources than do nonmotorized recreation uses. Therefore, expected recreational impacts on aquatic, riparian, and fisheries resources are related to the estimated miles of proposed system roads by alternative as shown in the table below. Using the estimated miles of proposed system roads as an indicator alternatives A and B are expected to have the highest risk for potential, adverse effects to aquatic resources from recreation, followed in order by alternatives C, D FEIS, D DEIS, E and F. Despite watershed conservation practices implemented to protect aquatic and riparian resources, impacts to these resources will likely increase given increased use because stream and lake environments will continue to disproportionately attract Forest users.

Table 3-14. Relative impacts among alternatives given recreation prescriptions.

	A	B	C	D DEIS	D FEIS	E	F
Total estimated miles of proposed system roads.	2,403	2,400	2,350	2,223	2,244	2,210	1,754

Hiking trails are popular among Forest users in the Medicine Bow National Forest, though trail networks and trail use can adversely impact aquatic, riparian, and wetlands environments. In addition, trail use can contribute to the propagation and distribution of pathogenic agents such as the whirling disease protozoan, coliform bacteria, and Chytrid fungus in aquatic environments. Whirling disease has profoundly impacted trout fisheries in the western United States and chytrid fungus appears to be a causal agent in the decline of boreal toad populations in the Rocky Mountains. Other native amphibians may be impacted by the Chytrid fungus too. Finally, trails can provide relatively easy access and opportunities to those who would introduce exotic species into aquatic environments. Given the popularity of trail networks among Forest users, it is reasonable to expect increasing demands by the public for additional hiking trails over the coming decades. An expanded trail network could result in the alteration and degradation of aquatic, riparian, and wetland resources.

Effects from Wilderness Allocation

Water quality, aquatic habitat and aquatic biota would benefit from additional wilderness allocation. Water bodies within Wilderness Areas are often classified as outstanding waters by the State of Wyoming Department of Environmental Quality and therefore receive the highest possible level of water quality protection. Anthropogenic sources of non-point source pollution are limited in these areas due to the types of activities occurring in wilderness areas as compared to other multiple use areas. Effects to water resources from natural disturbances such as fire can be expected to vary over time. There may be short periods where water quality degradation occurs due to large-scale natural disturbances such as fire, followed by longer periods where water quality has recovered and is higher than in watersheds with anthropogenic pollutant sources. It is not expected that public water systems will be affected by additional wilderness allocation, because the areas proposed for wilderness designation are far removed from municipal water sources. Existing water development facilities may be allowed until a Congressional designation decision is made. New water development facilities are unlikely in any of the areas recommended for wilderness. Any proposed water development facilities in these areas would likely be incompatible with wilderness characteristics and not authorized. Aquatic habitats and biota would benefit from the increased water quality protection and limits in anthropogenic sources of degradation.

Alternatives D DEIS, D FEIS, E, and F include areas recommended for wilderness (MA 1.2) that would provide additional water quality protection and beneficial effects to aquatic biota. Alternative D DEIS includes additions to the Encampment River Wilderness, the Huston Park Wilderness, as well as new wilderness areas in the Rock and Ashenfelder Creek areas. Alternative D FEIS is similar, except the proposed wilderness allocation in the Ashenfelder Creek area has been dropped. Alternative E includes additions to the Encampment River Wilderness, and the Huston Park Wilderness. Alternative F includes additions to all four existing Wilderness Areas as well as extensive additional areas recommended for Wilderness. Existing stream habitats extant within the Forest that are protected for wild, genetically pure Colorado River cutthroat trout and associated native fishes within their historic range are relatively small compared to the amount of stream habitats that support non-native fish. Alternatives D DEIS, D FEIS and F recommend wilderness additions in the North Fork Little Snake River drainage in areas with habitat for Colorado River cutthroat trout. Wilderness allocation in Colorado River cutthroat trout habitat would provide the greatest benefit to aquatic resources. Additional benefits to aquatic resources are estimated to be proportional to the amount of wilderness recommended in each alternative (see following table). Therefore, alternative F, D DEIS and D FEIS provide the greatest benefit to aquatic resources. Alternative E provides the next greatest level of benefit, but does not include areas with Colorado River cutthroat habitat. There is no difference between alternatives A, B, C. There will be no difference during the planning period (10-15 years) among alternatives for existing Wilderness Areas.

Table 3-15 Comparison of expected impacts due to wilderness allocation among alternatives.

Alternative	A	B	C	D DEIS	D FEIS	E	F
Acres Recommended for Wilderness	0	0	0	60,859	27,973	4,553	271,357

Effects from Oil and Gas Leasing

The potential commercial reserves of oil and gas that may warrant exploration are relatively low in the majority of the Forest. There is some indication that oil and gas resource potential may warrant exploration and development at lower elevations along the north side of the Snowy Range mountains and along the west side of the Sierra Madre mountains.

Because of the limited potential for oil and gas leasing on the Forest, this issue has not been a primary concern for aquatic resources. Risks from oil and gas well drilling include the potential for contamination by petroleum products, drilling mud, and other contaminants. Road and drill pad construction also increase the risk of erosion and sedimentation. If exploration discovers economic quantities of oil or gas, a producing field can be developed. Effects from such a field would include

more surface disturbance and potential contamination from water and oil brought to the surface.

However, protection measures for soils, riparian and aquatic resources are important to ensure adequate protection exists in the areas that may receive oil and gas development on the Forest. The State of Wyoming and the Bureau of Land Management drilling regulations require isolation of water producing zones as wells are drilled and before wells are abandoned. Standard lease terms apply to all areas on the Forest with potential for oil and gas development for all alternatives, except Alternative A where no lands are administratively available for oil and gas leasing. Standard lease terms are normally adequate to protect soils, riparian areas, stream channels, and water quality. In Alternative B, impacts would be mitigated using only standard lease terms, which require the lessee to minimize impacts to soils, and require reclamation. In addition, the use of standard lease provisions that allow for moving a well site up to 200 meters would provide avoidance of steep slopes and riparian area in most cases. Additional stipulations have been developed to address areas of concern in alternatives C, D DEIS, D FEIS, E, and F to minimize soil erosion, prohibit operations on steep slopes and to locate activities outside of riparian areas and floodplains (see Forest Plan Appendix E - Oil and Gas Leasing Stipulations). Alternatives C through F have the same number of acres with the No Surface Occupancy and Controlled Surface Use stipulations protecting high erosion and geologic hazard, steep slopes, and hydric soils. Since these lease stipulations to protect soil, water and aquatic resources apply to the same locations under alternatives C, D DEIS, D FEIS, E and F, (see table below), there is no difference in aquatic resource effects between these alternatives. Alternative B has the greatest risk of adverse aquatic resource effects from oil and gas development, since only standard lease terms apply to that alternative. Since the potential for oil and gas development is low, the risk of adverse effects is also relatively low for all alternatives.

Table 3-16. Comparison of impacts between alternatives for oil and gas development.

Alternative	A	B	C	D DEIS	D FEIS	E	F
Acres stipulated to protect soil, water and aquatic (X 1000s acres)	0	0	67	67	67	67	67

Effects from Land Use Authorizations

Various laws enacted prior to the Federal Land Policy and Management Act of 1976 (FLPMA) provide for rights-of-way through public lands. The Forest Service is responsible for administering existing grants and permits applicable to National Forest System lands.

Water developments on the Forest include irrigation diversions ditches, irrigation storage reservoirs, and water augmentation via transbasin-diversions ditches and pipelines. Water diversions can reduce or eliminate downstream flows. Reductions

or elimination of streamflows can affect channel form and function and limit and alter habitats required to sustain management indicator species. Dams can alter natural flow regimes by storing water during runoff and releasing it later in the year. Both dams and diversions can create significant barriers to movements by fish, amphibians, and aquatic insects. In addition, diversion and dams can dewater streams at certain times fragmenting and degrading the quality of aquatic, riparian, and wetland ecosystems. Alternatively, altered flow regimes can sometimes prolong the duration of runoff and result in enhanced riparian vegetation communities and improved conditions for certain aquatic biota.

Dams, depending on how they're operated, can affect stream channels in different ways. Reservoirs store sediments derived from the watersheds in which they're located and tend to discharge relatively sediment free water into their tailwaters. Relatively, sediment free water tends to erode new sediments and transport new and existing, in-channel sediments, the result of which is channel downcutting of the streambed or lateral widening the channel downstream of the dam. Alternatively, if water storage in a reservoir causes reductions in the magnitude and duration of peak flows, then the channel downstream of the dam can be the stabilized or experience reductions in channel capacity.

Transbasin diversions can have spectacular effects on channels. When water is diverted from streams in one basin and transported into streams in another basin, waterflow in the receiving basin is substantially increased. Additional flows in the receiving basin can cause severe channel downcutting or channel widening as the affected channel adjusts to the increased flows. Structural failures associated with dams and water diversion structures can severely impact aquatic, riparian, and wetland ecosystems.

When dams and water diversion structures fail, the resulting environmental impacts can be manifest both locally (directly downstream of the reservoir or diversion) and for many miles downstream. Local environmental impacts can affect fish, aquatic insects, aquatic and riparian plants, mammals, and birds. When considered in the context of the cumulative effects of other dams and water diversions in the Platte River or Colorado River basins, Forest water developments contribute to stream dewatering and altered streamflows downstream of the Forest. The results of stream dewatering contribute to the adverse impacts to threatened and endangered species that occur downstream in those basins.

The 1985 Forest Plan contained provisions to protect aquatic habitats and stream channels from potential adverse effects of water development. Under the existing Plan, the Forest has reviewed some existing water use permits to ensure protection of aquatic habitats and stream channels and to assess whether water uses were meeting Forest Plan standards. A limited number of existing, Forest land use authorizations contain stipulations that protect water resources and streamflow conditions. Other stipulations and conditional clauses exist in land use authorizations to prevent environmental damage such as gully erosion. The Forest Plan revision includes

standards and guidelines intended to provide adequate flows in perennial streams that protect aquatic communities and that help prevent the occurrence of environmental impacts such as gully erosion (*Water Conservation Practices Handbook, FSH 2509.25*).

When special use permits are amended, renewed, or issued, the Forest will assess the associated environmental effects and determine whether mitigation or additional terms and conditions are required to meet all legal and regulatory requirements, or not. In some cases, environmental analyses and appropriate terms and conditions will pertain to individual permits. In other cases, environmental analyses and terms and conditions will apply to all permitted activities that occur in a watershed. The magnitude and extent of environmental effects associated with permitted activities in the Forest are currently unknown. Although the environmental impacts associated with these permitted activities can be substantial, associated environmental impacts are not expected to widely vary among alternatives for two reasons: First, demand for water use authorizations is driven by proponents of water development rather that by Forest programs or budgets. Second, many water facilities are operated under perpetual easements or other authorizations that are subject to limited environmental mitigation.

Cumulative Effects

Introduction: This cumulative effects analysis is temporally bounded by the planning period (fifteen years) and spatially bounded by those lands (within and downstream of the Forest boundary) contained in all fifth level watersheds originating on the Forest. Both the temporal and spatial bounds have been selected under the assumption that for most past, present, and reasonably, foreseeable future activities proximate to the Forest, the uncertainty in assessing and describing the likely cumulative effects to the Forest increases the greater the magnitude of temporal and spatial bounds. This cumulative effects analysis will take a systematic approach to describing and assessing major activities (on and off Forest) that could cumulatively impact the aquatic resources in the Forest.

The systematic approach used to describe and assess cumulative impacts to Forest aquatic, riparian, and wetland resources will incorporate several factors: "key indicators" that are pertinent to aquatic resources and that vary in magnitude, in a material way, among alternatives; alternative prescriptions (alternative A will be used as the frame of reference for comparisons) pertinent to other resource areas that vary among alternatives and that may impact aquatic, riparian, and wetland resources; and activities that occur or projects that are implemented under the jurisdictions of entities other than the U.S. Forest Service; these projects and activities may occur on or off Forest.

Aquatic, riparian, and wetland ecosystems are affected by both natural and anthropogenic impacts that occur in watersheds; natural phenomena and anthropogenic impacts combine to provide important indices of effects of cumulative

impacts on watershed conditions. Headwater streams are often located entirely within NFS lands. Limited land ownership in jurisdictions other than those under NFS administration are situated within the Forest boundary (Laramie Peak is an exception to the previous statement because this area is characterized by extensive lands in ownerships other that national forest). Therefore, activities on other lands (e.g. private, State, BLM) typically do not have a widespread effect on aquatic resources on National Forest System lands, but may affect aquatic resources downstream of the Forest (see Activities Governed by Other Jurisdictions: Impacts section below). Conversely, activities that do occur on National Forest System lands contribute to downstream conditions with other ownership. An example is the effect of sedimentation from the transportation system on the Forest. Relatively small dispersed contributions of sediment to the aquatic ecosystem, when combined with many other sediment sources on and downstream of NFS lands, has the potential to cumulatively increase sediment loads and turbidity in rivers downstream of the Forest.

Future management of Forest resources depends upon cooperation with other federal and state agencies. Interagency cooperation is important because most Forest management – conducted by Forest Service personnel focuses on maintenance, protection, and enhancement of *habitats***,** rather than measuring or manipulating the organisms that inhabit them. However, the National Forest Management Act (NFMA) requires federal resource management agencies to maintain viable populations of management indicator species (MIS). Managing wildlife *populations* (vertebrates) is the primary responsibility of state; the state owns the wildlife that exists within its boundaries. Also, federal agencies are responsible for managing MIS populations and their habitats in order to comply with the viability requirements in NFMA.

An example of the effect of interagency cooperation in complying with the NFMA requirement to manage for viable populations of MIS is the management of common trout species in the Forest; common trout species are designated MIS in the proposed Plan revision. Cooperative recovery efforts, including state control on nonnative stocking and careful management of fishing in refuge streams to protect pure strains of native Colorado River cutthroat trout, are key to retaining this element of Forest ecosystems. Priority should be given to sensitive fish and MIS when developing habitat restoration and improvement projects. Additionally, management decisions that affect sensitive species and MIS should be made in cooperation with the WG&FD and the BLM, where feasible. Moreover, threats to the viability of native and desired, non-native species due to invasive species, habitat loss and degradation, and pathogens must be cooperatively managed by interagency communication and cooperation in the field. In conclusion, the long-term maintenance and protection of aquatic, riparian, and wetland ecosystems in the Forest are predicated on effective natural resource management by the Forest Service and cooperating agencies.

Past and Present Impacts

Multiple-use activities have altered aquatic ecosystems in the Medicine Bow National Forest decades before the Forest received federal designation as a forest reserve, and later designation as a national forest. By the turn of the twentieth century, the Forest had been extensively logged to supply wood for use as railroad ties (Transcontinental Railroad), mine structural supports, commercial and residential dwellings construction, and for routine domestic uses such as cooking and heating. In addition, livestock, primarily sheep and cattle, had grazed NFS lands with impunity from, territorial, state, or federal regulations. Precious minerals mining occurred on the Forest, essentially unregulated except for applicable land ownership and mine claim laws and regulations. Finally, non-native trout were introduced into Forest streams, probably prior to 1880 (Wyoming statehood), and they have become abundant and widely distributed in the Forest and in streams in adjacent lands. One of the difficulties in describing and assessing the cumulative impacts on today's Forest aquatic ecosystems from activities that occurred more than fifty or more years ago is the lack of pre-treatment data.

There are essentially no quantitative, pre-treatment data (before about 1867) that pertain to the conditions of aquatic, riparian, and wetland ecosystems in what was to become the Medicine Bow National Forest; the year, 1867 is arbitrary, but it is within to the timeframe that the Transcontinental Railroad was being constructed and completed (1869). It is reasonable to suggest that activities such as tie drives, livestock overgrazing, unregulated mining activities, and introductions of non-native trout profoundly impacted the abundance and distribution instream habitat features such as pools, riffles, beaver ponds, and woody debris and they have had similar effects on the integrity of native fish, aquatic insects, and amphibian communities. Additionally, overgrazing and timber harvest almost certainly impacted –in a material way - the community composition, abundance, and distribution of riparian and wetland vegetation. Although some of the impacts due to the aforementioned activities can be inferred from present environmental conditions, the actual alterations that have occurred to aquatic, riparian, and wetland ecosystems due to past Forest multiple-uses are unknowable. Multiple-use activities that have occurred after the turn of the twentieth century have added more complexity to cumulative effects analysis.

In the years after the Medicine Bow National Forest was given federal designations and protections as forest reserve and national forest (1902 to present), a variety of multiple uses have occurred and continue to occur in the Forest (see Current Aquatic Conditions section above). Tie drives were conducted on the Forest until the 1950s. Livestock grazing continues as a legal and legitimate use in the Forest, though the magnitude of overgrazing (along with its impacts), especially by sheep, has substantially diminished. Precious minerals mining continues to occur on the Forest, though most of the mining now (2003) is recreational in scope rather than commercial or industrial; there are some existing, residual environmental impacts to

aquatic ecosystems due to mining such as the habitat conditions in Douglas Creek and water quality degradation in Haggarty Creek due to copper effluent from the Haggarty mine. Much of the construction of irrigation ditches, dams, and reservoirs that are situated in the Forest has occurred after 1902, although some of these existing structures predate forest reserve or national forest designation. Timber harvest is an on going multiple use in the Forest that affects aquatic, riparian, and wetland ecosystems; some of the timber harvest prescriptions are mechanical treatments to manage Forest fuels. Given past and present impacts, how are the proposed alternatives in the Forest Plan revision expected to affect cumulative impacts to aquatic, riparian, and wetland ecosystems?

Future Impacts: Revision Alternatives

Alternative A, S-2 Table data, and key indicators will be used to establish the frame of reference by which to compare the likely and relative cumulative impacts to aquatic, riparian, and wetland ecosystems among alternatives. The key indicators that will be used are: miles of roads maintained to national standards; miles of new road construction; miles of road decommissioning (system and non-system); number of acres allocated to emphasize timber management; and, the number of acres treated for fire and fuels management (70% prescribed fire/30% mechanical treatments). The magnitude of livestock grazing (Decade 1, Ten-Years Desired Condition Level) is predicted to be the same for all revision alternatives (see FEIS, Chapter 2, S-2 Tables), so this key indicator will not be used in this cumulative effects analysis. All numbers taken from the S-2 Tables for comparison will reflect those found in the "Decade 1, Ten-Years Desired Condition Level" rows, by activity and alternative.

Alternative A: The number of acres allocated to emphasize timber management (Total Harvest, all types contributing to ASQ) in alternative A is 3,245. The number of acres allocated to fuels management is 3,750. The number of miles of road maintained to national standards is 1,898. The number of miles (per annum) of proposed new road construction is 5.1. The number of miles (per annum) of proposed road decommissioning is 27. The aforementioned numbers (key indicators) do not necessarily indicate that some or all of the prescriptions in alternative A are inconsistent with maintaining and enhancing aquatic, riparian, and wetland ecosystems that function within the range of "natural variability". Many of the magnitudes of the proposed activities in alternative A are substantially less than those prescribed in the original Forest Plan (1985). Under the previous Forest Plan, there were no dramatic declines in aquatic, riparian, and wetland ecosystems. In fact, under the previous Plan, the Wyoming Game and Fish Department and the Forest Service substantially increased the available habitats for Colorado River cutthroat trout (native) with its native range in the Sierra Madre, west of the Continental Divide.

Alternative B: The number of acres allocated to emphasize timber management (Total Harvest, all types contributing to ASQ) in alternative B is 3,123; this number

is about 10% less than the number in alternative A. The number of acres allocated to fuels management is 5,250; this number is about 40% more than the number in alternative A. The number of miles of road maintained to national standards is 1,898; this number is the same as the number in alternative A. The number of miles (per annum) of proposed new road construction is 5.1; this is the same number in alternative A. The number of miles (per annum) of proposed road decommissioning is 27; this is the same number in alternative A. The aforementioned numbers (key indicators) do not necessarily indicate that some or all of the prescriptions in alternative B are inconsistent with maintaining and enhancing aquatic, riparian, and wetland ecosystems that function within the range of "natural variability".

Alternative C: The number of acres allocated to emphasize timber management (Total Harvest, all types contributing to ASQ) in alternative C is 2,975; this number is about 8% less than the number in alternative A. The number of acres allocated to fuels management is 5,250; this number is 40% more than the number in alternative A. The number of miles of road maintained to national standards is 1,898; this number is the same as the number in alternative A. The number of miles (per annum) of proposed new road construction is 4.8; this is about 6% less than the number in alternative A. The number of miles (per annum) of proposed road decommissioning is 27; this is the same number in alternative A. The aforementioned numbers (key indicators) do not necessarily indicate that some or all of the prescriptions in alternative C are inconsistent with maintaining and enhancing aquatic, riparian, and wetland ecosystems that function within the range of "natural variability".

Alternative D DEIS: The number of acres allocated to emphasize timber management (Total Harvest, all types contributing to ASQ) in alternative D DEIS is 2,814; this number is about 13% less than the number in alternative A. The number of acres allocated to fuels management is 6,000; this number is 60% more than the number in alternative A. The number of miles of road maintained to national standards is 2,291; this number is about 21% more than the number in alternative A. The number of miles (per annum) of proposed new road construction is 4.5; this is about 12% less than the number in alternative A. The number of miles (per annum) of proposed road decommissioning is 27; this is the same number in alternative A. The aforementioned numbers (key indicators) do not necessarily indicate that some or all of the prescriptions in alternative D DEIS are inconsistent with maintaining and enhancing aquatic, riparian, and wetland ecosystems that function within the range of "natural variability".

Alternative D FEIS: The number of acres allocated to emphasize timber management (Total Harvest, all types contributing to ASQ) in alternative D FEIS is 2,735; this number is about 16% less than the number in alternative A. The number of acres allocated to fuels management is 6,000; this number is 60% more than the number in alternative A. The number of miles of road maintained to national standards is 2,291; this number is about 21% more than the number in alternative A.

The number of miles (per annum) of proposed new road construction is 4.1; this is about 20% less than the number in alternative A. The number of miles (per annum) of proposed road decommissioning is 27; this is the same number in alternative A. The aforementioned numbers (key indicators) do not necessarily indicate that some or all of the prescriptions in alternative D FEIS are inconsistent with maintaining and enhancing aquatic, riparian, and wetland ecosystems that function within the range of "natural variability".

Alternative E: The number of acres allocated to emphasize timber management (Total Harvest, all types contributing to ASQ) in alternative E is 2,561; this number is about 21% less than the number in alternative A. The number of acres allocated to fuels management is 6,000; this number is 60% more than the number in alternative A. The number of miles of road maintained to national standards is 2,099; this number is about 100% more than the number in alternative A. The number of miles (per annum) of proposed new road construction is 3.9; this is about 23% less than the number in alternative A. The number of miles (per annum) of proposed road decommissioning is 112; this is about 400% greater than the number in alternative A. The aforementioned numbers (key indicators) do not necessarily indicate that some or all of the prescriptions in alternative E are inconsistent with maintaining and enhancing aquatic, riparian, and wetland ecosystems that function within the range of "natural variability".

Alternative F: The number of acres allocated to emphasize timber management (Total Harvest, all types contributing to ASQ) in alternative F is 167; this number is about 500% less than the number in alternative A. The number of acres allocated to fuels management is 3,300; this number is about 12% less than the number in alternative A. The number of miles of road maintained to national standards is 1,666; this number is about 12% less than the number in alternative A. The number of miles (per annum) of proposed new road construction is 0.0 this is 100% less than the number in alternative A. The number of miles (per annum) of proposed road decommissioning is 181 this is about 670% greater than the number in alternative A. The aforementioned numbers (key indicators) do not necessarily indicate that some or all of the prescriptions in alternative F are inconsistent with maintaining and enhancing aquatic, riparian, and wetland ecosystems that function within the range of "natural variability".

Activities Governed by Other Jurisdiction: Impacts

Activities that occur on lands owned by state of Wyoming, on lands administered by the Bureau of Land Management (BLM) and on lands owned by private parties that are adjacent to the Forest can affect Forest environments and ecosystems. There are a variety of activities under the jurisdiction of other federal, state, local governments and private entities that may cumulatively effect aquatic resources on the Forest, including: Cheyenne Stage I and II water diversions, High Savery Dam, residential and commercial development, coalbed methane development, Ferris Haggerty mine

reclamation, spruce bark beetle epidemic/mountain pine beetle epidemic, and timberlands within watersheds on the Forest. Cheyenne Stage I and II water diversions and High Savery Dam are described in detail below. Other activities are described in detail in other resource area cumulative effects discussions and only the cumulative effects to aquatic resources associated with these activities are discussed below.

Cheyenne Stage I and II Water Diversion project: The Cheyenne Stage I and II Water Diversion project is essentially a mitigation project by the City of Cheyenne for diverting water from the North Platte River basin for municipal use; the City holds water rights in the upper Colorado River basin, but not in the Platte River basin. The water diverted by is transported from the upper Colorado River basin into the North Platte River basin. The diversion structures capture water from and fragment several headwater streams in the North Fork, Little Snake River (NFLSR) basin. The NFLSR basin, which includes the West Branch, NFLSR and tributaries, contains what is considered to comprise the largest remaining, self-sustaining, native population of wild, genetically pure, Colorado River cutthroat trout (CRCT) that exists within its historical range. Although there are minimum flow requirements (not greater that 2.0 cubic feet per second) for eleven of the headwater streams in the basin, the diversion structures prevent CRCT from migrating upstream of the structures; some CRCT that exist upstream of the structures may occasionally get flushed (alive) downstream, but whether that happens is unknown. Clearly, the water diversion structures effectively fragment CRCT habitat and prevent, or at least attenuate, emigration and immigration among subpopulations in the basin.

High Savery Dam project: The High Savery Dam project is located on private land in the Savery Creek drainage. The Savery Creek drainage is connected to headwaters in the Forest via the East Fork Savery Creek drainage and its associated tributaries and via the Dirtyman Fork, and its associated tributaries. Primarily, the dam's function will be to store runoff for irrigation use by local ranchers. Other dam functions will be: to support a recreational fishery; and to contain a self-sustaining population of Colorado River cutthroat trout that can be used for translocations in the Sierra Madre, west of the Continental Divide.

The Wyoming Game and Fish Department plans to stock the following fish in the High Savery reservoir to provide a recreational fishery: kokanee (landlocked variety of sockeye salmon *Oncorhynchus nerka*); splake (hybrid cross between lake trout and brook trout: *Salvelinus namaycush x Salvelinus fontinalis*); and tiger trout (hybrid cross between a brown trout and a brook trout: *Salmo trutta x Salvelinus fontinalis*). The tiger trout is an aggressive, piscivorous (fish-eating), sterile hybrid that is expected to control the white sucker population in the reservoir and provide anglers with an aggressively biting gamefish. There are, however, potential problems for the Forest given this fish stocking scenario, although the risks of problems arising are probably small; a small risk operating over a long time can become a reality.

Tiger trout are reservoir and stream dwelling hybrids, and though they are sterile, they are aggressive predators. If by chance, tiger trout breach the beaver dam complexes and the fish barrier on Dirtyman Fork (T.15 N., R.87 W., sec.29) or they get beyond the beaver dam complexes in the East Fork, Savery Creek, then they could impact populations of CRCT and common trout (brook trout, brown trout, and rainbow trout), respectively; the hybrid trout could end up in the Forest by their own means or by illegal translocation.

Residential and Commercial Development: The residential and commercial development of private lands located within the Forest boundary is another example of off Forest activities affecting Forest ecosystems. Further residential and commercial development of private land inholdings can negatively impact water quality and aquatic, riparian, and wetland ecosystems in the Forest. Water quality conditions that are affected by increased surface runoff, erosion, and sedimentation due to the presence of roads, roofs, and driveways, can be directly linked to residential and commercial developments. Additionally, water quantity can be affected due to residential and commercial demands on surface and groundwater. Increased uses of herbicides, pesticides, and fertilizers often associated with residential development can impact water quality. Finally, increased demand for recreational uses on the Forest as well as the previously mentioned impacts are all associated with residential and commercial developments.

Coalbed methane development: Coalbed methane development may occur off and downstream of the Forest boundary to the west and north of the Sierra Madre Range. Since the development is off and downstream of the Forest, there are not likely to be affects to aquatic resources on the Forest. Surface and ground water quality and quantity may be affected off Forest.

Ferris Haggerty Mine Reclamation: A variety of reclamation efforts have occurred at the mine site and additional efforts may be undertaken. The objective of the reclamation has been to improve water quality through reductions in heavy metals entering surface waters in the area. Monitoring is underway to determine the effectiveness of the reclamation efforts. Improved water quality would benefit aquatic resources, including Colorado River Cutthroat trout. Improvements to water quality would may also result in Haggerty Creek and West Fork of Battle Creek being removed from the Wyoming Department of Environmental Quality 303(d) list of impaired water bodies, which would help to achieve Forest Plan Objectives related to water quality.

Spruce Bark Beetle Epidemic/Mountain Pine Beetle Epidemic: Insect and disease impacts to vegetation outside of the Forest boundary may have some impacts on aquatic resources downstream of the Forest boundary, but would have little affect on aquatic resources on Forest since the effects would be downstream of the Forest. Insect and disease on private and State lands with in the Forest boundary may affect aquatic resources on the Forest. Due to the limited amount of inholdings, these effects would likely be minor compared to insect and disease outbreaks on National

Forest System lands. Although minor, the effects would cumulatively contribute to effects on NFS lands.

Timberlands within watersheds on the Forest: State and private lands within the Forest boundary are used for a variety of purposes including timber harvest. Due to the limited amount of inholdings, these effects would likely be minor compared to timber harvest on National Forest System lands. Although minor, the effects would cumulatively contribute to effects on NFS lands.

Cumulative Effects Summary

Watershed Conservation Practices and Forest Plan standards and guidelines prescribe extensive measures to protect aquatic and riparian resources on NFS lands. If all applicable measures are implemented and if they are effective, adverse cumulative effects from any of the proposed alternatives should be minimized. However, as levels of activity increase, the risk that conservation practices will not be properly implemented or will not be entirely effective increases. Therefore, alternatives that propose higher levels of activity for various resources pose greater inherent risks to aquatic and riparian resources. The following table provides a summary of the relative impacts of alternatives on aquatic resources. The land use categories are ranked in order of existing and potential impact to aquatic resources on the Forest. In general, land uses that have direct effects on aquatic resources that are outside of the range of variability have a greater effect than those with indirect effects (Affected Environment, Human Influences on Aquatic Ecosystems). The top line indicates highest degree of impact and bottom line indicates lowest degree of impact.

Table 3-17. Relative impacts of forest plan alternatives on riparian and aquatic resources.

Land Use Category	**Less Impact← Relative Impact →More Impact to aquatic resources**						
Effects from land authorizations	No real difference between alternatives						
Effects from travelways	F	E	D FEIS	D DEIS	C	B	A
Effects from rec. mgmt	F	E	D DEIS	D FEIS	C	B	A
Effects from livestock grazing	F	No real difference between alternatives A, B, C, D DEIS, D FEIS, and E					
Effects from timber harvesting	F	E	D DEIS	D FEIS	C	A	B
Effects from fire	E	D FEIS	D DEIS	C	B	A	F
Effects from mining	F	D FEIS	D DEIS	E	C	B	A
Effects from utility corridors	No real difference between alternatives						
Effects from oil and gas leasing	A	No real difference between alternatives C, D DEIS, D FEIS, E and F					B

Based on this interpretation and analysis of the revision alternatives, there are apparent differences among the alternatives in their potential and likely cumulative

impacts to aquatic, riparian, and wetland ecosystems that should be noted. Prescriptions in alternatives F and E tend to have values for key indicators that appear to suggest a relatively small likelihood of negatively impacting aquatic, riparian, and wetland ecosystems in the Forest, especially in their prescriptions for timber harvest and road construction/decommissioning (see previous discussions and the Roads Table and Timber Harvest Table). The exception is that relatively light emphasis on fuels treatments in alternative F could also increase the risk of adverse effects to aquatic, riparian, and wetland ecosystems from severe wildfire. Prescriptions in alternatives D FEIS and D DEIS tend to have key indicator values that suggest somewhat more likely cumulative impacts to aquatic, riparian, and wetland ecosystems than do alternatives F and E, but suggest less likely cumulative impacts to these ecosystems than do alternatives A, B, and C.

Heritage Resources

Introduction —Heritage resources, or cultural resources, on all federal lands are protected by a series of federal laws that were enacted to protect these resources from damage or loss due to federally funded or permitted activities. In the early twentieth century, the public recognized that these nonrenewable resources were important and should be protected.

Legal and Administrative Framework

Antiquities Act of 1906 – 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 valid permit.

National Historic Preservation Act (NHPA) of 1966, as amended – 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 that the federal government take into account the effects of their undertakings on historic properties. An undertaking is any action that requires federal involvement such as issuance of a permit or expenditure of federal funds. Furthermore the NHPA requires consultation with State Historic Preservation Officers, American Indian Tribes, and any interested parties.

Federal Land Policy and Management Act of 1976 Section 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 – This act imposes civil penalties for the unauthorized excavation, removal, damage, alteration, or defacement of archaeological resources. This law applies to cultural resources.

Native American Graves Protection and Repatriation Act 0f 1990 (NAGPRA) – American Indian burials and sacred items are protected by this act. If human remains or objects of cultural patrimony are discovered, this law requires that the Indian Tribe most closely related to the individual will be consulted and they will determine the appropriate treatment of the remains. It applies to cultural resources.

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 historic or scientific interest" on the National Forest System lands. This law applies to paleontological resources.

Code of Federal Regulations (CFR) 36 CFR 261.9 – This regulation prohibits "excavating, damaging, or removing any vertebrate fossil or removing any paleontological resource for commercial purposes without a special use authorization."

Executive Order 13007 (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.

Key Indicators

- Number of acres surveyed.
- Number of sites located and evaluated.
- Number of sites protected.
- Number of sites stabilized.
- Number of sites interpreted.

Resource Protection Measures

The National Historic Preservation Act protects historic properties (archaeological and historic properties), which are eligible to the National Register of Historic Places. Prior to any undertaking, as defined in 36 CFR 800, all cultural resources are located and, in consultation with the State Historic Preservation Officer, are evaluated for their potential to be placed on the National Register of Historic Places. The State Historic Preservation Office (SHPO) and, in some cases, the Advisory Council on Historic Preservation (the Council) must be informed of potential adverse effects to any historic properties. If an adverse effect is determined though consultation with the SHPO, then agreement on mitigation of the adverse effects to all historic properties must be reached through consultation with State Historic Preservation Office, any interested parties, and the Council before any project may take place.

AFFECTED ENVIRONMENT

The total extent of the cultural resource base is unknown since less than 10% of the Forest has been intensively surveyed. As of December 2000, cultural inventories

have recorded a total of 1,218 individual cultural sites on the Forest in compliance with NHPA Section 106. Until 1984, most cultural resource inventories were conducted for commercial timber sales and mineral activities. After 1984, the list of activities requiring cultural surveys expanded to include range allotment plans, wildlife habitat improvement projects, public-proposed projects, recreation projects, and hazardous fuels reduction projects. The majority of the inventories completed before 1986 are not adequate for project clearances (as defined in 36 CFR part 800) due to problems with survey intensity, the limited range of projects surveyed, research design, and methodology.

Prehistoric/American Indian Resources

Of the 273-recorded American Indian sites on the Forest, 45 have been field evaluated as eligible for inclusion on the National Register of Historic Places (NRHP), 61 remain unevaluated for cultural significance, and 167 have been determined to be not eligible to the National Register. The majority of these sites are open lithic scatters, open campsites, or small lithic quarries. Open lithic scatters are sites that have a visible surface component of flaked stone material and stone tools. Open campsites are essentially lithic scatters that have surface features such as hearths or stone circles and stone alignments. Lithic quarries are areas from which the raw lithic/stone material needed to make stone tools was acquired. During the process of acquiring the raw material from outcroppings, flakes and tools were produced.

The earliest evidence of human activity on the Forest comes from the Paleoindian period, which lasted from approximately 11,000 to 8,000 years before present. Paleoindian people are thought to have been largely dependent upon big game hunting, especially during the end of the Ice Age when the large mammals, such as mammoth, wild horse, giant ground sloth and ancient bison, were still living. The cultural remains from the Paleoindian period can include open lithic scatters, quarries, kill/butcher sites, and campsites.

The Archaic period spans the time period from approximately 8,000 to 2,500 years before present. The first evidence of structures in southwest Wyoming and northwest Colorado are dated to this period. Cultural remains from the Archaic period include base camps, open lithic scatters, stone quarries, and drivelines[1] at high altitudes.

The Late Prehistoric culture added the bow and arrow to hunting tools, along with the limited use of ceramic vessels. Ceramic sherds are not common, but a few pieces

[1] Drive lines usually consist of relatively small piles of stones arranged in lines leading toward bison procurement features that were generally determined by the natural topography. Lines of closely spaced and/or contiguous stones appear as drive line features in rough country and at higher elevations in communal mountain sheep procurement sites.

of utility ware have been located in Laramie Range and the Sierra Madre and Medicine Bow Mountains. Wickiups, probably dating back 110 years, are further evidence of late occupation. Major historic tribes in the Medicine Bow and Sierra Madre Mountains and Laramie Range included the Northern Arapaho, Northern Cheyenne, Eastern Shoshone, and the White River Ute.

There are numerous traditional resources which remain of use to American Indians. These include lodge pole pine, ponderosa pine, medicinal plants, and mineral resources. In addition, there are locations which have spiritual value to various Tribes and are locations where religious events may take place.

The United States has a trust responsibility to tribal governments, brought about by treaties and federal laws. The welfare, land, and resources of the tribe are entrusted to the United States Government. The obligation that the government has toward tribal governments is particularly important where it involves lands that are subject to treaty rights. All of the Medicine Bow National Forest is within lands ceded by several Tribes. The United States Government has signed several treaties with the Tribes that inhabited Wyoming from the plains to the Continental Divide.

The Sioux, Gros-Ventre, Assinaboines, Arrivckaras, Mandan, Blackfoot, Crow, Cheyenne and Arapaho signed the Fort Laramie Treaty of 1851. In this treaty each of the Tribes acknowledged their territories. The Cheyenne and Arapaho defined their territory as "Commencing at the place where the road leaves the North Fork of the Platte River: thence up the Platte River to its source; thence along the main range of the Rocky Mountains to the head waters of the Arkansas River; thence down the Arkansas River to the crossing of the Santa Fe Road; thence in a northwesterly direction to the forks of the Platte River, and thence up the Platte River to the place of the beginning" (Kappler 1904). This places portions of the Medicine Bow National Forest in the area claimed by the Cheyenne and Arapaho.

Several members of the Cheyenne and Arapaho tribes signed the Treaty of Fort Wise in 1861. This treaty set aside a reservation in the Arkansas River Valley for the exclusive use of the Tribes. At this time the Arapaho and Cheyenne agreed to "cede and relinquish to the United States all lands now owned, possessed, or claimed by them, wherever situated, except for a tract to be reserved" (Kappler 1904) as a reservation.

In 1868, the Tabaquache, Muache, Capote, Weeminuche, Grand River, and Uintah bands of the Ute Indians signed a treaty with the United States that set the boundaries of the Ute Reservation in Colorado and established two Indian Agencies, the White River Agency near Meeker Colorado and the Los Pinos Agency on the Rio de Los Pinos. The Ute bands relinquished all claim and rights to the lands in Colorado and Wyoming not contained in the Reservation.

Historic/Euro American Resources

Of the 945 historic sites recorded on the Forest, ten are listed on the National Register of Historic Places, 238 have been evaluated as eligible for NHRP inclusion, 152 remain unevaluated for cultural significance, and 555 have been determined to be not eligible to the National Register. The Euro-American cultural remains on the Forest are related to early farming and ranching, the timber and mineral industries, early military activities, and early federal conservation practices. The majority of the historic sites are directly related to the historic economic development of the area.

Farming and Ranching – Small homesteads were patented on lands before the federal government set aside forested lands. Many of these homesteads remain in private ownership; however, a number of homesteads have reverted to federal ownership. Very few of the structures on these homesteads retain enough integrity to be eligible for the NRHP. Historic stock trails used to move sheep and cattle from Wyoming into Colorado are still in use and are now a part of the Forest's developed trail system. These stock driveways are potentially eligible for inclusion on the NRHP. Other farming and ranching cultural remains on the forest include sheep camps, corrals and stock pens, loading chutes, and ditches.

Mining – Mining played an extremely important role in the early Euro-American settlement of southwest Wyoming. Although most of the early mines were patented and transferred to private ownership, some patents were transferred back to federal ownership. Heritage resources that relate to early mining consist of the mines, debris from mining, and small towns and camps that supported the mines. Evidence of mining and mineral test pits is located throughout the Forest. Many of these remains are not significant. Significant mining resources on the Forest include the Jesse Mine, the Queen Mine, and the White Swan Mine.

Timber – The timber resources on the Forest provided the majority of the raw material for the Transcontinental Railroad and Transcontinental Telegraph passing through the area in the late 1800s. Forest timber resources also provided the raw materials for early towns, ranches, and other buildings and structures constructed by the Euro-American settlers. The remains of company camps, bachelor camps, individual cabins, surge dams, flumes, sawmill sets, decking areas, logging roads, cross-tie piles, and tree stumps are found throughout the Forest. The majority of these sites are not significant, as they are badly deteriorated. Significant sites on the Forest include Smith North Camp, Devil's Gate Flume, Muddy Park Dam, and Hog Park Camp.

Military – Between 1879 and 1964, the administration of the Pole Mountain Division of the Forest was shared between the War Department and Forest Service. During this time, varying portions of the Pole Mountain Division were used first as a wood reservation, then as a target and maneuver reservation, and finally as a game/hunting refuge for the military, in addition to Forest administrative and recreation use. Cultural remains in the area included permanent and temporary

camps, observation posts, firing/target ranges, water reservoir and pipelines, bunkers, roads, and isolated structures.

Federal Conservation Practices, Civilian Conservation Corps and WPA – Federal conservation practices on the Forest began with the establishment of the Crow Creek Forest Reserve (1900), the Medicine Bow Forest Reserve (1902) and the Sierra Madre Forest Reserve (1905). The sites, which are associated with the Early Federal Conservation period, include work centers, guard stations, and fire towers. Many of these structures are still used as administrative sites. These sites are protected as administrative site and most have been evaluated for eligibility for NRHP inclusion. Two administrative sites, Keystone and Centennial Work Centers, are listed on the National Register of Historic Places.

ENVIRONMENTAL CONSEQUENCES

General Effects

As use of the forest continues to rise from population increases and nonresident visits, impacts to heritage resources are expect to increase. Unauthorized collection, theft, excavation, and vandalism will continue under all alternatives. Natural erosional and depositional processes and structural deterioration will also continue to degrade heritage resources. Data collection through excavation, the most common mitigation for unavoidable impacts, also results in some loss of the resource. Inadvertent damage during project implementation may also occur.

As surveys are completed and projects implemented, additional resources may be located that require inventory, evaluation, protection and interpretation. Based on the current number of sites and acres surveyed, an additional 10,962 sites may exist on the Medicine Bow National Forest. This represents about seven sites per square mile. Recent surveys indicate that site densities may be even higher. Based on past evaluative site testing and investigation, about 4,604 new sites may be found eligible for listing to the National Register of Historic Places.

In all alternatives, heritage resources will be managed as required by the legal administrative framework. The program includes inventory, analysis, evaluation, stabilization and public interpretation under all alternatives. Alternatives A, B and C emphasize commodities and motorized recreation and have the greatest potential to affect heritage resources. These alternatives would require the greatest amount of inventory and mitigation.

Areas important to American Indian traditional practices would be considered under all six alternatives. Alternatives A, B, and C (commodities and motorized recreation emphasis) have the most potential to affect unidentified areas that may have traditional cultural importance to American Indian people.

Alternative A

Alternative A provides the second highest levels of resource outputs. Under this alternative, timber, grazing and travel management policies would continue at current levels. While adverse effects to sites can be easily mitigated through avoidance for timber, grazing and other planned activities, there are difficulties in effectively mitigating negative impacts from dispersed recreation and other non-project activities. Alternative A would continue current travel management policies.

Alternative B

Alternative B provides the highest levels of resource outputs. Under this alternative, vegetation management activities, oil and gas activities and the number of special interest areas and wild and scenic rivers would increase substantially. The increased commodity development that occurs in Alternative B requires more inventories for cultural resources, which would lead to more information for the site record. However, for sites important for traditional cultural purposes, formal recording in itself can be regarded as disrespectful treatment through the very act of recordation and public knowledge (even though locational information is protected). This can lead to looting or simply inappropriate visitation, from a traditional point of view. It would also continue the project-oriented approach to understanding forest prehistory and history rather than a more holistic approach designed to provide information on other areas. Introduction of visual, audible and atmospheric elements associated with commodity development may compromise the sense of place and alter the setting of many heritage sites.

Reduced investments in recreation would limit opportunities for public education and interpretation. Alternative B would continue travel management polices at near present levels.

Alternative C

Under Alternative C there is an increased emphasis on a mix of recreational opportunities while slightly reducing the emphasis on vegetation management from current levels. There is a substantial increase in gas and oil activities. The number of special interest areas increases and there is a slight increase in acres retaining roadless characteristics. The amount of commodity development and the increase in year round motorized recreation that occurs in Alternative C will require inventories for cultural resources slightly above current levels. Increased investments in recreation would increase opportunities for public education and interpretation. However, this can also lead to looting or simply inappropriate visitation from a traditional point of view. Introduction of visual, audible atmospheric elements associated with commodity development and increased recreational development and visitation may compromise the sense of place and alter the setting of many heritage sites.

Alternative C would continue travel management polices slightly below current levels.

Alternative D DEIS

Alternative D DEIS provides a mix of multiple-use activities with an emphasis on providing a mix of recreation opportunities with a stronger emphasis on non-motorized opportunities. Under this alternative, vegetation management activities would be reduced and number of special interest areas would be significantly increased. With less commodity production, there would be less cultural surveying conducted, fewer sites located and a lower potential for negative impacts to heritage resources. However, increased recreation opportunities would provide more public education and interpretation opportunities. Motorize travel restrictions would also lessen the potential for adverse impacts to heritage resources.

Alternative D FEIS

Alternative D FEIS also provides a mix of multiple-use activities. The increase in acreage for motorized recreation does not in reality add additional impacts as these are primitive (two-track) roads that are in current use and no additions to the number or miles of primitive roads will be considered. Timber harvest will increase under this alternative and will result in the identification of heritage resources. Historic properties (heritage resources eligible to the National Register of Historic Places) will be avoided or will have adverse effects mitigated in conformance with the National Historic Preservation Act of 1966, as amended (NHPA).

Alternative E

Alternative E would bring vegetation management activities and recreation activities closer to current levels. There would be a significant increase in special interest areas and oil and gas opportunities and motorized recreation would continue near present levels. In addition, natural processes would be aggressively managed through a variety of management activities. The result would be slightly less cultural survey conducted than at current levels, fewer sites located and a lower potential for negative impacts to heritage resources. Increased recreation opportunities would provide more public education and interpretation opportunities. Motorized travel would be only slightly less than current levels providing only a slightly decreased potential for adverse impact to heritage resources.

Alternative F

Alternative F has the least commodity-driven activities and therefore, the least potential to negatively affect heritage resources. Timber and recreation activities are greatly reduced. The number of special interest areas, gas and oil opportunities, percent of wilderness and areas retaining roadless characteristics are significantly

increased. Under this alternative cultural resource management would be held to a minimum, fewer project-driven compliance inventories would be accomplished resulting in less opportunity for adding to the overall inventory of sites. Because recreation is not emphasized, opportunities for the public to enjoy their heritage and nominations to the National Register of Historic Places would both be infrequent.

Table 3-18. Potential number of heritage resource sites located annually due to Forest activities.

Alternative	Potential Number of Sites Located Annually
A	50
B	50
C	53
D DEIS	42
D FEIS	45
E	41
F	22

Direct and Indirect Effects

Effects from Fire and Fuels Management

The suppression of wildfires has the potential to affect historic properties if the fire line runs directly across a historic property. Fire control measures, such as emergency road blading, can also destroy culturally sensitive sites. Wildfires can destroy irreplaceable structures and flammable site types, such as log cabins and conical timbered lodges. Prescribed burns, as well as unregulated fires, can increase the propagation of certain tree and grass species that have traditional uses. They can also increase the discovery of heritage sites. In all six alternatives, fire prevention methods, which reduce fuel loads (i.e., prescribed burns and salvage sales), are projects that require compliance with the NHPA.

Effects from Land Exchanges

The exchange of federal land for private land has the potential to affect historic properties on the formerly federally administered lands. The legal protection for historic properties ends once the land ownership becomes private. In all alternatives, this adverse effect to historic properties must be mitigated in compliance with the NHPA before the land exchange takes place.

Effects from Oil and Gas and Minerals Management

In all alternatives, the heavy machinery involved in the construction of and access to energy and mineral extraction areas, as well as the actual extraction activities

themselves have the potential to adversely affect historic properties. Adverse effects must be mitigated in compliance with the NHPA. Indirect effects include the potential for vandalism of a site or theft of artifacts during the execution of the project and the increased potential for vandalism and theft due to new public access.

One possible benefit of oil and gas development is that it results in more archaeological inventory, which could identify more historic properties and provide more information on the distribution of historic and prehistoric period resources.

Effects from Livestock Grazing and Big Game Use

Impacts on archaeological sites from grazing can be divided into two categories: impact to the soil, which contains buried cultural remains; and damage and/or displacement of artifacts and other cultural remains located on the surface. Effects include trampling, trailing, soil compaction, erosion related to pipeline and water tank construction and associated vehicle trails, which can expose artifacts and make them vulnerable to theft. While the historic landscape is usually retained, individual historic properties may be adversely affected.

One common activity associated with livestock grazing is the development of springs. Prehistoric and historic Indian groups, as well as historic homesteaders, commonly used springs, and sites are often found within close vicinity of springs. Development of springs, consequently, has the potential to adversely affect historic properties. In all alternatives, the effects on historic properties from livestock grazing activities will be mitigated in compliance with the NHPA. Indirect effects of livestock grazing and big game grazing/browsing include seasonal removal of vegetation and trampling-induced compaction. These effects can lead to reduced infiltration, increased runoff, and an increase in vandalism of sites and theft of artifacts, due to increased visibility.

Effects from Recreation Management

The construction of recreation facilities (campgrounds, trails, comfort facilities, parting areas, etc.) has the potential to affect historic properties. Under all six alternatives, these direct effects must be mitigated before the initiation of the construction. Indirect effects from recreational management can be beneficial or adverse. The adverse impacts include vandalism of sites and theft of artifacts, inadvertent camping directly on sites, and soil erosion. Some of the beneficial effects are the edification and education of the public about their heritage, which in turn provides public support for the preservation and interpretation of heritage resources. The construction of new trails into areas that previously had little access creates an indirect effect to historic properties as it opens new areas to recreational activities and increases the potential for disturbance. Impacts to historic properties in the form of vandalism and theft of artifacts are generally the greatest in areas of public concentration. These threats generally occur within one-quarter mile of a developed road or a two-track road. Motorized access to cultural sites seems to

increase the probability of damage to a site. Alternatives A, B, C, and D FEIS have a fairly high emphasis on motorized recreation and will therefore have greater indirect impacts on historic properties

Effects from Roadless Area Management

Currently, most cultural resource inventories are conducted in areas where ground-disturbing projects are proposed. In areas managed as roadless there are fewer ground disturbing projects. Natural degradation of sites, from erosion and wildfire, for example, can cause damage to historic properties. Activities associated with decommissioning of two-track or user created roads within roadless areas can also damage cultural resources. In all alternatives, adverse effects to historic properties must be mitigated in compliance with the NHPA. Alternatives F, E, D DEIS, and D FEIS have larger portions of the Forest managed as roadless. Although these alternatives reduce the amount of potential damage to historic properties from management activities, they will also reduce the amount of surveys conducted and thus the number of sites located and protected.

Effects from Special Areas Management

The preservation of special environmental and cultural values through the designation of Special Interest Areas, Research Natural Areas and recommended Wilderness would protect and preserve the historic record while offering opportunities to study and interpret these areas. Alternative F would include the most acres with special area designations, followed by Alternatives E, D DEIS and D FEIS, C and B. Although these management prescriptions reduce the amount of potential damage to heritage resources from management activities, they also reduce the amount of required surveys conducted and the number of sites located and protected. These management prescriptions do, however, often promote natural, remote settings that preserve and protect sacred and historic landscapes, traditional cultural properties, and the "sense of place" some people seek. Designation of Special Interest Areas for heritage resources does offer opportunities for education, interpretation and research. Alternatives B, E and F would have the greatest number of heritage Special Interest Areas designated.

Effects from Travel Management

Increased road construction and unauthorized off-road motorized access into areas containing significant sites or structures would expose sites to the public and potentially decrease the seclusion and quiet necessary for many traditional practices. Artifact collecting or similar activities could physically alter sites and may increase with more public access. Alternatives A and B have the most motorized access. Restricted access in Alternatives E and F should reduce vandalism and illegal collection, but may also reduce access for traditional users.

The construction of new trails can create an indirect effect to historic properties by opening up new areas to recreational activities and increasing the potential for disturbance. Adverse effects to historic properties in the form of vandalism and theft of artifacts are generally the greatest in areas of public concentration and dispersed camping. These threats generally occur within one-quarter mile of a road or trail. Alternatives C, D DEIS, and D FEIS would construct the most miles of new trail, while Alternatives E and F would construct the least amount of new trails.

Road maintenance, reconstruction and decommissioning address the existing travel system on the Forest and have the potential to have an adverse effect on historic properties. The majority of existing Forest roads have not been surveyed for adverse effects to historic properties prior to construction because these roads were built prior to passage of the NHPA. The same is true for all user created roads. Some existing roads are considered historic properties in their own right. Heavy maintenance or reconstruction of existing roads, especially two-track roads, would provide improved access, thereby, increasing exposure of sites to the public, increasing opportunities for vandalism and possibly physically altering a site within or adjacent to the road. Decommissioning of existing roads can result in both positive and negative effects, depending on the chosen methods of decommissioning, ranging from simple signing to total obliteration, such as recontouring and reseeding. Signing and gating would cause the least ground disturbance as long as minimal maintenance was employed to stop excessive erosion, which could damage nearby sites. Scarifying and recontouring roads would result in the greatest amount of ground disturbance, which would destroy the surface and subsurface context of the sites. In all six alternatives, road construction, reconstruction, maintenance and decommissioning, are projects that require compliance with the NHPA.

Effects from Timber Management

The heavy machinery used to harvest trees and the actual harvesting has the potential to affect cultural resources. Archaeological sites are threatened by the disturbance of the soil. Historic buildings are sometimes threatened by the falling of trees. All such undertakings must be conducted in compliance with the NHPA. Indirect effects of timber harvest include, but are not limited to, soil erosion and compaction. Another indirect effect is the potential for vandalism of the site or theft of artifacts during the execution of the project. All alternatives require compliance with the NHPA. Thus, more sites will be recorded.

Effects from Wilderness Management

Impacts to cultural resources from the management of designated wilderness are generally restricted to historic structures. Often the management of wilderness requires the removal of buildings. This poses a direct effect if the structure involved is considered to be a historic property. In all alternatives, any undertakings must be in compliance with the NHPA. Currently, most cultural resource inventories are conducted in areas where ground-disturbing projects are proposed. In areas, which

are managed as wilderness, there are fewer ground disturbing projects. Alternatives D DEIS, D FEIS, E and F have larger portions of the Forest managed as wilderness. Although these alternatives reduce the amount of potential damage to heritage resources from management activities, they will also reduce the amount of surveys conducted and thus the number of sites located and protected.

Cumulative Effects

Cumulative effects over time can include loss of sites or parts of sites prior to development of better research techniques, loss of interpretive values, and incremental loss of the heritage resource base. Most of the impacts cited above could have long-term cumulative consequences. These include land management projects that cause surface disturbance, increased public visitation, long-term consequences of non-sanctioned activities, such as vandalism and illegal excavation, natural weathering and deterioration, erosion, landslides, fires and other physical processes. The alternatives differ only slightly in their potential for cumulative effects to heritage resources, even though sanctioned management activities vary, because protection and mitigation measures are common to all alternatives. Enforcement of protective measures would also be common to all alternatives and should result in an extremely low level of cumulative effects.

Non-project related proactive heritage resource management would also help preserve heritage resources. It is required that important known sites be identified under Section 110 of the NHPA. Heritage resources are important in their own right and merit careful management planning for inventory, evaluation, nomination, enhancement, protection, monitoring, and interpretation.

Cumulatively, heritage resources on federal lands may assume greater importance because similar resources on lands of other ownership are not provided the same degree of protection. Construction and development on private lands may destroy heritage values without providing mitigation unless the projects are the result of federal licensing, permitting or funding. Cumulative risks to heritage resources on state and private lands are furthermore thought to be greater than on federally administered areas for several reasons. There is a higher likelihood that important heritage resources occur on these lands from historic settlement patterns and more favorable environmental patterns. Where federal licensing, permitting or funding is not involved, less inventory or evaluation is being conducted, implementation of protection or mitigation measures is rarely instituted, and local governments have few ordinances to protect the full range of heritage resources.

Soil

Introduction – 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 Medicine Bow National forest are dependent upon soil. Soil is considered a nonrenewable resource because of the length of 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 forest recognized the importance of soils information as an integral part of land management planning and began soil resource inventory efforts in the 1980s. Since then, soil resource inventories, also know as soil surveys; have been completed on the entire Forest. The goal is to utilize soils data as much as possible in the revision process so management activities may be blended with the ecological capabilities and potentials of the land.

The primary goal of soil management is to maintain or enhance long-term site productivity. There are five categories of physical soil disturbances that have been found to affect soil productivity. The categories include: compaction, displacement, erosion, puddling, and severely burned. Soil impacts may not exceed 15% of an activity area (USDA Forest Service 1992).

Soils information is used and analyzed at both the forest planning level, and the project level. This Environment Impact Statement (EIS) presents an overview of alternatives and general effects on the soil resource. 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.

Legal and Administrative Framework

The Organic Administration Act of 1897 – "to improve and protect the forest within the boundaries …"

The Multiple-Use Sustained-Yield Act – this act sets forth the secondary purpose of the establishment "for outdoor recreation, range, timber, watershed, and wildlife and fish purposes."

The Forest and Rangeland Renewable Resources Planning Act (RPA) – this act requires an assessment of the present and potential productivity of the land. Regulations are to specify guidelines for land management plans developed to achieve the goals of the program that … ensure that timber will be harvested from

NFS lands only where soil, slope, or other watershed conditions will not be irreversibly damaged.

The National Forest Management Act – this act was amended with the addition of a section that stressed the maintenance of productivity and need to protect and improve the soil and water resources and avoid permanent impairment of land productivity.

Key Indicators

- Erosional Index
- Acres of Timber Harvest
- Total Acres of Soil Disturbance

Resource Protection Measures

In order to maintain long-term soil productivity, soil disturbance should be kept to a minimum, and adequate measures need to be implemented to protect the soil resource. Mitigation measures have been developed to protect the soil resource and can be found in the forest-wide standards and guidelines, timber sale contract, and best management practices (BMPs). Resource protection measures apply to all alternatives.

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.

AFFECTED ENVIRONMENT

The Medicine Bow National Forest has more that 150 different soil types (USDA Forest Service 1989). Soil formation is dependent on five factors: parent material, topography, climate, organisms, and time. The Forest has so many different soil types because it has a side range of parent material (more than 35 geologic formations), a wide range in elevation (7,000 to 11,000 feet) and precipitation (15 to 60+ inches), dramatic topographic variations, and a range in time during which soil formation has been taking place. At high elevations, vegetative growth and microbial activity are restricted due to the short growing season and high snow pack. Under these conditions, the rate of soil formation is much slower than the more temperate lower elevations. These high-elevation soils are generally not as well developed as those occurring at lower elevations.

Soil 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 and on toe slopes and benches.

The concept of productivity includes both the ability to grow vegetation as well as the maintenance of slope stability. In some areas, past practices have slightly reduced growth potential from compaction, nutrient loss from fires, and loss of large woody material. Soil productivity is the principle area of concern on the Forest, 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.

Soil erosion, soil compaction, and organic matter content all determine the productivity of Forest soils. The following section describes these processes/factors and their influence on productivity.

Soil Erosion is the origin of most of the delivered sediment to streams. This sediment can have adverse effects on water quality and fish habitat. The primary cause of soil erosion is overland flow from spring runoff or high intensity storms. Without overland flow, there is very little erosion. Wind erosion may occur on some exposed wind scour ridges, if the soil surface is exposed and unprotected.

Timber harvesting, site preparation, fuels treatment, and road construction remove or rearrange organic matter, which changes 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.

Mass movement of soil (geologic hazards) include slumping, slope failure, and earthflow. The geologic hazards with highest probability of mass movement potential have special management implications. Descriptions of the slope stability, or potential of mass movement, have been and will continue to be used to indicate the types of management practices and mitigation measures which are appropriate for the site.

The majority of the Forest is in the stable class, thus no special measures are needed. The land in the moderately stable class requires more work in layout and design of roads and increased road construction cost. The most potentially unstable group is areas that should generally be avoided because the risk of resource damage is higher than the benefit (Warrington 1981). These acres are removed from the tentatively suited timber base. More information on the process can be found in Appendix B "Description of the Analysis Process."

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 decrease the amount of destabilizing groundwater (Swanson, et al. 1989).

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 in order to minimize the overall effect. The Region 2 Soil Management Handbook (FSH 2509.18) defines detrimental compaction as a greater than 15% increase in the average undisturbed soil bulk density. It is believed that an increase of 15% or more would represent a loss of 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.

Organic matter – An important component of soil productivity is organic matter content and related nitrogen availability. 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 (leaves, needles, and twigs) decomposes, it releases nutrients, especially in higher-elevation 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 losses of the surface horizon, volatilization by fire, or whole-tree harvesting.

Large woody material (3 inches) 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 the upper elevations where the colder climate and short growing season do not generate large amounts of annual vegetative growth.

ENVIRONMENTAL CONSEQUENCES

Methods of Analysis for Environmental Consequences

To determine the effects of management activities on the soil resource, an erosional index was calculated for each alternative. This will allow better comparison of the alternatives by using soil information. For each of the prescription watersheds, the soil erodibility factor was calculated. This is based on average slope of the watershed and the soil erodibility factor. Using Spectrum outputs, which estimate the acres of watershed scheduled to be harvested, an erosional index was calculated for each alternative. This erosional index is a unit-less number for comparing the different alternatives at a forest wide scale. It is not a prediction of actual soil erosion in tons per acre. It simply indicates the relative degree to which the Spectrum model selected stands with steeper slopes or higher erodibility factors. It is not spatial, so the estimate is simply an index for comparison of alternatives. The higher the erosional index number, the greater potential for soil impacts.

The major change to the soil section between draft and final was use of the updated numbers from the S-tables that was revised after the draft EIS was completed.

General Effects

Litter, humus, soil wood, and certain key properties of the surface mineral layers of forest soils are usually most critical when developing silvicultural systems. These are the soil layers most easily and commonly disturbed by silvicultural activities, yet they are the most crucial to forest productivity (Graham, et al. 1991).

Coarse woody debris physically protects the soil from erosion, displacement, and compaction. In addition, it can protect a regenerating forest from both abiotic and biotic elements. Coarse woody debris provides shade and protection from wind and snow and can be a critical factor in protecting newly established seedlings from livestock and other large animals.

The silvicultural methods available to manage the forest need to be assembled into complete silvicultural systems—planned programs of treatments to be applied throughout the life of a forest stand. This is important in ecosystem management. Soils are critical to the regeneration, productivity, nutrient values, and moisture-retention abilities of all forest sites.

The choice of regeneration methods is, in many ways, the most critical decision regarding the entire system. It should be selected by considering all abiotic and biotic elements that might influence forest regeneration and development, but soil properties are especially important. Physical properties of the mineral soil, especially water-holding capacity, can be used to help determine which regeneration methods would be appropriate. For example, stands located on soils with high amounts of available water would be most suited to the clear-cut methods, and stands on droughty soils with little available water would be more appropriate for selection or

shelterwood methods. This is not to say that soil is the only fact that should be considered when selecting a harvest method, but soils should be used as input in the decisions. Silvicultural prescription in some cases may depend more on the shade tolerance of the tree species. Table 3-19 shows the amount of even-aged and uneven-aged management by alternative.

Many public forestry agencies have shifted from even-aged to uneven-aged management, primarily because of the public perception that uneven-aged management is less damaging to the environment, better for wildlife, and will result in a more aesthetically pleasing landscape.

Harvey, et al. (1994) stated that with uneven-aged management, the potential for soil damage increases because, with fewer trees removed over larger areas, ground-based extraction is mandatory to avoid excessive cost. With this forest management approach, potential soil damage threatens long-term wood production. Short- and long-term growth reductions from traffic-induced soil compaction and soil displacement can be expected. The use of mitigation such as designated skid trails will keep the disturbance to an acceptable level.

Tractor piling of logging debris and machine site preparation is used throughout the West. Similar to tractor yarding, tractor piling can detrimentally impact the soil. The greater the disturbance, the greater the potential loss of the surface organic layers. A balance is needed to achieve the level of disturbance required for site regeneration while minimizing adverse impacts from that disturbance.

After the site preparation and hazard reduction treatments are completed, it is imperative to leave sufficient large woody material on the site. As mentioned earlier, residue has several properties important for maintaining forest productivity. Graham, et al. (1991) recommend leaving a minimum of 5 to 15 tons per acre of large woody material after timber harvesting and other site treatments. These recommendations are general and will be refined as more research makes them more site-specific (Graham, et al. 1994).

Direct and Indirect Effects

Effects from Fire and Fuels Management

Wildfire is a natural process, which can cause many impacts to the soil resource, including erosion and severely burned soil (DeBano 1991).

Wildfire can have serious short-term implications for soil and watershed protection. This is especially true if the area burned was outside the historical range of variability in terms of fire frequency and severity. Severe wildfires not only destroy vegetation but also can detrimentally burn soils. Soils are considered detrimentally burned when most woody debris, litter, duff, and humus are consumed down to bare mineral soil (USDA Forest Service 1992). Detrimental burning reduces soil productivity. Gully formation, shallow slumping, and decreased microbial activity may result.

DeBano et al (1998) in their book "Fire's Effects on Ecosystem" discussed that fire-related changes in soils produce a wide array of changes in the surrounding ecosystem because of the interdependency between the soil and other ecosystem components. Immediate short-term and long-term response to fire occurs. Immediate effects of fire arise as a result of the heat released during a fire and directly impact the soil and surrounding ecosystem. The response of biological components (soil microorganisms and vegetation) of the fire is rapid. Another immediate effect is the release of gases and other air pollutants by the combustion of soil organic matter during a fire. The long-term fire effects are usually subtler, but they can persist for years following a fire or be permanent. When the effects become long-term, they are considered an impact to the soil resource. An example of long-term fire effects is the disruption of the relationship between nutrient cycling and long-term productivity.

In the aftermath of wildfires, streamflow may increase in response to soil and vegetation changes. A severe wildfire may create hydrophobic soil condition, which decreases the infiltration capacity. This decrease in the soil's ability to absorb water, combined with reduced transpiration resulting from vegetation removal, can result in significant streamflow increases. If the resulting streamflow causes streambank instability and undermines the integrity of downstream structures in the floodplain, soil erosion will occur. This is particularly important in forested areas where intense thunderstorms can create considerable overland flow if infiltration capacity is reduced.

Severely burned areas would need emergency treatments to prevent watershed and soil degradation. The Forest has a burned area emergency rehabilitation program and plan that would respond to watershed concerns after a major wildfire (USDA Forest Service 1995). This would be true for all alternatives.

For prescribed burning, the same potential hazards exist as described for wildfires. The areas selected for burning are usually small enough and burn cool enough so that widespread adverse effects are minimized, and effects are not as severe as those resulting from a major stand replacement fire.

Prescribed burning can affect the physical and chemical nature of the soil. The amount of soil erosion after a prescribed burn depends on the inherent erodibility of the soil. Project analysis and monitoring would be completed for all prescribed burn proposals so that long-term soil productivity would not be impaired. Prescribed fire programs in all alternatives can be implemented in a way that prevents excessive soil impacts.

The effects of wildfire could potentially be greater in those alternatives where natural processes dominate. This will depend on fuels loads, moisture, insect and disease activity, but the more natural processes are allowed, the greater the potential change of wildfire impact to the soil resource. The impacts would be greatest in alternative F, E, D DEIS, D FEIS, C, B, and A would be least. See write-up on ecological function (Biodiversity section) for more information on natural processes. The potential for impacts fuel treatment would be similar for most of the alternatives.

Effects from Rangeland Management and Big Game Use

In the Eastside Forest Health Assessment (Johnson, Clausnitzer et al. 1994), the discussion on vegetation stated that perhaps livestock grazing during the late 1800s has caused the greatest degree and extent of disturbance in the western United States. The mobility and extensive use of the various ungulates across western rangeland affected virtually all segments of the landscape to some extent. The effect was greatest along watercourses, in basin meadows, and on ridgetops, where stock driveways and bedding grounds were used season after season for many years. The degrading of native vegetation in some areas has been so complete that thresholds were passed, leaving disclimactic vegetation. This "new" vegetation is usually either simpler biologically than the native flora or contains invasive, less desirable, or noxious plants.

Under a properly managed grazing system, livestock are well distributed, grasses are grazed to a preferred use, and trailing is minimized. There is plenty of vegetation left for soil protection. The use of ground cover for soil protection is a basic premise. When the vegetation is utilized to its allowable limits it is time to move the livestock. 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. Excess trailing can result in rilling, which would not maintain the integrity of the ecosystems.

An analysis of desired vegetation condition and soil standards on the Forest showed that some of the rangelands are not meeting forest plan direction. This indicates that soils may be exceeding allowable soil loss limits in some locations. Soils information is vital to conducting range analysis and would provide site-specific information at the project level. Changes in amount and timing of use, pasture rotation, deferment, resting, and vacating allotments may all be appropriate means to reduce grazing-related erosion problems. Vegetation utilization monitoring indicates that levels of use are being met across the vast majority of rangelands on the forest. See section on rangeland grazing and big game use for more information.

Soil surface characteristics are currently the best available indicators of soil stability and watershed function. Soil surface characteristics, such as presence of rills and gullies or pedestaling of plants, have been widely used as indicators of the degree of soil movement and condition of the soil surface. An evaluation of soil stability and watershed function, using soil surface characteristics as indicators of soil erosion and runoff, should become a fundamental component of all inventory and monitoring programs for rangelands (National Research Council 1994).

With grazing occurring over large areas of the Forest in all alternatives, the possibility for erosion exists. Erosion takes place on livestock trails to watering sites or favored crossings, such as over roads, ridges, and streams. In some areas,

overgrazing has resulted in soil compaction. These effects would be similar under all alternatives.

Effects from Recreation Management

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 (the application of gravel or paving) for heavily used footpaths or by closing areas to dispersed camping. Mitigation would be applied under all alternatives.

Since vegetation is removed from trails and compaction occurs, either during construction or by use, trails increase the potential for erosion. Where trails descend/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 form 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.

Off-road motorized recreation has the potential for heavy impacts to the soil resource. Such use disturbs grasslands and forest floor vegetation. 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.

There is concern that off-road recreation, especially off-road vehicle (ORV) and snowmobile use, damage soil and water resources. Because the areas affected are so small and scattered, the effects on soil and water area negligible at the forest-wide scale. In general, the impacts occur when users do not comply with existing regulations: for example, ORV use occurring off designated travel ways. Incorporating the watershed conservation practices identified under forest-wide standards in the Revised Plan will further mitigate effects. During implementation of the forest plan, site-specific project analyses will identify and address localized adverse effects from snowmobiles and other ORV uses. Effects from recreation use would be similar in all alternatives.

Effects from Timber Harvesting and Road Construction

Timber harvesting affects the soil in many ways. 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 and water-barred or if insufficient slash is left on the skid trail surface.

The effects of equipment operation will result in varying degrees of disturbance or removal of the existing vegetation, litter, and humus from the surface of the soil.

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 area 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 with heavy equipment compaction to the soil and the removal of nutrients in the form of tree boles, limbs, and branches. Heavy equipment on the forested site can result in detrimental puddling, compaction, erosion, and displacement. In addition to these direct effects, damaged soil can lead to increase runoff from the lower infiltration rates, sedimentation, lower permeability, and reduced site productivity. Timber harvesting on the Forest is done by conventional tractor logging or by mechanized logging. Conventional tractor logging is done whereby trees are felled, limbed, and bucked with manually operated chainsaws at the stump. A crawler tractor of rubber-tired skidder then drags the logs to a landing where they are loaded onto a logging truck. In mechanized logging, trees are felled and bunched by swing-boom or drive-to-tree feller-bunchers. Skidders or tractors then skid bunches of trees to roadside landings where they are limbed, bucked, and stacked for later hauling

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.

The road building activities associated with timber management can impact the soil resource. 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, there is an increased chance that erosion will 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, reconstruction is counted as an impact rather than a benefit.

The following table gives the acres harvested by alternatives and erosional index for the experienced budget levels. Also listed in the table is the number of watersheds that are entered to get the volume that the model predicted. From this table, the

ranking of alternatives from greatest to least potential for erosion would be B, C, A, D FEIS, D DEIS, E, and F.

Table 3-19. Timber harvest activities affecting soils - experience budget level per year.

		Alternatives						
Activity	**Unit**	**A**	**B**	**C**	**D DEIS**	**D FEIS**	**E**	**F**
Timber Harvest								
Total Sale Program Quantity	MMBF/yr	15.2	17.5	15.2	14.9	14.9	11.8	6.1
Even-aged	acres/yr	1,388	1,972	1,729	1,820	1,866	1,481	1,044
Uneven-aged	acres/yr	935	1,141	1,130	1,280	1,279	1,260	689
Total Acres harvested	acres/yr	2,323	3,113	2,859	3,100	3,139	2,741	1,733
Erosional Index		70	84	71	52	53	60	30
Watersheds entered	number	72	57	60	56	57	58	35

The choice of silvicultural systems can affect soil characteristics. Clear cutting creates immediate impacts and is generally a one-time event. In other systems, such as shelterwood and selection, impacts are added incrementally. In shelterwood and selection systems, the designation of skid trails can reduce the cumulative effects of incremental entries into the stand. The time of year can effect what the impacts of harvesting are. Winter logging can have less adverse impacts to the soil especially when done under frozen conditions or sufficient snow cover. One issue is the amount of ground disturbance needed for regeneration of a new stand of trees. Some areas that were winter logged do need additional ground disturbance for regeneration to occur. This will depend on the type of harvest, tree species, and what the objectives were for the harvest.

The use of designated skid trails can also reduce the amount of soil exposed by certain harvest activities. According to Childs et al. (1989), the amount of soil exposed by tractor yarding was 20% to 40% of the area. The use of designated skid trails reduced the amount of exposed soil to 7% to 15% of the area.

The potential effect of new road construction associated with timber harvesting will mimic the ranking of alternatives for timber harvesting. The Forest will mitigate the effects of road construction and maintenance with best management practices (BMPs) and standards and guidelines in the Watershed Conservation Practices (WCP) handbook.

Effects from Travel Management

Motorized vehicle use on designated travelways and off-road uses have the potential to adversely impact soils through loss of vegetative cover, erosion, and compaction. Road decommissioning should re-establish proper drainage, remove structures requiring long-term maintenance, and restore vegetative cover that would stabilize soils and reduce sedimentation. Road closure techniques may vary, but it is essential that soil and water objectives be met in the selected closure method.

Motorized off-road uses do not cause damage if the use is minimal and infrequent. However, once the vegetation has been imprinted with wheels, the potential for additional use and resource impacts (including erosion and compaction) increases. For this reason, motorized use is restricted to roads and trails in all alternatives, unless specifically allowed by Forest order.

Decommissioning of a road can have a positive effect on the soil resource, especially if the road is obliterated and put back into production. Alternatives E, and F would decommission the greatest amount of roads.

Uninventoried two-track roads exist on the Forest, but are generally limited to concentrated areas of high use. These roads are not part of the Forest road system and are not designated for motorized use. These roads are the results of hunters, wood gathers, firefighters, and others driving off designated travel ways. As management activities occur, these roads will be identified and obliterated or placed on the Forest road system. Obliteration of two-track roads (both uninventoried and inventoried) will have a beneficial effect on long-term soil productivity and will reduce overall open-road density on the Forest.

Cumulative Effects

The effects on soils from all major ground-disturbing activities expected to occur under the alternatives for the next decade are shown in the following table.

Existing, past and future disturbance activities within the forest include roads, timber harvest, grazing, fires, recreation and mineral activities. These activates are based on the cumulative effects activates table that was created for this forest plan analysis. The 6^{th} level watershed scale was used for doing cumulative effects analysis for this forest plan.

Cumulative soil erosion has been documented intensively in related research. Intensive studies were completed in northern California forested lands (within different climatic and environmental condition from the Medicine Bow/Routt N.F.) on estimating erosion form logging and forest roads. Although distant from this forest local conditions the studies do lead to some simple conclusions about erosion on timber related management activities. The studies concluded, " most erosion occurring on timber harvest areas was due to large mass wasting found on a small fraction of the harvest sites (Rice 1991). They further went to suggest that because only a relative few (logging or road) sites accounted for most of the erosion, the identifying (and thus avoiding /mitigating these site) would be a key to reducing erosion on a cumulative basis. At the project level analysis, these areas of concern are identified and avoided or mitigated.

Table 3-20. Primary activities affecting soils - experience budget level per year.

		Alternatives						
Activity	**Unit**	**A**	**B**	**C**	**D DEIS**	**D FEIS**	**E**	**F**
Timber Harvest								
Total Sale Program Quantity	MMBF/yr	15.2	17.5	15.2	14.9	14.9	11.8	6.1
Even-aged	acres/yr	1,388	1,972	1,729	1,820	1,866	1,481	1,044
Uneven-aged	acres/yr	935	1,141	1,130	1,280	1,279	1,260	689
Total Acres harvested	acres/yr	2,323	3,113	2,859	3,100	3,139	2,741	1,733
Erosional Index		70	84	71	52	53	60	30
Watersheds entered	number	72	57	60	56	57	58	35
Livestock Grazing								
active allotments		104	104	104	104	104	104	97
Oil and Gas								
available	acres	0	272,524	272,524	272,524	272,524	272,524	272,524
standard stipulations	acres	0	265,582	78,745	62,153	62,153	54,393	32,625
Roads	miles/yr							
new construction		4	2	2	2	2	2	0
reconstruction		4	5	4	4	4	3	1
decommission		18	18	18	18	18	75	121
Fuels Treatments	acres/yr	2,500	3,500	3,500	4,000	4,000	4,000	2,200
Prescribed Fire	acres/yr	1,750	2,450	2,450	2,800	2,800	2,800	1,540

Repeated harvest activity within the same site (or cutting unit) can lead to detrimental loss of topsoil or excessive compaction and displacement. Medicine Bow NF standards and guidelines call for minimizing soil compaction by reducing vehicle passes, skidding on snow frozen or dry soil conditions. Soils are considered to have compaction if there is a 15 percent increase in bulk density. Harvested stands would not be re-entered for 20 years or more; therefore any cumulative compaction or displacement would be minimized.

New road construction, both temporary and permanent, can be considered cumulative in nature, especially if roads are not properly drained, or are placed in unstable locations. If proper BMPs are applied in any newly constructed roads, them cumulative impacts on soil productivity would be minimized. Roads constructed within a sale area show greatly reduced erosion and sedimentation rates within 5 years after a sale. BMPs help to insure that erosion from cutting units or roads are excessive.

There is a Spruce Bark Beetle/Mountain Pine Beetle epidemic that is occurring on some of the surrounding forest (Routt) and on state and private land. This epidemic has the potential to spread to part of the Sierra Madre or Laramie Peak units. If a beetle epidemic were to occur on this forest and was followed by a major fire, there could be irreversible and irretrievable effects to the soil resources. Those alternatives that would be treating those stands at the highest risk of beetle infestation through timber harvesting and or fuel treatments, which would reduce the volume of the heavier fuels.

Alternatives can be evaluated on a cumulative effects basis in terms of the amount of activity in the same area. For timber harvesting, those alternatives with greatest multiple entries to the same area would potentially have the greatest cumulative effects. Ranking alternatives from a management activities cumulative effects would be Alternative B, C, A, E, D DEIS, D FEIS and F from highest to lowest. The potential for bark beetle cumulative effects would be the opposite with greatest potential in Alternative F and least in Alternative B. This assumes that the bark beetle epidemic occurs with a major fire occurring; there could be major soil impact occurring.

While the potential for cumulative impacts may vary by alternative, none of the alternatives have significance cumulative effects at this level of planning. Cumulative effects will also be analyzed at the project level. Each alternative differs in the relative amount of activities schedules.

Biological Elements

Biological Diversity

Introduction: Biological diversity refers to "the full variety of life in an area, including the ecosystem, plant and animal communities, species and genes, and the processes through which individual organisms interact with one another and with the environment" (USDA Forest Service 1992a). Conservation of biological diversity has become a concern of many and is reflected in the Forest Service's mandate to provide for the diversity of plant and animal species (36 CFR §219.26). The Medicine Bow National Forest has adopted a two-part approach to assessing and analyzing ecosystem and species diversity in support of revising the 1985 Plan. Part 1 is the Ecosystem or Biological Diversity Analysis and Part 2 is the Single Species Analysis. This approach is consistent with direction from the Acting Deputy Under Secretary for Natural Resources and Environment, USDA (Tenny 2001).

The Biological Diversity Report (Appendix D) has detailed information on the existing condition (affected environment), the historic range of variability (HRV) and the potential natural vegetation (PNV) of the ecosystems of the MBNF.

That report is presented in two parts:

- Part 1: The Ecosystem Assessment includes the hierarchy of nested ecosystems, how they relate to the Medicine Bow National Forest ecosystem, a description of composition, structure, function and disturbance processes that shape those ecosystems, and finally, information about the historic range of variation within those ecosystems;
- Part 2: The Single Species Assessment includes the list of animal, fish, insect, mollusk and plant species that have population viability concerns and the threats that place them in this category of concern.

Part 1, the Ecosystem Assessment, focuses on composition, structure, and function of ecosystems and addresses the integrity of the forest ecosystem. The Ecosystem Assessment is where most species' needs are described. The following ecosytem analysis will address how well each alternative provides for composition, structure and function and the integrity of the forest ecosystem.

Part 2, Single Species Assessment, focuses on selected species that may require special attention due to unique habitat requirements or threats to their continued viability. A summary of the single species determinations is found in this section, but full analysis about these species as they are impacted by alternatives can be found in Appendix I.

Spatial scales for the analysis of biological diversity include the ecoregion and MBNF boundaries. The appropriate scale for analysis was determined by the spatial extent and grain of ecosystem elements being evaluated or, in the case of species

analyses, by the movement patterns, population distribution, and other biological characteristics of specific taxa.

This ecosystem analysis will examine the consequences of the alternatives and their effects on the composition, structure, function, disturbance regimes and land uses of the ecosystems of the MBNF. Additional detail can be found in Chapter 3 under Vegetation Section and the Insects and Diseases Section. The projected effects to wildlife are disclosed in Chapter 3 - Wildlife Section. The projected effects to aquatic organisms are disclosed in Chapter 3 - Aquatics Section.

Legal and Administrative Framework

The following laws, executive orders, regulations, and policies guide management of biological diversity on NFS lands.

Laws

The 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 therefrom…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."

The Endangered Species Act of 1973 – "The purposes of this act are to provide a means whereby the ecosystems upon which the endangered species and threatened species may be conserved, to provide a program for the conservation of such endangered species and threatened species…"

The National Forest Management Act of 1976 – "It is the policy of the Congress that all forested lands in the National Forest System 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 objectives…provide, where appropriate, to the degree practicable…to preserve the diversity of tree species similar to that existing in the region controlled by the plan."

Executive Orders

EO 11990 Protection of Wetlands – "Each agency shall … provide leadership and take action to preserve and enhance the natural and beneficial values of wetlands in … conducting Federal activities and programs affecting land use."

Regulations and Policies

36 CFR §219.19 (a)(5) Evaluate the effects of pest and fire management.

36 CFR §219.26. Forest planning shall provide for diversity of plant and animal communities and tree species consistent with the overall multiple-use objectives of the planning area. Such diversity shall be considered throughout the planning process. Inventories shall include quantitative data, making possible the evaluation of diversity in terms of its prior and present condition. For each planning alternative, the interdisciplinary team shall consider how diversity will be affected by various mixes of resource outputs and uses, including proposed management practices.

FSM Directive No. 2600-94-2. This directive designated sensitive species for The Rocky Mountain Region, USDA Forest Service (Region 2) and provided regional direction for implementation of agency regulations set forth in the Forest Service Manual (FSM 2670).

Ecosystem Analysis Key Indicators in the Context of Historic Range of Variability

- Spatial extent (acres and distribution) of vegetation types;
- Spatial extent (acres and distribution) of forest age classes and habitat structural stages;
- Spatial extent (acres and distribution) of non-forested habitat structure stages;
- Spatial extent (acres and distribution) of old growth;
- Vegetation patterns related to fragmentation (patch size and isolation, road effects, edge);
- Amounts and distribution of snags and coarse woody debris;
- Changes in key ecosystem processes
- Spatial extent and frequency of disturbances (fire insect and disease related tree mortality);

Single Species Analysis Key Indicator

- Species viability determination summary.

Resource Protection Measures

In order to maintain biological diversity and viability, management areas have been designed and desired conditions described that will guide the implementation of the plan. In addition, standards and guidelines have been developed to limit adverse effects from resource management actions and forest uses. Monitoring is a part of project planning and implementation. A key part of monitoring is to determine if the standards and guidelines are working and protecting the intended resources.

Changes between Draft and Final

- The use of Yellowstone National Park as a reference landscape has been strengthened.
- The estimates of the extent of timber harvest, stand-replacement wildfire and non-stand replacement wildfire, stand-replacement and non-stand replacement insects have been revised.
- Some additional information on age, old growth and fragmentation has been added in response to comments.

Summary of Ecosystem Analysis Key Indicators

Vegetation Types

Although the vegetation will change with time, the spatial extent of vegetation types will remain relatively stable. Under all alternatives, the composition of the MBNF will continue to be influenced predominantly by the climatic and biological processes that shaped it. These processes provide the array of compositional elements (e.g. vegetation associations, soil types, rare species) that are available to respond to disturbances. The composition of the MBNF will vary by the type and extent of disturbances (natural or human land uses) implemented under each alternative. Alternatives F, E, D DEIS and D FEIS, have a greater predicted occurrence of natural processes than the other alternatives.

Alternative A has the least stand replacement disturbance predicted from both natural disturbance and management actions with the greatest contribution from human land use disturbance (see table under environmental consequences –composition) and would support the most extensive area of older forest over the long-term. Alternative F has the next least amount of disturbance with the greatest contribution from natural disturbance. Alternatives C, B, E, D DEIS, and D FEIS follow with an increasing amount of stand disturbance and fewer acres of older forest. These predictions are based on critical assumptions regarding the interactions of natural disturbance and management. Assumptions are outlined in this document and described more completely in Appendix B.

Age and Habitat Structural Stages

The occurrence of different habitat structure stages is not evenly distributed across management areas. The even distribution of age classes desired on suitable lands for sustainable renewable resource management is different than what currently exists on these suitable lands. It is also different than that expected under natural disturbance regimes (variation in age class abundance) that would be created by natural process. This desired distribution of age classes, if, and when it is achieved, would be directly reflected in the distribution of habitat structure stages. Furthermore, maintaining a uniform distribution of age classes (a feature not

expected under a natural disturbance regime) will require significant management effort over the long-term in the face of pressure from broad-scale natural disturbance agents.

The alternatives with the greatest allocation of land to renewable resources uses in order Alternatives B, A, C, D DEIS and D FEIS, E, and F. If "extreme" conditions were to occur, or a series of years with "ordinary" conditions but relative high fire occurrence, along with planned harvesting, HSS 3c, 4a, 4b, and 4c could become rare on landscape when considering the historic range of variability. Alternatives E and F have the largest amount of planned wildlife habitat restoration. Alternatives D DEIS and D FEIS have the greatest amount within MA 5.15, which emphasizes restoration activities.

Historically, fire suppression and grazing have altered the non-forested systems on the Forest. While all alternatives actively restore fire to the ecosystem, which historically has been the primary agent-of-change, Alternatives D DEIS, D FEIS, and E do so to the greatest extent.

Old Growth Forest

While Alternatives A and F have different standards for old growth, all alternatives will meet the minimum standards for old growth retention and management set for the alternative. Alternative F is likely to exceed these minimums.

Patch Size

Alteration of patch sizes will vary by alternative and occur primarily as a result of timber harvesting, road construction, and natural disturbances such as those from wildfire, insects and disease. Patch sizes will be reduced through timber harvest and road construction most significantly (ordered from high to lower) in Alternatives A, B, C, D FEIS, D DEIS, E and F. Based on assumptions described in following sections and in Appendix B – Biological Diversity Analysis Process, natural disturbance processes will influence patch size most in Alternative F, followed by E, D DEIS, D FEIS, C, B and A.

Snags and Coarse Woody Debris

Changes to levels of snags and coarse woody debris on the forest will vary by alternative and occur primarily as a result of timber harvesting, and natural disturbances such as those from wildfire, insects and disease. Reduced levels as a result of harvesting in order from highest to lowest will be Alternatives A, B, C, D DEIS, D FEIS, E, and F.

Ecosystem Processes

Changes based on natural disturbance processes in order from highest to lowest will be Alternatives F, D DEIS, E, D FEIS, C, B, and A. Based on important

assumptions, Alternatives F, E, would work to actively alter native ecosystem processes the least while Alternatives D FEIS and D DEIS (in order presented) would have an increasing effect on the extent and frequency of natural disturbance agents. Alternatives A, B, and C would have the greatest potential adverse effects based on the percentage of areas where natural processes could be interrupted.

Frequency of Natural Processes

Occurrence of fire, insect, and disease on the forest will depend on the amount of pre-suppression measures taken and on climatic factors. Potential occurrence, by alternative, in order from most to least are; Alternatives F, E, D DEIS, D FEIS, C, A and B.

AFFECTED ENVIRONMENT
VEGETATION TYPE

The ecosystems of the MBNF have a combination of forest, shrub, grass and other vegetation. The composition of the MBNF can be described by the occurrence of dominant vegetation types (cover type) and is displayed in the following table. Forested vegetation covers 80% of the MBNF. Lodgepole pine is the most common forest cover type. Non-forest cover types occur on 20% of the MBNF with shrublands the most common non-forest cover type.

Patterns of vegetation composition result from the interaction of climate, topography, aspect, current vegetation conditions, and ecological disturbances such as fire, windthrow, and insects/disease (Veblen, Hadley et al. 1994). The combination of climate, topography and aspect create zones on the mountain ranges of the MBNF where the major vegetation cover types occur. Riparian areas cross through the various vegetation zones. There is more information on the location and climatic requirements of the different cover types in Appendix D.

The following table displays the cover types found on the Forest in order of decreasing abundance.

Table 3-21. Spatial extent of cover types of the Medicine Bow National Forest.

Forest Cover Types	MBNF Acres	Percent of MBNF	Laramie Peak	Sherman (Pole Mtn)	Sierra Madre	Snowy Range
Lodgepole pine	472,577	43.6%	58,061	6,097	134,169	274,250
Spruce/fir	191,695	17.7%	2,556	21	73,237	115,881
Ponderosa pine	95,949	8.8%	85,566	9,037	30	1,317
Aspen	83,686	7.7%	2,535	3,772	58,782	18,596
Limber pine	11,633	1.1%	9,681	411	36	1,504
Douglas-fir	10,297	0.9%	1,609	712	2,964	7,396
Cottonwood	408	>0.1%	115	0	286	7
Juniper	243	>0.1%	70	0	0	173
Gambel oak (tree)	43	>0.1%	0	0	43	0
Total Forest Cover Types	866,532	79.9%	160,194	20,051	267,163	419,125
Non-Forest Cover Types	**Acres**	**Percent of MBNF**	**Laramie**	**Sherman (Pole Mtn)**	**Sierra Madre**	**Snowy Range**
Shrub	132,863	12.2%	12,111	10,285	58,040	52,426
Grass	71,278	6.6%	5,571	23,906	8,643	33,158
Rock (non-vegetated)	9,702	0.9%	2,580	961	1,948	4,214
Wet and water	2,315	0.2%	0	12	658	1,645
Krummholz	1,896	0.2%	0	0	0	1,896
Urban and Right-of-Way	28	>0.1%	0	0	1	27
Total Non-forest Cover Types	218,082	20.1%	20,262	35,164	69,289	93,366
Total	**1,084,614**	**100.0%**				

Source: MBNF RMRIS Database 2002, MBNF GIS, (USDA Forest Service 1998b).

All of the major vegetation types present in the 1700s and 1800s are still represented today, though in different abundances (Dillon, Knight et al. 2003). The high elevation forest cover types (spruce/fir and lodgepole pine) occur in similar pattern and distribution to historic conditions. Dillon *et al.* (Dillon, Knight et al. 2003) describe changes in the distribution of ponderosa pine (low elevation forest type) from fire suppression, possible changes in the amount of aspen and the amount of land in mountain meadows (grass cover type).

The current amount and distribution of riparian cover types is similar to the amount and distribution that occurred historically. Riparian cover types have been altered by natural disturbances and land uses in the past (Von Ahlefeldt and Speas 1996).

Changes to riparian areas include:

- Lowered water tables and changed vegetation due to removal of beavers;
- Alteration of riparian vegetation resulting from historical tie drives;
- Removal of large trees during the tie drives created relatively young, even-aged stands of trees (restoration of riparian ecosystems is dependent upon the growth of large trees in the riparian zone and their eventual recruitment into the streams as coarse woody debris);
- Alteration of riparian vegetation and stream channels from past and present grazing, especially on the west side of the Sierra Madre Mountains and in the Laramie Mountains;
- Changes to aquatic and riparian areas caused by management activities such as road construction, timber harvesting, and grazing in specific watersheds;
- Alteration of aquatic communities in Haggerty Creek and Bear Creek from point source pollution (Haggerty Creek has been identified by the WY Dept. of Environmental Quality as the most severely affected creek from point source pollution in the state);
- Alteration of natural flow regimes and riparian vegetation due to water diversions and sediment spills which change habitat characteristics (diversion of water from natural stream courses on the Forest has lowered water tables and altered riparian vegetation (primarily in the foothills areas of the Forest);
- Alteration of high-elevation riparian communities due to past timber harvesting around kettleholes in the northern Snowy Range;
- Proliferation of exotic noxious weeds in many lower elevation riparian areas. (See Fish and Aquatics section of AMS for details.)

There are approximately 1,600 miles of perennial stream channels on NFS lands within the Medicine Bow National Forest boundary. Water originating on the Forest contributes to flows in both the Platte and Green River (Colorado River) basins. The majority of the Forest is in the Platte River drainage (86%). Rob Roy (640 acres) and Hog Park (520 acres) are the two largest reservoirs on the Forest. Lake Owen, Turpin Reservoir, and Sand Lake are each approximately 100 acres in size. Hundreds of smaller lakes, reservoirs, and ponds occur on the Forest; the northern half of the Snowy Range has the largest concentration.

Shrublands and coniferous forests make up more than 80% of the riparian areas on the Forest. In contrast, less than 10% of the riparian areas are deciduous forests and grass/forb dominated. Riparian and wetland areas range from 4 to 8% (70,000 acres) of NFS lands.

Table 3-22. Riparian and wetland acres by mountain range.

Vegetation Type	Sierra Madre	Snowy Range	Sherman (Pole Mtn)	Laramie Peak	Total Acres and % of Vegetation Type
Deciduous Forest	2,155	1,806	355	486	4,802 7%
Coniferous Forest	6,612	13,533	510	4,306	24,961 36%
Shrubland	8,439	18,515	2,487	2,233	31,664 46%
Grass and Forb	937	1,701	1,191	431	4,260 6%
Other	839	2,381	34	3	3,257
Total Acres	**18,892**	**37,936**	**4,577**	**7,449**	**68,944**
% of land in riparian/wetland	6%	7%	8%	4%	6%

Source: (Von Ahlefeldt and Speas 1996)

Fens occur on the MBNF but occupy a very small percentage of the overall riparian/wetland acreage, fens are an important element of biological diversity, and often support globally rare plant and invertebrate species and unique species assemblages (Heidel and S. Laursen 2003), (Proctor 2003), (Reider 1983), (USDA Forest Service 2002). (See discussion of sensitive plant species and fens in Appendix I for more information.)

ENVIRONMENTAL CONSEQUENCES
VEGETATION TYPES

The changes in the ecosystem component of **composition** (cover type) are discussed in this section. Changes to the ecosystem components of **structure** (habitat structure stages and landscape arrangement of patches) and **function** (growth and disturbance processes) are discussed in following sections. The ecosystem components of composition, structure, and function provide a basis for describing ecosystem diversity.

The composition of the MBNF will vary by the type and extent of disturbances (natural or human land uses) included in each alternative. Under all alternatives the composition of the MBNF will continue to be influenced by the climatic and biological processes that shaped it. These processes provide the array of compositional elements that are available to respond to disturbances. Compositional changes following disturbances can last for varying amounts of time depending upon the severity of the disturbance. Knight (Knight 1994) notes that severe wildfire disturbances in spruce-fir ecosystem can change composition for hundreds of years following the disturbance. Other types of disturbances create compositional changes that last only for a few years.

These predictions are, however, based on critical assumptions regarding the interactions of natural disturbance and management. Assumptions are outlined below and the modeling processes based on these assumption are described more completely in Appendix B.

Critical Assumptions:

1. Natural disturbance processes are most likely to occur in a similar amount and pattern to the recent historical period.
2. Natural disturbance patterns are reflective of existing conditions and levels of insect and disease activity and risk of increases based on forest conditions.
3. Climate patterns that would influence the occurrence of natural disturbance patterns are not likely to change suddenly or drastically in the implementation period for this plan (10-15 years). These climate patterns are not expected to produce conditions that exceed those described as part of the historic range of variability (Griggs 1938.), (Griggs 1946),(Kipfmueller and W. L. Baker 2000). Other climatic events that can create extreme conditions (such as the Hale magnetic cycles, El nino-southern oscillation or volcanic eruptions (Fye and M.K. Cleaveland 2001)) are unpredictable. Natural disturbances are unpredictable in the short term (10-15 years) because of the fluctuations from year to year. Therefore this analysis focuses on a longer period of 50 years. A wider variety of climate change is possible over longer periods. Other possible outcomes that deviate significantly from those presented this are also noted or described.
4. Active management is not expected to entirely prevent native disturbance processes. However, salvage activities permitted and/or encouraged in management areas with renewable resource management emphasis are likely to utilize most of the timber mortality from wildfires, insects and diseases. Although not required, this material has in the past substituted for live green volume with regards to the allowable sale quantity. It is likely that this pattern of substitution will prevail in the future. Since cumulative effects have been based upon the patterns of human uses and natural disturbance patterns, where natural disturbance processes occur in area where salvage harvesting would be expected, this has been shown as part of the predicted harvesting.

Composition Changes from Natural Disturbance Processes

Fire can change composition by killing dominant vegetation and providing for replacement by other vegetation. Insects and diseases and blowdown can also influence composition through mortality and replacement.

The occurrence of wildfires and insects are influenced by stand structure, forest type, and drought. There is an extensive discussion of this in the following section under Environmental Consequences Age Classes: Flammability of Forests of Different Ages/Structures. Dwarf mistletoe, a major disease of forest trees, is currently

thought to occur independently of drought, but intensity of effects is often greater in certain stand structure stages (Lundquist An Interpretation of Landscape Scale Spatial Patterns in a Lodgepole Pine Forest Infected by Dwarf Mistletoe.), (Kipfmueller and W.L. Baker 1998b) and during droughts. Other forest diseases (heart rots and root rots) take time for effects to be evident and are more frequently noted in older stands and during times of drought (Alexander 1986).

The allocation of the MBNF to management areas for which natural processes (wildfires and insects and diseases) will be the dominant agents of vegetation change is displayed in the following table. Natural disturbances will be allowed to dominate under those management prescriptions where resources management such as timber harvest is not emphasized. However, natural disturbance could be the dominant force under any alternative, depending on future disturbance events such as bark beetle outbreaks, wildfire, or windthrow (blowdown). Active management is not expected to entirely prevent native disturbance processes.

Table 3-23. Percent of MBNF in management areas where natural processes are the dominant agent of vegetation change.

	Alternatives						
	A	**B**	**C**	**D DEIS**	**D FEIS**	**E**	**F**
Natural Processes (% of MBNF)	20%	28%	35%	46%	45%	46%	72%

Source: MAs: 1.13, 1.2, 1.31, 1.33, 1.41, 1.5, 2.1, 2.2, 3.21, 3.24, 3.31, 3.32, 3.4, 3.5, 3.51, 3.54, 3.56, 3,57, 3.58.

Similarly, not all of the acres within the management areas that allow natural disturbances as the primary agent of vegetation change will be affected by wildfires, insects, or diseases. Natural disturbances are unpredictable in the short term (10-15 years) because of the fluctuations from year to year. Therefore this analysis focuses on a longer period of 50 years. Even at this temporal scale, however, predictions have a high degree of uncertainty and the results provide a picture of one potential outcome.

Wildfire suppression direction varies by management area. The appropriate fire management response, actions taken in response to a wildland fire to implement protection and fire use objectives, is described for each management area in Chapter 2 of the Revised LRMP and directs the immediate response to a wildfire ignition. Management areas where natural processes are the dominant agents of vegetation change are more likely to have indirect response strategies than management areas where human processes will be the dominant agent of vegetation change. The Fire Management Plan is strategic plan that defines the program to manage wildland and prescribed fires and documents the Fire Management Program in the approved land use plan. This plan is supplemented by operational plans such as preparedness plans, preplanned dispatch plans, prescribed fire plans, prevention plans, and operational wildland fire use plans. All of these plans will implement the forestwide and

management area goals, objectives, strategies, and strive to create the described desired conditions.

Although wildfires ignited in management areas where natural processes are the dominant agent of vegetation change will be managed through a variety of strategies, extreme wildfire incidents can exceed management and suppression capabilities. This analysis focuses on wildfire events and occurrences that are similar to those that have occurred during the historic period (previous 50 years) in which extreme events that exceed management and suppression capabilities are very rare. Other outcomes than those described are also possible. Other possible outcomes that deviate significantly from those presented this are also noted or described.

The extent of wildfire in the next 50 years is expected to be similar to that described for HRV if climate and biophysical processes remain similar to the past. The amount of land that is estimated to be affected by wildfire for each alternative over the next 50 years is displayed in the following table. This amount was estimated using information on HRV for the extent of wildfire from Dillon *et al.* (Dillon, Knight et al. 2003) as a base and was applied to each alternative based upon the allocation to management areas with natural processes as the major agent of change. Although not all wildfires would be expected to occur within management areas with natural processes as the dominant agent of vegetation change, using the percentage of the forest in which natural processes is the dominant agent of vegetation change provides a basis from which to calculate the amount of wildfire. (A full description of the process for predicting area affected is in Appendix B –Biological Diversity Analysis).

Table 3-24. Predicted wildfire acres: cumulative through decade 5.

	Alternatives						
	A	**B**	**C**	**D DEIS**	**D FEIS**	**E**	**F**
Wildfire Stand Replacement (acres)	13,065	18,135	23,855	31,070	29,250	31,005	48,035
Wildfire Stand Replacement (% of MBNF)	1.2%	1.7%	2.2%	2.9%	2.7%	2.9%	4.4%
Wildfire Non-stand Replacement (acres)	65,325	90,675	119,275	155,350	146,250	155,025	240,175
Wildfire Non-stand Replacement (% of MBNF)	6.0%	8.4%	11.0%	14.3%	13.5%	14.3%	22.1%
Total Wildfire	78,390	108,810	143,130	186,420	175,500	186,030	288,210
Total %	7.2%	10.0%	13.2%	17.2%	16.2%	17.1%	26.5%

Source: % acres within MAs with natural processes applied to base from Dillon et al. (Dillon, Knight et al. 2003), Romme (Romme 2002) and Rothermel et al. (Rothermel, Hartford et al. 1994). See Appendix B – Biodiversity Analysis for details.

If "extreme" climatic conditions such as described by Romme (Romme 2002) are experienced over the next 50 years, then amounts of wildfire predicted could be similar to that experienced in YNP in 1988 when 54% of the sub-alpine forest burned. If the next 50 years are the beginning of a "very long fire free period" such as described by Romme (Romme 2002), then fewer acres than those described above could be affected by wildfire. Under this scenario there would not be any difference among the alternatives in the number of acres affected. There would still be a difference in the amount of salvage of dead and dying timber based upon management areas where human disturbance processes are the dominant agent of vegetation change. See the following discussion on human disturbance processes for more information on this.

MBNF fire history from Von Ahlefelt and Speas for 48 years indicates that only 1.6% of total acres or about 3% of the forested acres (if all applied to forested acres) (25,995 acres) of MBNF forest cover acres (866,531) burned in those 48 years. This was mostly during a period of extensive fire suppression and low frequency of ignitions. A "long fire free period" would be expected to have a similar spatial extent of wildfire. Under this scenario there would not be any difference among the alternatives in the number of acres affected. There would still be a difference in the amount of timber reaching older successional stages and moving towards the potential natural vegetation. See the following discussion on human disturbance processes for more information on this.

There will likely be a greater and longer lasting occurrence of post fire environments in alternatives with greater amounts of stand replacement wildfire (Alternatives F, E, D DEIS and D FEIS). Post fire environments have been noted as being scarcer now than during the reference periods for HRV (Dillon, Knight et al. 2003). Regeneration of forest trees can be delayed following wildfires, especially at high elevations in large openings and when other vegetation occupies the site (Knight 1994). Forest cover types can remain in grass/forb or shrub stages for hundreds of years following severe fires (Knight 1994).

Mortality caused by insects has probably been the second most important type of disturbance in high elevation forests (Dillon, Knight et al. 2003), (Veblen, Hadley et al. 1994) (Baker and T.T. Veblen 1990) . The composition of the forest can change when there is extensive mortality from insects Veblen *et al.* (Veblen, K. S. Hadley et al. 1989), Veblen *et al.* (Veblen, Hadley et al. 1991), Schmid and Hines (Schmid and Hinds 1974) Schmid and Mata (Schmid and Mata 1996) and Knight (Knight 1994) discuss changes in composition following insect activity in high elevation spruce-fir stands. 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).

On the Laramie Range, in ponderosa pine (low elevation forest), an extensive mountain pine beetle epidemic occurred between 1988 and 1994. The Cold Spring

Ecosystem Management Project (USDA FS Douglas Ranger District 1998) stated that there was extensive tree mortality on 7,500 acres due to that epidemic.

The amount of land that would be affected by insects and diseases is a function of the risk level of the forest and management area desired conditions that allow for natural processes. The amount of land that is estimated to be affected by insects and diseases for each alternative over the next 50 years is displayed in the following table. (Appendix B –Biological Diversity Analysis contains a full description of the process for predicting area affected). As indicated earlier, several critical assumptions have a significant influence on the outcome of this model. Therefore, the level of certainty in the predicted pattern is relatively low. However, the results provide an example of one potential outcome.

Table 3-25. Predicted insect and disease acres: cumulative through decade 5.

	Alternatives						
	A	**B**	**C**	**D DEIS**	**D FEIS**	**E**	**F**
I&D Stand Replacement (acres)	9,266	12,806	16,845	21,940	20,655	21,894	33,920
I&D Stand Replacement (%)	0.9%	1.2%	1.6%	2.0%	1.9%	2.0%	3.1%
I&D Non-stand Replacement (acres)	6,151	8,537	11,230	14,627	13,770	14,596	22,613
I&D Non-stand Replacement (%)	0.6%	0.8%	1.0%	1.4%	1.3%	1.5%	2.0%
Total (acres)	15,377	21,344	28,076	36,567	34,425	36,491	56,534
Total (%)	1.4%	2.0%	2.6%	3.4%	3.2%	3.4%	5.2%

**See Appendix B Biological Diversity Analysis Process for information on how these numbers were developed. Because of the stochastic nature of natural disturbances and the particular assumptions forming the foundation of this model, results are extremely uncertain. These results should be regarded as one of many potential outcomes that could results from strict implementation of each alternative.*

Although insect epidemics in management areas where natural processes are the dominant agent of vegetation change will be managed through a variety of strategies (silvicultural treatments, suppression), extreme insect epidemics can exceed management and suppression capabilities. This analysis focuses on insect epidemics and occurrences that are similar to those that have occurred during the historic period in which extreme events that exceed management and suppression capabilities are very rare. Other outcomes than those described are also possible. Other possible outcomes that deviate significantly from those presented this are noted and described in the following paragraphs.

If a spruce beetle epidemic occurred, then amounts of spruce-fir affected by insects could be similar to those reported by Schmid and Frye (Schmid and Frye 1977) of 13,000 acres in New Mexico but would be less than that the 420,000 acres reported by Schmid and Beckwith (Schmid and Frye 1977) for British Columbia and Alaska

or 900,000 acres reported by Werner (Werner 2003) in Alaska as there are only 191,695 acres of spruce-fir cover type on the MBNF and only 152,647 of a size (>12 inches dbh) attractive to spruce beetles. Spruce beetle epidemics often affect all of the contiguous acres of spruce-fir with trees greater than 12 inches dbh (Schmid and Frye 1976)and result in the death of the large spruce trees, changing the internal composition of the stand from dominantly spruce to dominantly fir and changing habitat structure stages from later (e.g. HSS 4a, b, c or HSS 5) to earlier (HSS 3a, b, c, 4a, b or c).

Similarly mountain pine beetle in lodgpole pine could affect all of the acres of lodgepole pine with trees greater than 9 inches dbh (Schmid and Mata 1996) (220,794 acres). However, it can take 5-10 years for mountain pine beetle epidemics to subside and 10 years or more for spruce beetle epidemics to subside (USDA FS Douglas Ranger District 1998), (Schmid and Mata 1996).

Ponderosa pine can also be affected by the mountain pine beetle. There are 84,573 acres of ponderosa pine that are generally greater than 9" dbh in the RIS database. Very recent wildfires and continuing insect activity have reduced the total mature ponderosa pine and reduced the density of some stands from what is currently displayed in the RIS database. The Insects and Disease section of this chapter displays the acres of Spruce-fir, Lodgepole pine, and Ponderosa pine that are considered high risk.

Under this scenario (epidemic conditions) there would not be any difference among the alternatives in the number of acres affected. There would still be a difference in the amount of salvage of dead and dying timber based upon management areas where human disturbance processes are the dominant agent of vegetation change. See the following discussion on human disturbance processes for more information on this.

There will be a greater and longer lasting occurrence of insect and disease influenced environments in alternatives with greater allocations to natural processes. Regeneration to forest trees species can be delayed following insect or disease attacks similar to fire effects. Forest cover types can remain in grass/forb or shrub stages for hundreds of years following extensive disturbances (Knight 1994). Insects and disease create structures and niches that can't be created by timber harvest (dwarf mistletoe and other brooms, hollow trees).

The following table presents information on predicted occurrence of natural disturbance processes cumulatively through decade 5. (See previous discussion on other possible scenarios under wildfire and insects and diseases for more information on this.)

Table 3-26. Predicted natural process: cumulative through decade 5.

	Alternatives						
	A	B	C	D DEIS	D FEIS	E	F
Stand Replacement (acres)	22,291	30,941	40,700	53,010	49,905	52,899	81,955
Stand Replacement (%)	2.1%	2.9%	3.8%	4.9%	4.6%	4.9%	7.6%
Non-stand Replacement (acres)	71,476	99,212	130,505	169,977	160,020	169,621	262,788
Non-stand Replacement (%)	6.6%	9.1%	12.0%	15.7%	14.8%	15.6%	24.2%
Cumulative Total (acres)	93,767	130,154	171,206	222,987	209,925	222,521	344,744
Cumulative Total (%)	8.6%	12.0%	15.8%	20.6%	19.4%	20.5%	31.8%

**See Appendix B Biological Diversity Analysis Process for information on how these numbers were developed.*

Forested areas disturbed by wildfires may subsequently be attacked by insects or disease. Areas disturbed by insects or disease may have wildfires burn through them. The analysis above attributes the vegetation change to one agent or the other and does not duplicate acres between categories. In addition, there is a high degree of uncertainty associated with these projections on a year-to-year basis. Uncertainty decreases as the size of the landscape under consideration increases and as the time frame increases (*e.g* over 50-100 years versus a single year). The influence of climatic and biological processes can be variable from year to year but over longer time frames generally operate in predictable patterns.

Control of native insects and diseases relies on changes to composition or structure of the forest vegetation. The confidence in achieving control of insect populations or diseases is greater for small and isolated incidents and lower for larger and more extensive incidents.

Alternatives F, D DEIS, C and D FEIS, have a greater predicted occurrence of natural processes, and are expected to have a greater occurrence of post fire environments. Post-fire environments have been noted as being scarcer now than in the reference period for HRV (Dillon, Knight et al. 2003). Regeneration to forest tree species can be delayed following wildfires (Knight 1994). Insects and disease create structures and niches that can't be created by timber harvest (dwarf mistletoe brooms, hollow trees).

Alternatives A, B, and C provide the greatest amount of pest management and wildfire suppression in support of resource outputs. Alternative F focuses on restoring the greatest number of acres to natural conditions with minimal human intervention. Alternatives C, D DEIS and D FEIS, and E provide a mix of management areas with differing objectives for managing pests and suppressing wildfires and providing for natural processes to occur.

Composition Changes from Human–Caused Disturbances

Forest Lands

Each alternative includes management areas where human-caused disturbances play the greatest role in changing composition and in which natural processes such as fire, insects, and diseases still operate but are not the primary agents of vegetation change.

The next table displays percent of forest where human activities directed toward renewable resource management will be the primary agent of vegetation change.

Table 3-27. Percent of forest where renewable resource management is the primary agent of change.

	Alternatives						
	A	**B**	**C**	**D DEIS**	**D FEIS**	**E**	**F**
Renewable Resource Mgt (% of MBNF)	55%	63%	53%	45%	44%	39%	25%

Source: Management area allocations MAs 5.11, 5.12, 5.13, 5.15, 5.21, 5.4, 8.6

Forested and non-forested composition in these areas is changed mainly by timber harvesting and prescribed fire. The compositional changes and the duration of those changes are determined by the management objectives and desired future conditions.

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. These composition changes are similar in direction to those for natural disturbance but may vary in timing, location and extent. Changes in the physical environment from human disturbances can lead to changes in plant species composition (Selmants and D. H. Knight 2003), (Jules 1998), (Germino and W. K. Smith 1999.), (Tomimatsu and M. Ohara 2002). (Structural changes and changes to large woody material are discussed in following sections.)

Forested stands managed for timber production using regeneration harvests such as clearcutting or shelterwood cutting must be reforested within 5 years of final harvest according to regulation (36 CFR 219.27(c)(3)). Forest regeneration shortens the natural time that grasses, forbs and shrubs might occupy these sites. This is different than post fire or post insect or disease conditions.

Prescribed fire objectives vary by vegetation type but most often are focused on re-establishing the same vegetation with a higher level of vigor. One of the methods used to maintain or restore aspen will be prescribed burning. This may result in an increase in aspen at the expense of other species such as lodgepole pine.

The confidence in achieving planned events such as regeneration harvests and prescribed burning is much greater than the confidence in projecting unplanned events such as wildfire and insect and disease attacks. Experience implementing silvicultural and burning prescriptions in subalpine forests has built a strong

foundation for predictions. This experience includes both local and regional applications of the common techniques (Alexander and O. Engelby 1983), (Burns 1989) (See Appendix G – Silviculture for more information).

Alternatives vary in the extent of early seral conditions that will result from planned even-aged regeneration harvests and prescribed burning over the next 10 years. After 50 years, human-induced early seral forest will very from 1% (Alternative F) to 6% of the forest (Alternatives A, B, C, D DEIS and D FEIS) (see following table).

Table 3-28. Even-aged regeneration harvest and prescribed burning for forest regeneration.

	Alternatives						
	Decade 1						
	A	B	C	D DEIS	D FEIS	E	F
Even-aged Regeneration Harvest (acres)	16,930	21,074	19,465	20,569	20,489	18,628	6,890
Aspen Prescribed Fire (acres)	3,500	4,900	4,900	5,600	5,600	5,600	3,080
Total (acres)	20,430	25,974	24,365	26,169	20,089	24,228	9,970
Total % of MBNF	2%	2%	2%	2%	2%	2%	1%
	Cumulative Decade 5						
Even aged Regeneration Harvest (acres)	44,142	45,450	40,868	33,112	37,782	28,513	0
Aspen Prescribed Fire (acres)	17,500	24,500	24,500	28,000	28,000	28,000	15,400
Total (acres)	61,642	69,950	65,368	61,112	65,782	56,513	15,400
Total % of MBNF	6%	6%	6%	6%	6%	5%	1%

Source: S-tables

Strategies and guidelines for every alternative include maintaining and restoring aspen and ponderosa pine. Aspen and ponderosa pine can be maintained or restored by renewable resource management activities, planned restoration actions or natural disturbances. Alternatives D FEIS, D DEIS and E will have the greatest maintenance and/or increase in the amount of aspen on the landscape. Based upon successional status criteria from Alexander (Alexander 1988), of the current 83,686 acres within the aspen cover type, there are 40,349 acres (48%) that are considered to be climax aspen and 43,337 acres that are successional to other cover types. In addition, there are an unknown number of acres that are currently occupied by lodgepole pine or spruce/fir that would have aspen as an early seral stage. Without disturbance (natural or human) those acres within the aspen cover type that are seral to lodgepole pine or spruce/fir will not remain in the aspen cover type.

Grass and Shrub Lands

Most of the acres impacted by prescribed fire will be shrubs or grasses from the non-forested vegetation. Over a 50-year time horizon, the same acres may be burned several times. Therefore, compositional and structural change may occur on the same acres several times over a 50-year period. In shrub-dominated sites, composition and structure following fire will depend on the age and species of shrubs prior to the burn, time of year of burning, burn intensity, and weather conditions in the years immediately following the burn.

Table 3-29. Prescribed burning grass and shrub lands.

	Alternatives						
	A	B	C	D DEIS	D FEIS	E	F
	Decade 1						
Prescribed Fire (acres)	14,000	19,600	19,600	22,400	22,400	22,400	12,320
	Decade 5						
Prescribed Fire (acres)	70,000	98,000	98,000	112,000	112,000	112,000	61,600
Total % of MBNF	6%	9%	9%	10%	10%	10%	6%
Total % of Grass + Shrub	34%	48%	48%	55%	55%	55%	30%

Source: S-Tables

Forested to Non-forested Ratio

Forest lands occupy 80% of NFS land and 20% is non-forested. Dillon et al. (Dillon, Knight et al. 2003) suggest that the ratio of forested to non-forested vegetation now is similar to what historically occurred. Low elevation shrublands and grasslands are routinely treated by prescribed fire for forage enhancement.

In some areas, forest trees encroach on meadows and grasslands. Removal of these forest trees to maintain grassland or meadows conditions may occur under all alternatives. Management Area 5.15 emphasizes treating areas to re-establish ecological processes and patterns similar to HRV. Meadows that would be priorities for mechanical treatments would generally occur within management areas where human disturbance processes are the dominant agent of vegetation change. Meadows that occur within management areas where natural processes are the dominant agent of vegetation change would generally be treated by managed wildland fires. Where trees are not removed by harvest or fire, grasslands and meadows could convert to forestland over the course of several decades (Dillon, Knight et al. 2003), (Jakubos and W.H. Romme 1993), (Bunting and E.F. Peters 1994). Natural processes such as fires, insects and diseases that remove forest cover may create conditions where grass, forbs and/or shrubs replace forest cover for hundreds of years.

Riparian Areas

The extent of riparian areas will change little under all alternatives (currently 68,944 acres). The composition of vegetation within riparian areas will trend towards species and life forms (trees and large shrubs) associated with later successional stages.

Fens that occur on the MBNF but occupy a very small percentage of the overall riparian/wetland acreage would be protected under the aquatic standards and guidelines and watershed conservation practices handbook direction (Maintain long-term ground cover, soil structure, water budgets, and flow patterns of wetlands to sustain their ecological function, per 404 regulations.) and the regional direction regarding fens (USDA Forest Service 2002). (See discussion of sensitive plant species and fens in Appendix I – Biological Evaluation for more information.)

Standards and guidelines limit activities adjacent to riparian areas and wetlands. For those alternatives with the largest allocation to renewable resources, there will be road construction associated with harvesting timber. Where these roads cross streams there will be some disruption of aquatic vegetation and function. Required use of watershed conservation practices (best management practices) limits the effects of roads and stream crossings on riparian area through road placement criteria (FSH 2509.25 Chapter 10). Riparian areas and wetlands are easily recognized and protected, thus all alternatives pose a low level of risk for management actions that involve project planning.

Recreational use with riparian areas can remove and/or injure plants, alter soil properties and reduce the overall vigor of plants. In particular, well-used fishing areas may result in some trampling of sensitive species (see Appendix I – Biological Assessment and Biological Evaluation for details). Recreational activities and effects can be managed through educational efforts and/or closure orders.

Potential Natural Vegetation

Currently the four most prevalent cover types are lodgepole pine, spruce-fir, ponderosa pine, and aspen, which occupy 44%, 18%, 9%, and 8% of the forest, respectively. Much of the lodgepole pine and aspen on the MBNF is seral to Spruce-Fir community types (Alexander 1988). Dillon *et al.* (Dillon, Knight et al. 2003) note that secondary succession initiated today could have quite different trajectories than 200-300 years ago because of different climatic conditions at least in part, to warmer and possibly somewhat wetter conditions since the end of the Little Ice Age (about 1850-1870). Over the last century, the average temperature in Laramie, Wyoming, has increased 1.5°F, and precipitation has decreased by up to 20% in many parts of the state (Environmental Protection Agency 1998).

The potential natural vegetation (that vegetation that would develop in the absence of disturbance) indicates that there is potential for more spruce/fir cover type and less

lodgepole and aspen in the absence of disturbance (see Appendix D – Biological Diversity Report for details).

The analysis of the potential for change from existing is shown in the following table.

Table 3-30. Potential change from existing cover types in the absence of disturbance.[2]

Cover Type	Existing Acres (MBNF RIS)	Potential Natural Vegetation Acres	Change
Lodgepole Pine	472,577	107,116	- 365,461
Aspen	83,686	40,349	- 43,337
Spruce-Fir	191,695	640,637	+ 448,942
Ponderosa Pine	95,949	46,650	-49,299

Source: Based on successional pathways identified in Alexander (Alexander 1988).

Resource management actions and natural disturbances will create disturbances that will counteract the natural successional processes and maintain a representation of forested cover types and non-forested vegetation. Certain cover types associated with early seral stages of forest development (such as aspen, grass and shrubs) may be maintained (increase from existing trend) by both natural disturbances and resource management. These changes will be subject to growth and succession processes and over the long-term will return to the original cover type. The information on PNV can be used to predict the direction for composition changes in the absence of disturbances such as long fire free periods discussed earlier.

Cumulative Effects

The amount of natural and management related disturbance was predicted based on planned stand replacement regeneration timber harvests, planned prescribed fire in aspen, and unplanned, but predicted stand replacement wildfire and insect or disease attacks. (See Appendix B – Biological Diversity Analysis for a detailed description of the methods used to generate this information.) The amount of natural and human-caused stand replacement disturbance is predicted in the following table.

[2] Changes to this extent are not expected under any management alternative because natural disturbance processes will create early successional conditions on some sites.

Table 3-31. Area and % of MBNF of forest stand replacement from natural and human disturbances over a 50-year period.[3]

	Alternatives						
	A	**B**	**C**	**D-DEIS**	**D-FEIS**	**E**	**F**
Regeneration Harvest (acres) Even and uneven-aged	54,872	58,680	50,068	45,312	53,972	40,873	11,930
Aspen Prescribed Fire (acres)	17,500	24,500	24,500	28,000	28,000	28,000	15,400
WF-I&D Stand Replacement (acres)s)	22,291	30,941	40,700	53,010	49,905	52,899	81,955
Total Stand Replacement Acres	94,663	115,091	115,878	127,153	133,177	122,793	110,125
Total % of MBNF	9%	11%	11%	12%	12%	11%	10%

Source: S-tables.

Cumulative effects of natural and management related disturbance is difficult to predict because of the uncertainty regarding both the intensity and extent of natural disturbance (e.g. wildfire, blowdown), and because the influence of management activities on natural disturbance is difficult to predict. Therefore, predictions regarding future vegetation should be examined in light of the particular assumptions used in this specific modeling exercise. The assumptions used in predicting the extent of disturbance from wildfire, insects and disease, and the management related vegetation changes presented earlier are found in Appendix B Biological Diversity Analysis.

The allocation of lands to Management Areas differing in emphasis of active management versus natural disturbance processes will influence ecosystem patterns and processes. The allocation of land to management areas with emphasis on human or natural disturbance processes varies among the different mountain ranges of the MBNF. The MA allocation with emphasis on human or natural disturbance processes is displayed by mountain range for each alternative in the following table.

[3] Values presented for Regeneration harvest and Aspen Prescribed Fire are more certain than values presented for Wildfire & insect/disease or Total Stand Replacement. See earlier sections to review the assumptions underlying these predictions.

Table 3-32. Allocation of MAs with emphasis on human or natural processes for each mountain range by alternative.

Primary Emphasis Category	Laramie Peak	Sherman Mountains	Sierra Madre	Snowy Range
Human Processes				
A	14.0%	4.5%	21.5%	39.2%
B	13.3%	4.5%	19.9%	34.3%
C	9.2%	4.4%	18.7%	32.6%
D DEIS	7.2%	4.5%	13.1%	29.0%
D FEIS	8.0%	4.3%	13.3%	29.5%
E	4.7%	4.5%	15.3%	29.4%
F	6.0%	0.2%	9.4%	12.3%
Natural Processes				
A	2.6%	0.6%	9.5%	7.3%
B	3.3%	0.6%	11.1%	12.9%
C	7.5%	0.7%	12.3%	14.6%
D DEIS	9.4%	0.6%	17.9%	18.3%
D FEIS	8.7%	0.8%	17.7%	17.8%
E	12.0%	0.6%	15.7%	17.8%
F	10.6%	4.9%	21.6%	35.0%

Source: MBNF GIS, MA allocations

Management in the Snowy Range will focus on active management in Alternatives A, B, C, D DEIS, D FEIS and E. The allocations on the Sherman Mountain Range (Pole Mountain) vary the least among the different alternatives.

Since the forest ecosystems on each mountain range are isolated from each other, natural processes on each mountain range may occur relatively independently of other mountain ranges. However, climate cycles influence the occurrence of natural processes and may drive synchronous occurrences on several mountain ranges at the same time (e.g. wildfire could burn on more than one mountain range at the same time). Human disturbance processes are driven by economic and community values and to the extent that MA allocations allow, are expected to occur synchronously on several mountain ranges at anytime (e.g. there would be grazing and timber sales occurring on several ranges at the same time).

For alternatives with less stand replacement disturbance (Alternatives A and F), forest composition would move toward spruce-fir and away from the other three major cover types in the absence of significant natural disturbance. For alternatives where there is more stand replacement disturbance (Alternatives D DEIS, D FEIS and E), but in particular where objectives call for maintaining or restoring aspen and ponderosa pine, there would be an increase in aspen and ponderosa pine with a decrease in lodgepole pine. Based on the predicted amounts of disturbance, over the very long term, the following changes to composition might occur.

Table 3-33. Direction of predicted composition changes by alternative.

More spruce-fir		←→	More lodgepole, ponderosa pine, aspen
Alt A	Alt F	Alt B Alt C	Alt D DEIS Alt D FEIS

For forest cover types, early successional stages may be dominated by different species and different life forms (grasses and/or shrubs) than late successional stages (Selmants and D. H. Knight 2003). The same is true for non-forested cover types. Not all compositional elements will be present in all cover types at all times.

Planned timber harvest and prescribed fire may mimic natural disturbances, but they cannot replicate natural disturbances precisely.

As with the earlier analysis of disturbance, the results displayed here depend on critical assumptions regarding the influence of management on natural processes. The potential outcomes presented here represent a small set of the potential outcomes. Some outcomes that have likelihood's similar to the probability of those presented here would result in very different patterns of forest cover.

Road, trail or developed site construction results in long-term compositional and cover types changes. The following table displays current, proposed and cumulative acres in roads and trails and developed sites.

Table 3-34. Area and % of MBNF predicted to experience composition changes associated with roads, trails and developed sites under each alternative.

	Alternatives						
	A	**B**	**C**	**D DEIS**	**D FEIS**	**E**	**F**
Acres Existing Roads							
Highways	456	456	456	456	456	456	456
FSR*	5,077	5,077	5,077	5,077	5,077	5,077	5,077
UCT**	825	825	825	825	825	825	825
Acres Road Construction							
Decade 1	25	25	23	22	20	19	0
End Decade 5	124	124	116	109	99	95	0
Acres Existing Trails							
Trails	202	202	202	202	202	202	202
Acres Trail Construction							
Decade 1	51	8	85	85	102	8	8
End Decade 5	255	42	424	424	509	42	42
Acres Existing Developed Sites+							
Existing Sites	130	130	130	130	130	130	130
Acres Road Decommissioning							

	Alternatives						
	A	B	C	D DEIS	D FEIS	E	F
Decade 1	458	458	458	458	458	1,901	3,072
End Decade 5	499	492	485	485	479	1,921	3,092
Cumulative Total Acres in Roads, Trails and Developed Sites							
Decade 1	6,307	6,265	6,340	6,338	6,354	4,817	3,627
End Decade 5	6,569	6,364	6,738	6,738	6,820	4,906	3,641
Cumulative Total % of MBNF Roads, Trails and Developed Sites							
End Decade 5	0.6%	0.6%	0.6%	0.6%	0.6%	0.4%	0.3%

*Source: S-Tables. *FSR –Forest Service Road. **UCT – User-constructed travelway.[+] -- There are no proposed increases in developed sites*

The number of miles of system roads will remain relatively stable for Alternatives A, B, C, D DEIS and D FEIS. Reductions in the road system will mostly result from project-level decisions to close unneeded roads and will be similar across alternatives. Alternative F has a greater portion of the Forest allocated to management area prescriptions with emphasis on un-roaded characteristics and will show a significant decrease in the Forest transportation system. For Alternatives E, and F road decommissioning would have a higher emphasis. Decommissioning objectives will be met within the first decade. Alternatives E and F have the lowest cumulative total acres in roads, trails and developed sites.

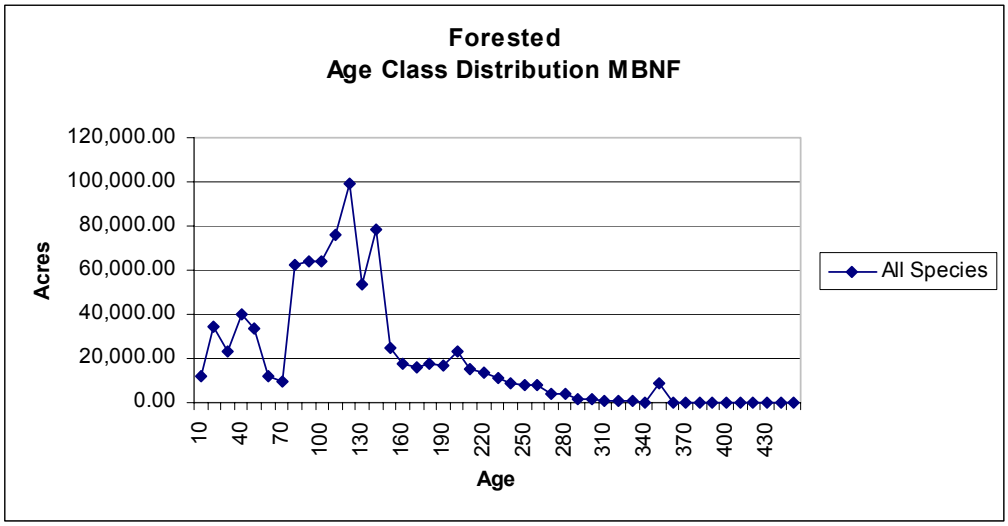
AFFECTED ENVIRONMENT
FORESTED AGE CLASSES

This section examines the potential changes in age structure of the forest as a consequence of alternative management directions. This section focuses on the most abundant forest cover types. (Habitat structure stages are used to describe the ecological function of stands -- see following section for more details. Age classes are roughly equivalent to habitat structure stages with more precision at younger ages and with more divergence at older ages. Age as a descriptor of old growth is discussed in the following section on old growth.)

An age class is a distinct aggregation of trees originating from a single natural event or regeneration activity, or grouping of trees, e.g. 10-year age class, as used in inventory or management (Adams, J.D. Hodges et al. 1994). For classification purposes, forested stands change age classes every 10 years, irregardless of the size of the trees or the function of the stand (HSS). Not all forest cover types have the same potential for longevity.

The following figure displays the existing 10-year age class distribution of the MBNF for all species.

Figure 3-1. Existing 10-year age classes for all forest species MBNF.



Source: MBNF RIS database

The following table displays a summary of acres by age class and percent of the MBNF. The 50-year age classes are specifically displayed to allow comparison with Dillon *et al.* (Dillon, Knight et al. 2003).

Table 3-35. Summary of age classes for all species as a percent of total forest cover.

0- 50 year age class	60-100 years age class	110-150 year age class	160 –200 year age class	> 200 year age classes
17%	24%	38%	11%	10%

Source: RIS database. Total Acres of forested NFS = 866,512

Table 3-36. Summary of age classes as a percent of total forest cover by major cover type.

Cover Type	0- 50 year age class	60 - 100 year age class	110-150 year age class	160 - 200 year age class	Greater than 200 year age classes
Spruce-Fir	14%	8%	35%	19%	24%
Lodgepole Pine	18%	19%	45%	10%	8%
Ponderosa Pine	7%	62%	22%	5%	4%
Aspen	28%	44%	27%	1%	<1%

Source: RIS database. Total Acres of four cover types = 843,888. % is % of cover type.

ENVIRONMENTAL CONSEQUENCES
FORESTED AGE CLASSES

The existing age class structure will change over time as disturbances replace older age classes with younger age classes and succession moves intact stands to older states. Age classes are roughly equivalent to habitat structure stages with more precision at younger ages and with more divergence at older ages. The rough equivalent of age class and habitat structure stage for all species is displayed in the following table. (More detailed information on habitat structure stage residence times for each cover type are displayed in Appendix D –Biological Diversity Report.)

Table 3-37. Age equivalents for habitat structure stages.

Habitat Structure Stage	Age Range For MBNF
1	0 - 70
2	10 - 90
3a	30 -140
3b	40 - 150
3c	60 - 200
4a	80 - 250
4b	100 - 300
4c	100 - 300
5	100 - 700

Source: FVS Modeling. See Appendix B – Biodiversity Analysis for details.

The even distribution of age classes desired on suitable lands for sustainable wood products production is different than what currently exists on these suitable lands. A uniform distribution of age classes is also different than the pattern most commonly observed under native disturbance regimes. This desired distribution of age classes, if, and when it is achieved, would be directly reflected in the distribution of habitat structure stages.

Flammability of Forests of Different Ages/Structures

Romme (Romme 1982) based on studies of fuels indicates that stand replacement fires in the subalpine forests of YNP are most likely in late successional stands. He goes on to note that several uncontrolled fires just previous to 1982 were observed to diminish in intensity and rate of spread or even to stop when they reached younger stands (<100 years old) despite weather conditions that would favor fire (Despain and R.E. Sellers 1977). These fires would have burned under conditions described by Romme (Romme 2002) as ordinary.

Weir *et al.* (Weir, Chapman et al. 1995) and Bessie and Johnson (Bessie and E. A. Johnson 1995) suggest that the flammability of subalpine forests generally increases as the forest structure changes and the forest ages. However, for subalpine forests under "extreme" burning conditions in the Canadian Rockies, past fires have not stopped when burning into younger or older stands.

Turner *et al.* (Turner, Romme et al. 1994) analyzed the difference between large fires that burned under extreme conditions and smaller fires that burned under "ordinary" conditions and demonstrated that the pattern of burn severities across the landscape is related to fire size.

Alternative A has the least stand replacement disturbance predicted from both natural disturbance and management actions (see previous table under environmental consequences – composition) and would have the most acres of older age classes over time. Alternative F has the next least amount of stand replacement disturbance. Alternatives B and C follow with an increasing amount of stand disturbance and fewer number of acres of older age classes. Alternatives D DEIS, D FEIS and E have the greatest amount of stand disturbance and would have the lowest amount of older age classes over time.

Management Area 5.15 gives priority to treating forested stands that return the area to habitat structural stages similar to those expected most commonly under natural disturbance regimes. This priority of treatment will result in fewer acres in the 50-150 year age class group. Alternative D DEIS has the greatest number of acres of MA5.15. Alternatives D FEIS, C, and E have the next greatest acres in MA5.15.

Cumulative Effects

Historic forest management activities and land uses that have changed age class structure of the Medicine Bow have included timber harvest, road construction, recreation site development, reforestation, and fire suppression. Historic forest harvesting has primarily replaced older mature forest stands with younger stands.

Wildfires and insect attacks have also changed the array of age classes. As described above, the combined effect of these factors has resulted in an age structure in lodgepole pine that may include more stands in mid-age classes than occurred most frequently on the forest, more old aspen and cottonwood stands than often occurred on the forest, and an age class distribution in spruce-fir forest similar to the pattern that frequently occurred in the past.

The amount and distribution of past management activities and those of disturbances such as stand replacement fires (except recent wildfires and insect attacks particularly on Laramie Peak) are reflected in the description of the affected environment.

Natural disturbance processes tend to create a shifting pattern of age classes over time and space as a consequence of the frequency and extent of large disturbance processes in relation to the rate of forest succession. The allocation of the MBNF to management areas for which natural processes (wildfires and insects and diseases) will be the dominant agents of vegetation change was displayed in the previous section on Composition – Natural Disturbances. Natural disturbances will be allowed to dominate under those management prescriptions where resources management such as timber harvest is not emphasized. The alternatives have

different allocations to management areas where natural disturbance processes are the dominant agent of vegetation change. From most to least allocation to these MAs, the alternatives are F, E, D DEIS, D FEIS, C, B, and A. However, natural disturbance could be the dominant force under any alternative, depending on future disturbance events such as bark beetle outbreaks, wildfire, or windthrow (blowdown). Active management is not expected to entirely prevent native disturbance processes.

Disturbances (natural or human caused) that result in high density tree stocking can create stands that stagnate and create divergences between age classes and habitat structure stages. Habitat structure stages are used to describe the ecological function of stands (see following section for more details). Where age class and habitat structure stage diverge, age class increasingly ceases to represent the ecological function of stands.

Wildfires and insect and disease occurrences are generally more common in older stands (Romme 1982), (Weir, Chapman et al. 1995), (Bessie and E. A. Johnson 1995). Alternatives with a greater amount of stand replacement from natural disturbances will exhibit the greatest change in the age class structure of the forest.

Management actions (timber harvests) specifically focus on age classes with merchantable volume (generally greater than age 50) as allowed by standards and guidelines. Age class distribution is a core concept to the long-term sustained yield of timber products (Davis 1966), (Davis and K. N. Johnson 1987). Management of lands allocated to timber production will strive to establish and maintain an even distribution of age classes on suitable lands to provide a sustainable and even-flow of wood products over time. Those alternatives with a greater amount of stand replacement from harvesting will exhibit the greatest change from human disturbance processes in the age class structure of the forest. Alternative B has the greatest amount of stand replacement from harvesting.

Those alternatives with a greatest cumulative amount of stand replacement from natural and human disturbances will exhibit the greatest change in the age class array. Alternative D FEIS has the greatest amount of total stand replacement acres. (See previous discussion under composition –cumulative effects for more details.)

AFFECTED ENVIRONMENT
HABITAT STRUCTURE STAGES

Habitat Structural Stages

Forested ecosystem elements are modified through the interplay of succession and disturbance. Succession is an orderly process of biotic community development that involves changes in species, structure, and community processes with time. It is reasonably directional and, therefore, predictable (Schwarz, Thor et al. 1976). Forest stands develop recognizable stand structures over time that can be described in terms

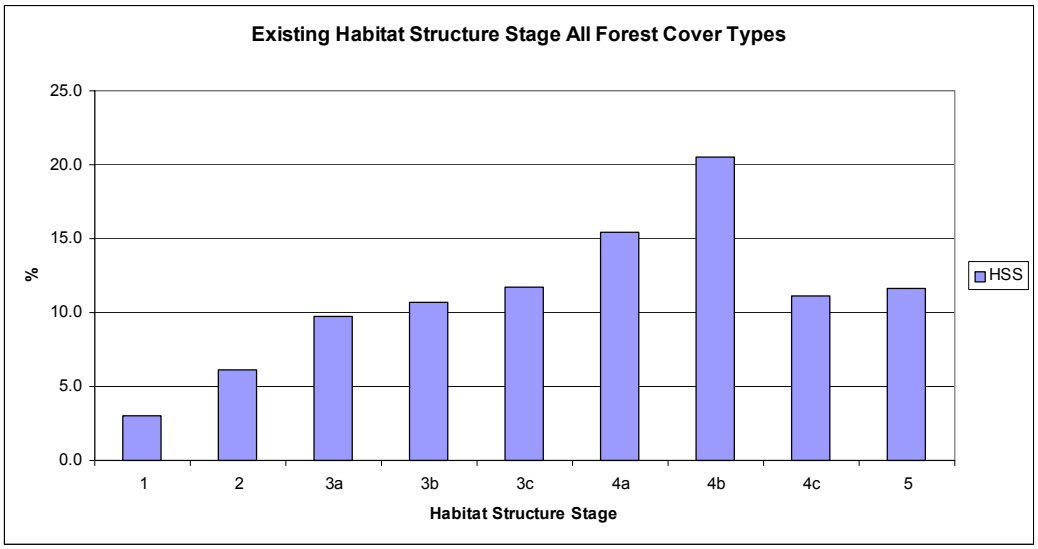
of the horizontal and vertical distribution of components including height, diameter, crown layers and stems of trees, shrubs, herbaceous understory, snags and down woody pieces (Thomas, Miller et al. 1979).

Different arrangements of these components provide different habitats for wildlife (DeVos and Mosby 1971; Edgerton and Thomas 1978). Hoover and Wills (Hoover 1987) identified combinations of these components as habitat structural stages (HSS). These definitions were incorporated into the RMRIS database (USDA Forest Service 1998b). These definitions are based upon even-aged stands. There are no provisions for multiple canopy layers or numerous age classes within the same stand of trees (Hoover 1987).

Comparing historic forest conditions with current conditions suggests that current conditions on the MBNF are similar to those expected to commonly occur under natural disturbance patterns. However, a closer look at specific environmental settings suggests some cases where current conditions may reflect a pattern that was more rare in the past. In their analysis of current conditions Dillon *et al.* (Dillon, Knight et al. 2003) suggested that the extent of older forest in environments where few fires are expected (north and leeward slopes and valley bottoms) at high-elevation (>7,800 feet) is less than expected under natural disturbance patterns. Also, in high elevation forests, ecosystem characteristics that depend on periods of forest development longer than 140 years may be lost in some areas where harvest and fire have influenced extensive areas in the past 1.5 centuries (Dillon, Knight et al. 2003).

The following figure displays the existing habitat structure stages for the forested portion of the MBNF.

Figure 3-2. Existing habitat structure stage distribution (% of forested acres) for the MBNF.



Source: RMRIS. 1-grass-forb, 2-shrub-seedling, 3a-low density sapling-pole, 3b medium density sapling-pole, 3c high density sapling-pole, 4a-low density mature, 4b-medium density mature, 4c high density mature, 5-old growth.

Across the MBNF, approximately 9% of the forested area is in a grass or seedling stage (HSSs 1 and 2); 32% is in a sapling-pole stage (HSS 3a, 3b, and 3c); 47% is in a mature stage (HSS 4a, 4b, and 4c); and 12% is classified as old growth (HSS 5). There is more complete discussion of the classification of old growth in the following section.

The four mountain ranges exhibit a wide variation in distribution of habitat structure stages. The pattern for each mountain range reflects the different history of natural and human disturbances to forest stands. (See Appendix D for data on the four sections of the Forest.)

Classifying non-forest stands in terms of horizontal and vertical cover is more difficult than classifying forest structure (Thomas, Miller et al. 1979). Non-forested vegetation on the MBNF has been assigned a habitat structure stage based the presence and size of any trees on the site or is classified as early successional stages (grass/forb, shrub/seedling).

The following table displays existing acres of each habitat structural stage for both the forested and non-forested stands of the MBNF.

Table 3-38. Habitat structure stages by cover type.

	Acres in Habitat Structure Stage									
Cover Type	**0**	**1**	**2**	**3a**	**3b**	**3c**	**4a**	**4b**	**4c**	**5**
Aspen	0	3,168	1,896	15,809	17,245	8,003	14,822	13,427	5,009	4,307
Cottonwood	0	0	0	84	25	41	122	128	7	0
Douglas-fir	0	131	0	232	359	1,403	2,407	2,678	1,525	1,561
Gambel oak (tree)	0	0	0	0	43	0	0	0	0	0
Limber pine	0	54	270	5,870	759	200	2,896	1,160	177	246
Lodgepole pine	0	13,561	41,645	44,307	64,861	87,408	39,758	86,858	54,329	39,849
Ponderosa pine	0	4,284	446	2,685	2,985	976	43,250	32,197	7,046	2,080
Spruce/fir	0	4,766	8,899	15,260	6,270	3,854	30,579	41,537	28,037	52,493
Juniper	0	0	0	154	0	0	89	0	0	0
Total Forested	**0**	**25,964**	**53,157**	**84,401**	**92,546**	**101,885**	**133,924**	**177,985**	**96,132**	**100,537**
HSS as % of Total Forested	**0**	**3.0%**	**6.1%**	**9.7%**	**10.7%**	**11.8%**	**15.5%**	**20.5%**	**11.1%**	**11.6%**
HSS as % MBNF for Forested		**2.4%**	**4.9%**	**7.8%**	**8.5%**	**9.4%**	**12.3%**	**16.4%**	**8.9%**	**9.3%**
Total Non-forested	**10,593**	**76,551**	**130,537**	**2**	**2**	**72**	**250**	**35**	**36**	**4**
HSS as %MBNF for Non-Forested	**1.0%**	**7.1%**	**12.0%**	**<0.1%**	**<0.1%**	**<0.1%**	**<0.1%**	**<0.1%**	**<0.1%**	**<0.1%**
Total	**10,593**	**102,515**	**183,693**	**84,403**	**92,549**	**101,958**	**134,174**	**178,020**	**96,168**	**100,541**
HSS as % of Total	**1.0%**	**9.4%**	**16.9%**	**7.8%**	**8.5%**	**9.4%**	**12.4%**	**16.4%**	**8.9%**	**9.3%**

Source: MBNF RMRIS database and MBNF GIS

0 –non-vegetated, 1-grass-forb, 2-shrub-seedling, 3a-low density sapling-pole, 3b medium density sapling-pole, 3c high density sapling-pole, 4a-low density mature, 4b-medium density mature, 4c high density mature, 5-old growth.

Although alterations in structure have been more apparent in ponderosa pine than in other forest cover types, the majority of ponderosa pine on the MBNF is classified as mature, low density (HSS 4a). Very recent wildfires and continuing insect activity have reduced the total mature ponderosa pine and reduced the density of some stands from what is currently displayed in the RIS database.

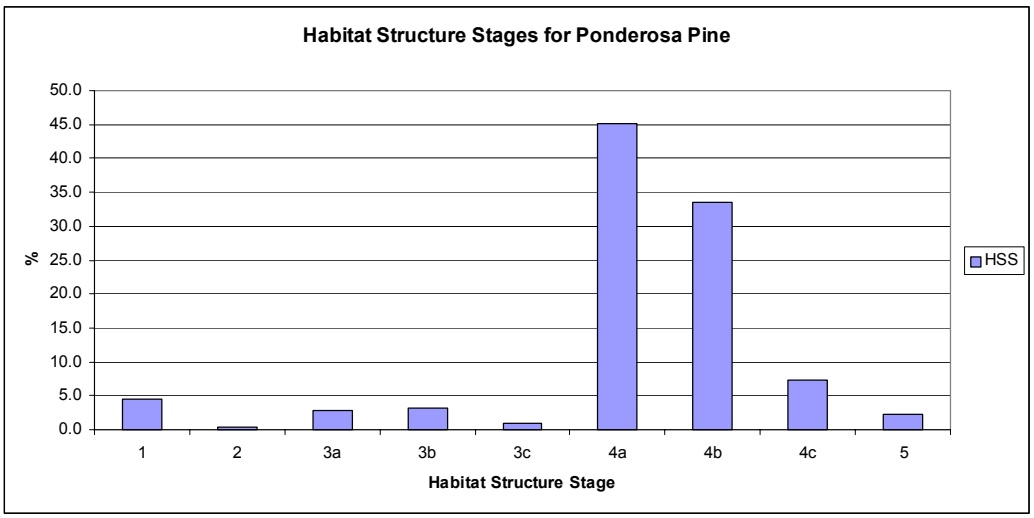
The Laramie Peak Range has 89% of the ponderosa pine that occurs on the MBNF. On the Laramie Peak Range, in ponderosa pine, an extensive mountain pine beetle epidemic occurred between 1988 and 1994. The Cold Spring Ecosystem Management Project (USDA FS Douglas Ranger District 1998) stated that there was extensive tree mortality on 7,500 acres due to that epidemic. The changes from this epidemic are reflected in the RIS data.

Also on the Laramie Peak Range, there are 16,194 acres of ponderosa pine within the perimeter of recent fires. Although the stand structure changes from these fires is not reflected in the RIS database, a sensitivity analysis of possible change verified that HSS distribution patterns remain nearly the same as distribution pattern derived from the RIS database. HSS 1 and HSS 4a would be expected to see slight increases. HSS 3b, HSS 3c, HSS 4b, HSS 4c and HSS 5 would be expected to slight decreases.

Some changes in stand structure may be expected in the Ponderosa pine system due to fire suppression. However Dillon *et al*. (Dillon, Knight et al. 2003) indicate that ponderosa pine in this area is subject to several different fire regimes and stands with dense multi-story structure may have occurred frequently under native fire regimes. Shinneman and Baker (Shinneman and W.L. Baker 1997) indicate that ponderosa pine forest can be subject to non-equilibrium dynamics and exhibit both open canopy structures and dense canopies under different fire regimes. Brown and Shepperd (Brown and W.D. Shepperd 2001) and Brown *et al.* (Brown, Ryan et al. 2000) discuss historic patterns of fire frequency for the Ashenfelder Basin area of the Laramie Peak Range and suggest that longer fire free intervals may have been common in this range than other areas studies within the Rocky Mountain region. The Biological Diversity Report (Appendix D) describes alterations in ponderosa pine communities on the MBNF.

The following figure displays the existing habitat structure stages for ponderosa pine of the MBNF.

Figure 3-3. Existing habitat structure stage distribution for ponderosa pine forestwide.



Source: RMRIS. 1-grass-forb, 2-shrub-seedling, 3a-low density sapling-pole, 3b medium density sapling-pole, 3c high density sapling-pole, 4a-low density mature, 4b-medium density mature, 4c high density mature, 5-old growth.

ENVIRONMENTAL CONSEQUENCES
HABITAT STRUCTURE STAGES

The recognizable stand structures that forest stands develop over time (horizontal and vertical distribution of components including height, diameter, crown layers and stems of trees, shrubs, herbaceous understory, snags and down woody pieces) (Thomas, Miller et al. 1979) will change over time as disturbances (human and natural) replace later structural stages with earlier structural stages and succession moves intact stands to older states.

Through the processes of growth and succession, most forest stands develop from earlier habitat structural stages to later stages unless succession is interrupted by natural or human-caused disturbance. However, some stands may never progress beyond HSS 3c (stagnate) while others may remain as HSS 4c for extended periods without ever developing the characteristics of HSS 5, old growth.

The occurrence of different habitat structure stages is not evenly distributed among the various management areas. The management area scenario may influence the creation of early HSS from later HSS or may favor progression of early stages to later stages.

Management scenarios are similar for many management areas. To facilitate the understanding of the consequences of the occurrence of habitat structure stages

within different management scenarios, management areas with similar management scenarios (emphasis) have been grouped by the dominant vegetation change process (human or natural).

The following table displays the current occurrence of habitat structure stages within management areas with emphasis on each of the two processes categories for each alternative.

Table 3-39. Existing percent of MBNF in each habitat structure stage by allocation to mas with dominant process type.

	Alternatives						
HSS	**A**	**B**	**C**	**D DEIS**	**D FEIS**	**E**	**F**
Human Processes							
0	0.6%	0.5%	0.5%	0.3%	0.3%	0.3%	0.2%
1	7.3%	6.0%	6.0%	5.5%	5.6%	5.4%	2.1%
2	15.6%	12.2%	12.0%	9.5%	9.7%	10.3%	5.2%
3a	6.2%	6.5%	5.6%	4.9%	4.9%	4.8%	3.1%
3b	6.5%	6.6%	5.4%	4.4%	4.4%	4.3%	2.5%
3c	7.7%	7.2%	5.9%	5.2%	5.3%	4.8%	2.6%
4a	8.5%	7.9%	6.7%	5.5%	5.8%	5.6	3.1%
4b	12.9%	12.4%	10.6%	8.8%	9.0%	8.6%	4.4%
4c	7.0%	6.6%	5.8%	4.7%	4.9%	4.6%	2.4%
5	7.6%	6.3%	6.4%	5.0%	5.1%	5.2%	2.1%
Total	79.9%	72.1%	65.0%	53.7%	55.0%	53.8%	27.8%
Natural Processes							
0	0.3%	0.5%	0.5%	0.7%	0.6%	0.7%	0.7%
1	1.8%	3.1%	3.2%	3.7%	3.5%	3.7%	7.0%
2	1.7%	5.1%	5.3%	7.7%	7.5%	7.0%	12.1%
3a	1.5%	1.2%	2.2%	2.8%	2.8%	2.9%	4.6%
3b	2.0%	2.0%	3.1%	4.1%	4.1%	4.2%	6.0%
3c	1.8%	2.3%	3.6%	4.3%	4.2%	4.6%	6.8%
4a	3.0%	3.6%	4.8%	6.0%	5.7%	5.9%	8.4%
4b	3.8%	4.4%	6.1%	7.9%	7.7%	8.2%	12.4%
4c	2.4%	2.9%	3.6%	4.8%	4.5%	4.9%	7.0%
5	1.7%	3.0%	2.8%	4.3%	4.2%	4.1%	7.2%
Total	20.1	27.9	35.0%	46.3%	45.0%	46.2%	72.2%

Source: RIS database, MA allocations.

The management area allocation of forested lands determines if and what type of management activities may change habitat structure stage distributions. The alternatives with the greatest allocation to MAs that emphasize human processes are, in order, Alternatives B, A, C, D DEIS and D FEIS, E, and F. (See discussion of disturbance processes in the previous Composition section.)

Management of lands allocated to timber production will strive to establish and maintain a regulated forest (even distribution of age classes) on suitable lands to provide a sustainable and even-flow of wood products over time (See timber section for details). Age classes are roughly equivalent to habitat structure stages with more

precision at younger ages and with more divergence at older ages. The rough equivalent of age class and habitat structure stage for all species was displayed in the previous discussion of forested age classes.

Forest stands are harvested at or beyond rotation age. Rotation age is generally required to be greater than the age at which annual growth decreases (see Forest Plan Chapter 1 for exceptions and MA 5.15 standards). Trees can be harvested at ages greater than rotation ages to maintain desired wildlife habitat (old growth and/or old trees). In addition, standards and guidelines require the retention of old growth and potential for recruitment of old growth. It is expected that unless "extreme" conditions for fire or insects prevail, the desired condition (a well-distributed system of stands managed as old growth representing at least 15% to 25% of forested habitat providing key habitat conditions needed for TES and non-TES wildlife species) will be maintained and/or achieved within the life of the plan (10-15 years).

Since wildfires and insects are both influenced by stand structure and drought, and since many of the existing forest stands originated between 100-150 years ago, the potential exists for large areas of the forest experience extensive tree mortality from natural disturbances when high risk climatic conditions occur (Brown, Kaufmann et al. 1999), (Romme and Knight 1981), (Veblen 2000). Under some scenarios, the arrangement of late successional habitat may be limited to fire refugia (areas characteristically resistant to fire such as north slopes and riparian areas (Dillon, Knight et al. 2003) or areas particularly resistant to insects at particular times in the future.

The following table displays the current amount of different cover types within the land base suitable for timber production.

Table 3-40. Acres suitable for timber production by cover type.

	Alternatives						
Cover Type	**A**	**B**	**C**	**D DEIS**	**D FEIS**	**E**	**F**
Aspen	8	0	0	0	0	0	0
% cover type	0%	0%	0%	0%	0%	0%	0%
Douglas-fir	1,935	1,324	593	557	550	235	505
% cover type	19%	13%	6%	5%	5%	2%	5%
Limber Pine	3	3	3	3	3	3	3
% cover type	0%	0%	0%	0%	0%	0%	0%
Lodgepole Pine	332,283	295,729	264,990	237,387	236,756	201,582	119,273
% cover type	70%	63%	56%	50%	50%	43%	25%
Ponderosa Pine	22,889	10,990	9,964	10,524	83	8,330	14,185
% cover type	24%	11%	10%	11%	1%	9%	15%
Spruce-Fir	117,709	99,757	95,111	82,088	83,443	80,006	38,488
% cover type	61%	52%	49%	43%	44%	42%	20%
Total	**474,827**	**407,802**	**370,660**	**330,559**	**320,835**	**290,156**	**172,453**

Source: RMRIS, MBNF GIS.

Timber harvest specifically focuses on those habitat structure stages that have merchantable volume (HSS 3c, 4a, 4b, 4c and 5) as allowed by standards and guidelines. Similarly, natural disturbance processes are generally more common in HSS 3c, 4a, 4b, 4c and 5. Romme (Romme 1982), based on studies of fuels, indicates that stand replacement fires in the subalpine forests of YNP are most likely in late successional stands. He goes on to note that several uncontrolled fires just previous to 1982 were observed to diminish in intensity and rate of spread or even to stop when they reached younger stands (<100 years old) despite weather conditions that would favor fire (Despain and R.E. Sellers 1977). These fires would have burned under conditions described by Romme (Romme 2002) as ordinary. Weir *et al.* (Weir, Chapman et al. 1995) and Bessie and Johnson (Bessie and E. A. Johnson 1995) discuss how, although generally acknowledged that the flammability of forests increases as the forest structure changes and the forest ages, for subalpine forests under "extreme" conditions in the Canadian Rockies, past fires have not stopped when burning into younger or older stands.

Based upon concepts from Romme (Romme 2002) if "extreme" conditions were to occur, or a series of years with "ordinary" conditions but relative high fire occurrence, along with planned harvesting, HSS 3c, 4a, 4b, and 4c could become rare on landscape with respect to HRV.

None of the alternatives include large amounts of ponderosa pine habitat within the land base suitable for timber production. Changes to existing structure of ponderosa pine habitat will be accomplished primarily through restoration projects. Management Area 5.15 emphasizes treating forested stands that return the area to habitat structural stages similar to HRV. The following table displays the allocation to MA 5.15 by alternative and the amount of wildlife habitat restoration estimated to occur by alternative.

Table 3-41. Acres of MA 5.15 and Acres of Wildlife Habitat Restoration.

	Alternatives						
	A	**B**	**C**	**D-DEIS**	**D-FEIS**	**E**	**F**
MA5.15 acres	0	125,937	231,656	303,981	281,835	256,826	0
Acres Wildlife Habitat Restoration Decade 1	1200	1080	1235	1235	1235	1620	1620

Source: S-Tables, MBNF GIS.

Alternative D DEIS has the greatest number of acres of MA 5.15. Alternatives D FEIS, C, and E have the next greatest acres in MA 5.15. Alternatives E and F have the largest amount of planned wildlife habitat restoration

Cumulative Effects

Historic forest management activities and land uses that have changed structure stages have included timber harvest, road construction, recreation site development, reforestation, and fire suppression. Historic forest harvesting has primarily replaced older mature forest stands with younger stands and provided for the existence of early seral structure stages similar to natural succession. Wildfires and insect attacks can also change cover types. When there is extensive mortality from either of these, early seral vegetation will occupy the site.

The amount and distribution of past management activities and those of disturbances such as stand replacement fires (except recent wildfires and insect attacks particularly on Laramie Peak) are reflected in the description of the affected environment.

Not all habitat structure stages will be present in all locations at all times but all should have opportunity to occur at some time at some place on the landscape. The sequential development of forest stands and changes from early seral cover types to later successional cover types would occur over hundreds of years following management actions or natural disturbances.

Projecting changes in vegetation structure and composition over time is an important part of predicting the environmental consequences of changes in the occurrence and distribution of ecosystem aggregates and in the maintenance of biological diversity from management area allocations.

Using values for harvest, prescribed fire, wildfire and insect and diseases predicted in the DEIS for each alternative a sensitivity analysis was conducted to determine if changes in vegetation structure over time would create unsustainable conditions. Succession models covering ten to twenty decades were formulated for each cover type and each habitat structure stage each alternative. Successional pathways were modeled after Stahelin (1943) and Moir (1992). Residence time in each structural stage and basic successional pathways were constructed based upon procedures developed by Stage *et al.* (1996) and Stage (1997). Based upon successional stage modeling, over the life of the plan (10-15 years) there will be a decrease in the amount of habitat structure stages 3c-4c for all alternatives as these are the habitat structure stages most affected by both human disturbance and natural disturbance processes. Alternatives B and D FEIS have the greatest amount of stand disturbance and are predicted to support the least amount of old forest over the long-term.

Alternatives with low amounts of natural disturbances (Alternatives A and B) will have a decrease in HSS 3a and 4a as growth processes cause these stands to become denser. Alternatives with higher amounts of natural disturbance processes (Alternatives F, E, D DEIS, D FEIS and C) will maintain current amounts or have an increase in HSS 3a and 4a as the lower intensity wildfires and lower intensity insect and disease occurrences create or maintain low density stand stocking.

As discussed earlier, these predictions have a high degree of uncertainty and the results provide a picture of one potential outcome. If "extreme" climatic conditions such as described by Romme (Romme 2002) are experienced over the next 50 years, then amounts of wildfire predicted could be similar to that experienced in YNP in 1988 when 54% of the sub-alpine forest burned. It is expected that unless "extreme" conditions for fire or insects prevail, the desired condition (a well-distributed system of stands managed as old growth representing at least 15% to 25% of forested habitat providing key habitat conditions needed for TES and non-TES wildlife species) will be maintained and/or achieved within the life of the plan (10-15 years).

There are additional cumulative effects that affect structure stages that are discussed in the following section on land uses.

AFFECTED ENVIRONMENT
NON-FOREST HABITAT STRUCTURE STAGES

The structure of climax grass and/or forbs lands (in contrast to the grass, forb and/or shrub stages of forestlands) is relatively constant throughout different successional stages (Knight 1994). Most shrubs have average life spans of 30-60 years and develop from grass-forb early successional stages. Different shrub communities provide different types of structure and when intermixed across the landscape provide habitat diversity (Knight 1994).

Dillon *et al.* (Dillon, Knight et al. 2003) noted the following: some meadows, grasslands and shrublands were grazed more heavily in the early 1900s than previously, but current management practices appear to be creating conditions that are similar to those that would have been common under natural disturbance regimes. In some instances, changing climatic or edaphic conditions may now allow tree seedling establishment on areas that were historically occupied by meadows.

Habitat structure stages have not been defined for non-forest communities, however these communities do exhibit structural changes over time (see Vegetation – Rangelands for more information on non-forest vegetation).

ENVIRONMENTAL CONSEQUENCES
NON-FOREST HABITAT STRUCTURE STAGES

Prescribed burning and grazing in non-forest vegetation are the primary land uses that will change non-forest structure stages. Older successional stages and decadent shrub fields are the non-forest cover type most often treated with prescribed burning. The previous table in Composition (Prescribed Burning Grass and Shrub Lands) displayed the estimated amount of prescribed burning in non-forest vegetation by alternative. By decade 5, a portion of the acres may have been treated two or more times. Therefore, structural changes may occur on the same acres several times over

a 50-year period. In shrub-dominated sites, composition and structure following fire will depend on the age and species of shrubs prior to the burn, time of year of burning, burn intensity, and weather conditions in the years immediately following the burn. Both riparian and upland non-forest vegetation would be treated by prescribed fire. The extent and intensity of prescribed burning in riparian areas would be limited by riparian standards and guidelines and other standards and guidelines for TES species.

Ecological restoration treatments could remove trees from natural meadows where they have encroached. Ecological restoration treatments are a focus of MA 5.15. The extent and intensity of this type of treatment would be limited by riparian standards and guidelines and other standards and guidelines for TES species. This type of treatment is expected to comprise a low number of acres of treatment over the life of the plan and would treat only a small percentage of the meadow acres.

Grazing under standards and guidelines, tends to maintain current structural stages for longer periods of time (changes structural stage residence times) but does not change structural stages in the manner that prescribed fire would. Grazing in willow habitat has been shown to alter structure (Knopf, J. A. Sedgwick et al. 1988) however, these structural alterations would still rarely be intensive and extensive enough to change structural stage classification. Alternative F with the lowest amounts of grazing would have that greatest amount and extent of older structural stages in non-forest vegetation.

Cumulative Effects

Since the mid 1800s, domestic livestock have grazed on the MBNF. In addition, wildlife grazing occurs throughout the MBNF. Fire and insects also have influenced the structure of non-forest vegetation. The effects of this past grazing, fire, and other disturbances on non-forest habitat structure are represented in the current cover type and structure stage presented in the affected environment. The effects of the alternatives are summarized in the section on Rangeland vegetation. Overall, however, proposed management is likely to result, in 50 years, in proportional representation of various non-forest vegetation structures very similar to that currently present.

AFFECTED ENVIRONMENT
OLD GROWTH

Old growth forests are ecosystems distinguished by relatively complex physiognomy, horizontal heterogeneity, relatively large old trees and related structural attributes (Thomas, Ruggiero et al. 1988; Hayward 1991). Old growth encompasses the later stages of stand development that typically differ from earlier stages in a variety of characteristics which may include tree size, accumulations of large dead woody material, number of tree top layers, species composition and

ecosystem function. It can require 80-200 years for forest stands within different cover types to develop the characteristics of old growth (Mehl 1992).

Since the 1985 Plan was approved, the definition of old growth has evolved. Forests in the Rocky Mountain Region have used generalized descriptions outlined by Mehl (Mehl 1992) to describe and inventory old growth after 1992 (Estill 1992). See Appendix D for a full discussion.

The current amount and condition of old growth on the MBNF is difficult to estimate because of changed old growth criteria between 1985 and the present. The MBNF does not have an inventory of old growth forest habitat based on the Mehl (Mehl 1992) descriptions, however the existing data can be used to provide an evaluation of existing old growth and effects to old growth. Baker (Baker 1994) used HSS 4a, HSS 4b, HSS 4c or HSS 5, a scorecard value greater than 37 or a year of origin prior to 1800 to analyze old growth and fragmentation.

There are three sources of information on old growth for the MBNF. They are discussed in detail in Appendix D. The information from these sources is stored in the RMRIS database.

1. Habitat structure stage –available for all forested stands;
2. Old growth scorecards – primarily available from project level inventory;
3. Stand age category of the RIS database – available where stand examinations have been completed.

Some of the forested acres are included in more than one, and sometimes all three of the different methods of estimating old growth. Based on the information from the three approaches to identifying old forest stands, between 10% and 60% of the forested acres on the MBNF represent old-growth forest as described by Mehl (Mehl 1992).

Late successional forest stands have some of the characteristics of old growth and provide many of the functions of old growth. Late successional forests can be considered to be represented by habitat structure stages 4 through 5 and/or older age classes.

Cover types of spruce/fir, lodgepole pine, limber pine, ponderosa pine, Douglas-fir, cottonwood, aspen and gambel oak were evaluated for late successional/old growth potential using all the available data, from the RIS database. The description of how the data were processed to identify those acres that have indicators of late successional forest and/or old growth is shown in the following table.

Table 3-42. Description of Available indicators of late sucessional and/or old growth forest.

HSS	Old Growth Score Card	Age from Average of Trees > 5" dbh	Available Indicator Level
4A-4C	Not available or < 38	Not available or < Mehl*	1
5	Not available or <38	Not available < Mehl*	2
4A-5	Not available or < 38	≥Mehl* definition	3
4A-5	≥38	Not Available or < Mehl* definition	4
4A-5	≥38	≥Mehl definition	5
<4A	Not available	Not available	Not Late Successional/Old Growth
<4A	Not available or < 38	≥Mehl* Definition	Not Late Successional/Old Growth
<4A	≥38	Not available or <Mehl* definition	4
<4A	≥38	≥Mehl* definition	5

**From (Mehl 1992); For species not covered by Mehl (Mehl 1992) from (Wier 1998), (Thorin 1999).*

The following table displays the summary of acres of late successional and old growth by available indicator level, for each mountain range.

Table 3-43. Acres of late sucessional and old growth forest by level of available indicators.

Mountain Range	Total Acres Forest Cover Types	1	2	3	4	5	Total Acres 1-5
Laramie Peak	163,587	66,456	142	4,269	12,584	1,664	85,114
Sherman Mtn	20,051	9,452	82	396	0	0	9,930
Sierra Madre	267,163	80,904	6,677	16,887	68,748	16,651	189,866
Snowy Range	410,229	67,572	8,872	47,298	62,978	42,692	229,411
Grand Total	**866,532**	**225,731**	**15,773**	**68,919**	**144,309**	**61,006**	**515,738**

There are **403,967** acres out of the total of **515,738** (78.3%) that have field verification of habitat structure stage or old growth score card rating greater than 20 (= Mehl (Mehl 1992) definition). The remaining 111,771 acres have only photo interpretation data available for determination of habitat structure stage. There are 575,831 acres over 100 years of age and 110,883 acres over 200 years of age.

The following map displays the location of Late Successional /Old Growth for the MBNF. The map also illustrates the variety of patch sizes and shapes and the distribution of old-growth forest (There are larger maps in Appendix D).

Although the map indicates that the Snowy Range and Sierra Madre Mountains appear to have the majority of the old growth while the Laramie Mountains have very little, and Sherman (Pole) Mountain appears to have almost none, this is more reflective of inventory status than of old growth status. The maps do not display the cover type of the polygons. The major cover-types are not evenly distributed across the four mountain ranges that make up the forest. The western Sierra Madre Range has a high concentration of aspen and Laramie Peak Range has a high concentration of ponderosa pine. (See previous discussion on composition by mountain range for details.)

Map 3-4. Late sucessional/old growth by level of available indicators.

ENVIRONMENTAL CONSEQUENCES
OLD GROWTH

Plan alternatives address the challenge of retaining old growth forest on the MBNF by requiring evaluation of old-growth distribution and abundance during project planning. Plan alternatives specify retention of old growth. Standards for mapping and managing old growth forest differ across the four major cover types (see following table). These standards were derived from information in Losensky (Losensky 1994) and Romme (Romme 2002). The scale of retention is by mountain range. Further direction states that old growth must be well distributed across the landscape. The standard also allows for substitute old growth if there is a limited availability of stands that meet Mehl (Mehl 1992) old growth descriptions. In addition, all of the alternatives include an objective to conduct an old growth inventory within 3 years of plan approval.

Table 3-44. Minimum standards for retention of old growth by cover type and alternative.

	Alternatives						
Cover Type	**A**	**B**	**C**	**D-DEIS**	**D-FEIS**	**E**	**F**
Spruce/Fir	10%	20%	20%	20%	25%	20%	10%
Lodgepole	10%	10%	10%	10%	15%	10%	10%
Ponderosa Pine	10%	25%	25%	25%	25%	25%	10%
Aspen	10%	10%	10%	10%	20%	10%	10%

*Source: Plan Chapter 1. *These do not represent a goal to manage toward, but rather minimum levels. Actual old growth mapped and managed will vary across the Forest but will not fall below these levels.*

The consideration of old growth habitat will also be incorporated into the Fire Plan, which will guide fire suppression responses. Old growth and recruitment old growth will be managed to maintain desired composition and structure and to reduce the risks of loss. Operations (such as timber harvest and other vegetative treatments) will be conducted to avoid creation of fragments of insufficient area or inappropriate spatial pattern to serve the habitat needs of species or communities at risk.

Implementing Alternatives A or F could result in retaining approximately 85,000 acres of old growth for the four cover types. Implementing Alternatives B, C, D DEIS and E would result in retaining a minimum of approximately 120,000 acres of old growth and D FEIS would result in retaining a minimum of approximately 150,000 acres of old growth.

The total amount and distribution of old growth retained on the landscape is dependent upon more than the minimum standards established for each alternative. There are 59,895 acres of HSS 5 within Management Areas that emphasize

renewable resources management and 40,643 acres of HSS 5 within management areas that do not emphasize renewable resources management.

For old growth identified by a combination of all three methods, the following percent of the total identified old growth is located on suitable lands included in timber production management areas (Snowy Range and Sierra Madre Mountains) by alternative: Alternative A 52%, Alternative B 54%, Alternative C 50%, Alternative D DEIS 41%, Alternative D FEIS 41% Alternative E 38%, Alternative F 18%. There are suitable and productive timberlands that are not included in timber production management areas that contribute to total old growth on the Forest. When identifying and mapping old growth to ensure that adequate amounts and distribution are maintained across the forest, it is quite possible to develop a well distributed old growth network on the Sierra Madre Mountains by considering lands not included in timber production management areas.

Alternative F allocates the greatest amount of land to management areas where natural processes are the primary agent of stand and landscape disturbance. In the short term, this will result in an increase in late successional habitat as existing stands age. In the longer term (50-200 years), as natural processes operate with little restriction, the availability of different habitat structure stages will fluctuate over time and space. Since both wildfires and insects are influenced by stand structure and drought, the potential exists for large areas of the forest experience natural disturbance when high risk conditions occur. Under extreme climate conditions over an extended period the arrangement of late successional habitat may be limited to fire refugia (areas characteristically resistant to fire such as north slopes and riparian areas (Dillon, Knight et al. 2003) or areas particularly resistant to insects at particular times in the future. Based upon concepts from Romme (Romme 2002) if "extreme" conditions were to occur, or a series of years with "ordinary" conditions but relative high fire occurrence, HSS 5, could become rare on the landscape relative to common patterns under natural disturbance regimes.

Aspen sites, may never develop characteristics of aspen old growth but may instead eventually develop characteristics of lodgepole or spruce/fir old growth where aspen is not climax but is successional to lodgepole pine and/or spruce/fir cover types (52% of the aspen cover type).

Alternative F uses cores and corridors where management is minimized. Therefore, the amount of old growth may exceed other alternatives even though the old growth standards for Alternative F are lower than those for Alternatives B-E. Alternative A sets minimums at 10% for all cover types so this alternative may not incorporate new knowledge about historical conditions. Alternatives B-E will all, at the least, meet the minimum standards, which vary by cover type, but these alternatives also contain opportunities for additional old growth to develop where natural and human disturbances do not create earlier structure stages from disturbance of older structure stages.

The pattern and distribution of old growth habitat is discussed further in the following section on fragmentation.

Cumulative Effects

Old growth development takes 80-200 years. Historic timber harvest has reduced the amount of old growth and changed the pattern and distribution from historic occurrences. Concurrently, stands have aged and developed old growth conditions due to stand-replacement natural disturbances occurring infrequently.

Proposed management actions that eliminate old growth would also influence the distribution and pattern of old growth for long periods. Alternatives proposed in the current plan vary in the extent to which they active management or timber harvest will reduce the abundance and distribution of old growth. Alternatives B, D DEIS and D FEIS have the highest predicted amounts of regeneration harvest, some of which may occur in old growth. (See previous discussion on composition changes from human disturbance for details on the relative amounts of human disturbances predicted for each alternative.) Actions necessary to maintain or restore old growth composition and structure, or actions necessary to reduce risks to loss of old growth composition and structure are permitted within old growth forests.

Areas retained for old growth or as recruitment old growth are not available for timber harvest for many years. This is a long-term commitment of resources.

Insect epidemics in progress on the Routt National Forest to the south may spread to the MBNF and change stand structure within old growth. Wildfires ignited within or outside of old growth stands can injure and/or kill trees, change stand structure and remove old growth attributes.

Vegetation and/or fuel management around old growth may provide some reduced risk from catastrophic fire. Vegetation management that changes canopy density or changes older structural stages to earlier structural stages may increase the risk of blowdown within the old growth. Either vegetation management around old growth and/or catastrophic fire may change both the amount and the distribution of managed old growth. However, because managed old growth does not represent a management area allocation, project level analyses can quickly re-map these areas using different stands to ensure that adequate amounts of old growth occur on the Forest.

AFFECTED ENVIRONMENT
FRAGMENTATION

Forest fragmentation is described as a broad-scale process in which forest tracts are progressively subdivided into smaller, geometrically more complex (initially but not necessarily ultimately), and more isolated forest fragments as a result of both natural processes and human land use activities (Harris 1984). Fragmentation is also

described as a disruption in the continuity of predominantly natural landscapes (Buskirk, W.H. Romme et al. 2000). Much of the research on fragmentation has focused on changes caused by agriculture or urban development, which are long-term or permanent in nature (Wiens J.A. 1995) Furthermore, this research has concentrated on landscapes where focal habitat patches are isolated in a matrix of disturbed lands. This pattern contrasts with the pattern most often observed as a consequence of management in many Rocky Mountain Forests (Wiens J.A. 1995). In contrast, most habitat alterations from timber harvests, other forest management activities are relatively temporary (Knight and Reiners 2000). Natural disturbance processes can result in short term and/or long term changes (Knight 1994).

Patch size and isolation, road effects and edge/interior are key indicators of fragmentation (Shinneman and W.L. Baker 2000). Several reports provide information on the HRV of patch sizes on the MBNF and the implications of those patch size changes:

- Patch size is decreasing and there is less interior forest (Dillon, Knight et al. 2003).
- Patches are more uniform in size (Dillon, Knight et al. 2003).
- The amount of high-contrast edge is increased in high-elevation forest because of roads and clearcutting (Dillon, Knight et al. 2003).
- Stands have been fragmented by roads, trails, and clearcuts (Cerovski, Gorges et al. 2001).
- Fire suppression has altered the structure and the patchiness of sagebrush and of associated species of plants, insects, and birds (Paige and Ritter 1999).
- The amount of timber harvesting is a significant source of variation in landscape structure across the MBNF (Baker 1994), (Tinker and Baker 2000).

For each cover type on the MBNF, similar habitat structure stages were grouped into habitat functional types (HFT). These groupings were made such that any stand within the group would not modify the ecological functions of any of the other stands within the group. The largest patches by mountain range are 11,880 acres of Spruce-fir on the Snowy Range; 8,422 of Spruce-fir on the Sierra Madre, 1,146 acres of Ponderosa pine on Laramie Peak Range and 248 acres of Lodgepole pine on Sherman (Pole) Mountain. These largest patches were most likely the result of wildfire (whether human ignited or natural ignition is unknown). The size of the largest patches is consistent with large patch sizes for Yellowstone. Turner *et al.* (1997) and Turner *et al.* (1994) document large patches of about 9,000 acres (3600 ha) that were created by the Yellowstone Fires of 1988.

The existing distribution of patch sizes is displayed in the following two figures. These figures are based on all cover types forestwide. Summaries by species and by mountain range are found in Appendix D.

The distribution of patch sizes illustrated in the following figure is typical of the Rocky Mountain Region (USDA FS Routt National Forest 1998), (USDA FS White River National Forest 2002). There is a greater percentage of small patches, but they comprise a relatively small amount of acres. Conversely, there are very few large patches, but they comprise the most acres. Summaries of patch size distribution by species and mountain range are found in Appendix D.

Figure 3-4. Patch size distribution for all cover types forestwide on the MBNF without consideration of roads.

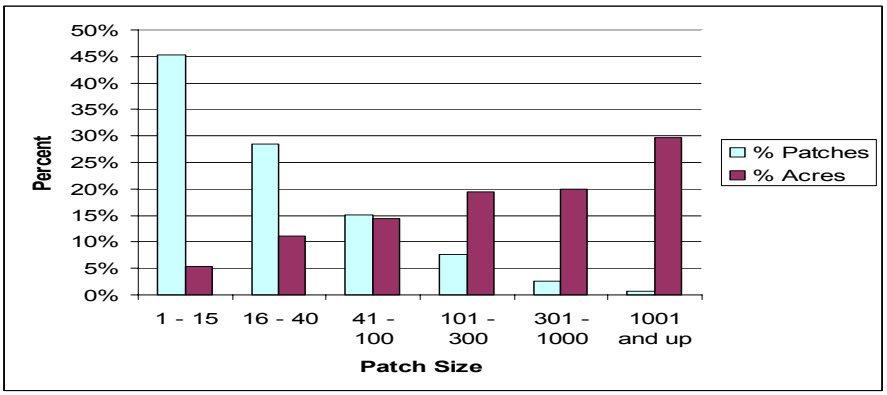
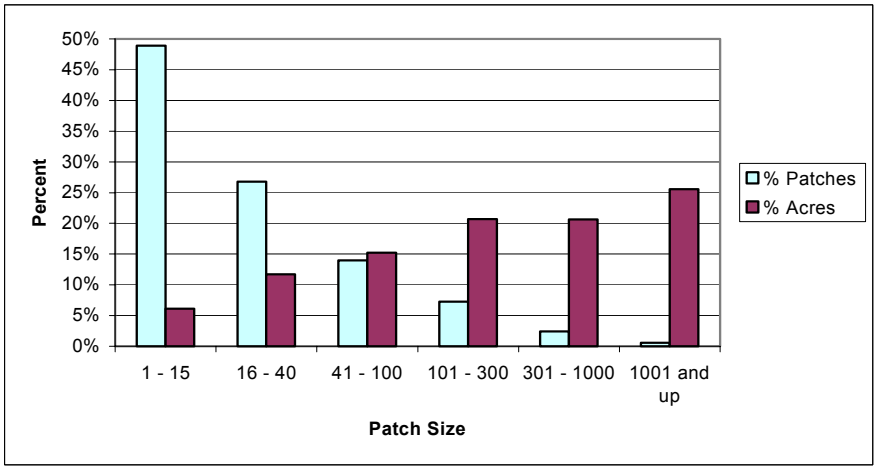


Figure 3-5. Patch size distribution for all types forestwide on the MBNF with consideration of roads.



Roads, trails and developed sites interrupt the continuity of the forest canopy and of the forest floor. The habitat provided in the forest near the roads is different than that provided away from roads. Some wildlife and some ecological functions are sensitive to the presence of roads while others are not. Average patch size and core area are different when roads are considered and this difference will influence certain

species and ecological processes. For instance, fire spread and movement of some small mammals will be influenced by the lack of ground vegetation in roadways, while annual movement of migratory songbirds, or seed dispersal patterns by nutcrackers likely will not.

The following table displays the amount of the forest within a specified distance of level 2, 3, 4 and 5 roads. The process for the analysis is described in Appendix B Biological Diversity Analysis Methods.

Table 3-45. Amount of the MBNF within a specified distance of Level 2, 3, 4 and 5 roads.

Area	Acres Within 150 feet (50 M)	% Within 150 feet (50 M)	Acres Within 300 feet (100 M)	% Within 300 feet (100 M)	Acres Within 2 Miles (32 KM)	% Within 2 Miles (32 KM)
MBNF	92,739	8.5%	175,863	16.2%	1,061,739	97.9%
Laramie Peak	6,622	3.7%	13,026	7.2%	176,968	98.1%
Sherman Mtns.	8,367	15.1%	15,558	28.0%	55,192	99.3%
Snowy Range	53,585	10.5%	100,994	19.7%	499,866	97.5%
Sierra Madre	24,165	7.2%	46,285	13.8%	329,713	98.0%

Source: MBNF GIS.

Shinneman et al. (Shinneman, McClellan et al. 2000) using data supplied by the MBNF indicate the areas immediately adjacent to roads are more likely impacted by road edge-effect, such as changes in microclimate and plant communities, invasion by weedy species, and are more readily accessible habitat by humans. This data also indicates how much of the Sierra Madre and Snowy Range is within large, roadless, interior habitat conditions that some native species require. For instance, for the Sierra Madre and Snowy Range there are 21 road-interior patches larger than 5,000 acres and the largest is 48,127 acres.

Where dissimilar HFTs occur adjacent to one another, there is an influence of each HFT upon the other and the associated species. For some species, this juxtaposition improves habitat quality. In any case the influence of this edge environment extends some distance into each of the HFTs that adjoin. This depth of edge influence may leave a core area within each patch beyond the edge influence zone (Baker 2000). Core areas or interior forest habitat represent an important component of the landscape. Cores were calculated using a 0-90 meter edge factor which varied based on the type of edge. With the influence of roads included, the Sierra Madre Range total core area is 22.6% with lodgepole late seral core area at 12.5% and spruce/fir late seral core area at 14.0% of the landscape (total acres analyzed for the Sierra Madre Mountain Range). Snowy Range total core area is 20.5% of the landscape with lodgepole late seral at core area at 11.2% and spruce/fir late seral core area at 8.5% of the landscape (total acres analyzed for the Snowy Mountain Range). Sherman Mountain Range (Pole Mountain) total core area is 26.3% of the landscape (total acres analyzed for the Sherman Mountain Range) and 5.3% of the core landscape occurs in ponderosa pine late seral, the dominant forest cover type.

Laramie Peak Range total core area is 12.6% of the landscape (total acres analyzed for the Laramie Peak Mountain Range) and 14.7% of the core landscape occurs in the late seral ponderosa pine, the dominant cover type.

There is more information on this analysis process and core area by cover type in Appendix D – Biological Diversity Report.

ENVIRONMENTAL CONSEQUENCES FRAGMENTATION

Fragmentation has been defined in various ways, but a simple definition suggest that fragmentation is the subdivision of a habitat or cover type into smaller, disconnected pieces (Turner, Gardner et al. 2001). Fragmentation is part of a continuum of landscape patterns ranging from perforation (Wiens J.A. 1995) to the development of habitat isolates. The specific landscape pattern has consequences for the ecosystems found in the landscape and individual species populations. These consequences might be called fragmentation effects and contrast with the more simple consequences of habitat loss. The effects of fragmentation vary across organisms, habitat types, and geographic regions (Haila 2002). Forest fragmentation may influence flora, soil characteristics, and microclimate through increased insolation and air movements (Vaillancourt 1995), (Potter, Teclaw et al. 2001), (Chen, S.C. Saunders et al. 1999). Changes in the physical environment near edges can lead to changes in plant species composition (Selmants and D. H. Knight 2003), (Jules 1998), (Germino and W. K. Smith 1999.), (Tomimatsu and M. Ohara 2002), foliage density and forest structure (Vaillancourt 1995), (Franklin, T.A. Spies et al. 2002).

Fragmentation affects animals through a number of mechanisms and results in isolations effects, increased predation and competition due to edge effects, and effects on movements among others (Beauvais 1997), (Beauvais 2000) (Yahner 1988), (Simon, Schwab et al. 2002). It is difficult to characterize fragmentation effects in general, because effects on species, if they occur, are species and context specific. Therefore, this discussion is very general while species-specific effects are examined in Appendix I -Biological Assessment and Biological Evaluation. Finally, in this section the focus is on fragmentation effects that extend beyond the effects of habitat loss.

In alternatives with the greatest allocation to renewable resources, patch sizes will be driven to a greater extent by economics of timber harvest and mitigated by standards and guidelines that limit patch sizes. Continued timber harvest can change the patch sizes on the forest. Tinker and Baker (Tinker and Baker 2000) modeled the implementation of the 1985 MBNF forest plan within suitable acres the lodgepole pine cover type. Their modeling indicates that under that plan, patch sizes would be smaller on average, the average age of stands would decrease and that core area would decrease. Alternative A is most similar to the 1985 MBNF Forest Plan and

would create patterns similar to those described by Tinker and Baker (Tinker and Baker 2000).

MA 5.15 emphasizes creating patches similar to those created by natural processes. Patch sizes would be larger in this MA and patch isolation would be lower because patches would be designed to emulate natural patch size shape and connectivity, however patch size would still be limited by the design features required to meet standards and guidelines for other resources such as riparian areas, recreation and scenic resources. Alternatives D DEIS, D FEIS, C and E, which allocate the most area to MA 5.15 (see previous table in composition section: Acres of MA 5.15 and Acres of Wildlife Habitat Restoration), would have the least increase in patchiness as a result of timber harvest. In addition, use of this MA could lead to a reduction in fragmentation by designing harvest units in highly fragmented areas to connect a series of smaller patches into one larger patch more consistent with natural patches. Baker (Baker 1994) indicates that approaches using landscape modeling to determine harvest unit placement and approaches using aggregated harvest unit placement could minimize fragmentation.

Alternatives A and B would have the most potential for creating small patches and reducing average patch size. Alternative F would have the least amount of additional patch creation through timber harvest and would have existing patterns primarily changed by growth, succession and natural disturbance processes.

Prescribed fire for stand regeneration (e.g. aspen) would be implemented. Prescribed fire can act similarly to wildfire and timber harvest creating patches and vegetation patterns that resemble those created by wildfire or timber harvest. Prescribed fire has fewer size limitations from Forest plan standards and guidelines. Patch sizes created with stand regeneration prescribed fire (e.g. aspen) are likely to be in-between those created by timber harvest and those created by the most extensive natural disturbances. Patches created by prescribed fire would often be designed to emulate natural patch size shape and connectivity, however patch size would still be limited by many of the design features required to meet standards and guidelines for other resources such as riparian areas, recreation and scenic resources. Alternatives D DEIS, D FEIS and E have the most acres of prescribed fire planned. The previous table in the composition section (Regeneration Harvest and Prescribed Burning for Forest Regeneration) displayed the area of timber harvest and prescribed fire that are structure-patch changing actions.

Natural processes that operate without control (limits) or suppression (elimination) have the potential to create large patch sizes. In areas without roaded access, suppression actions are less often attempted and less often successful at limiting the size of patches created. In years where extreme fire conditions are common, roaded access is less of a factor in limiting the size of fires. Based on these assumptions, those alternatives with the greatest emphasis on natural processes will, over time have the largest patch sizes.

Over time, natural processes (endemic levels of insects and diseases and small fires) would create numerous very small patches (<5 acres) and (epidemic levels of insects and stand replacement fires) would create a smaller number of very large patches (>1000 acres). Since insect risk is medium high or high on greater than 22,687 acres across the forest (from 172,129 inventoried acres), and since insect damage is associated with both population levels and drought cycles, it is possible that much of the area at medium to high risk of insect damage could be attacked within the next 50 years. (See Chapter 3 Insects and Diseases for more information.) Similarly, large, stand-replacement fires are associated both with fuel loading and with climate. There are 214,270 acres (20%) of the MBNF rated as condition class 2, where fire regimes have been moderately altered from their historical range and the probability of losing key ecosystem components is moderate. There are 82,708 acres where the hazard is high and 77,463 where the hazard is rated as extreme. (See Fire and Fuels section of this chapter for details). It is possible that many of these stands would burn in single year or in a series of drought years. The exact number of acres burned by wildfire in the future is difficult to predict. This is primarily due to annual variation in ignition sources and the flammability of fuels, which, in part, is a function of climate. Fire probability based on existing conditions for the four mountain ranges is displayed in Chapter 3 Fire and Fuels Management section. All probabilities are calculated from information on annual frequency of fires by size class.

There is a lower probability of a large fire than of a small fire and that based upon conditions similar to "ordinary" conditions as described by Romme (Romme 2002), there is some probability of fires similar to those described for YNP by Renkin and Despain (Renkin and D. G. Despain 1992) and Romme and Despain (Romme and Despain 1989) (See Fire and Fuels probability discussion for details).

Wind is another natural process that influences forest patterns on the MBNF. The effects of wind (blowdown) can be greater where trees are already affected by root diseases. Wind events can trigger spruce beetle epidemics that spread from the blowdown. Extensive insect mortality has occurred in spruce/fir on the Routt National Forest following the Routt Divide Blowdown of 1997. Wind events can also be followed by increases in spruce beetle and large-scale fires that can create extensive areas of severely burned soil and vegetation from the high loading of large fuels (Schmid and Frye 1977), (Jenkins, Dicus et al. 1998).

Many of the consequences of fragmentation result from changes in patch size. One of the primary effects of fragmentation is a reduction in interior forest habitat (Dillon, Knight et al. 2003), (Marcot, R. S. Holthausen et al. 1991). On the MBNF, most of the interior habitat occurs in existing inventoried roadless areas. Potential harvest in existing inventoried roadless areas is expressed by the percent of roadless areas allocated to timber management prescriptions and occurring on suitable lands. In order of most to least, the percentage of roadless area that is suitable is, by alternative, A (39%), B (22%), C (12%), D DEIS (3%), D FEIS (4%), E (1%) and F (< 1%).

Impacts on the landscape from natural processes will also vary by alternative. Those alternatives with the greatest emphasis on natural processes may, over time, have the largest patch sizes (for information on critical assumptions see the section on composition changes). Alternatives A and B would have the least change in patch size as the result of natural processes and the most as a result of active timber harvest and fuel reduction.

Road construction also has an effect on patch size and fragmentation. Fragmentation effects that result from road construction, differ among species; taxa that do not experience negative effects from other forms of fragmentation may respond negatively to roads while some taxa that exhibit negative effects of fragmentation from stand disturbing processes, may not respond negatively to road-induced fragmentation. Because the current transportation system is well established, very few miles of new road construction are proposed under any of the alternatives. The most potential for new road construction occurs in those alternatives that enter existing roadless areas for timber harvest. In order of potential road construction the alternatives rank from most to least as Alternative B, Alternative A, C, D DEIS, D FEIS, E, and F. Each alternative proposes a reduction in forest service system (FSR) roads. Some of that reduction will actually transfer road miles into trail miles. During the first decade, Alternatives A, B, C, D DEIS and D FEIS propose decommissioning 180 miles (458 acres); Alternative E – 750 miles (1,901 acres); and Alternative F – 1,210 miles (3,072 acres). Reductions in the road system will result generally from project-level decisions. Road decommissioning will not have an immediate change on fragmentation, but will reduce some of the associated impacts and over time and set the stage for long-term restoration as trees on these sites gradually reach maturity.

Cumulative Effects

The pattern of vegetation established through management activities is documented to be a long-term commitment of resources by Swanson and Franklin (Swanson and Franklin 1992) and by Franklin and Forman (Franklin and Forman 1987). Once a pattern of vegetation is established through either natural processes or human actions, it is impossible to return to the pattern of vegetation that existed prior to the natural or human action. However, large-scale stand replacement wildfire events can effectively modify the existing vegetation patterns, setting succession back to the grass/forb or seedling stage over large areas for both managed and unmanaged areas. These patterns would persist for at least 100-300 years into the future.

Each alternative includes management areas where human-caused disturbances will be the primary agent of patch size change (see previous table in composition section -- Percent of forest where renewable resource management is the primary agent of change). Proposed stand replacement timber harvest was displayed in previous tables in the section on composition (Regeneration Harvest and Prescribed Burning for Forest Regeneration). Over the longer-term (next 200 years), lands that are

suitable and scheduled for timber harvest are displayed for each alternative in the following table. There is greater confidence in estimates for the first decade with decreasing confidence over the next 200 years.

Table 3-46. Comparison of land scheduled for timber harvest over next 200 years by alternative.

Alternative	Acres Scheduled for Harvest Next 200 years	Scheduled as % of Suitable	Scheduled as % of Forested
A	339,873 acres	71.7%	39.2%
B	332,786 acres	81.6%	38.4%
C	318,295 acres	85.9%	36.7%
D DEIS	300,520 acres	90.9%	34.7%
D FEIS	286,120 acres	89.1%	33.0%
E	266,346 acres	91.7%	30.7%
F	147,469 acres	85.5%	17.0%

Source: SPECTRUM model.

Those alternatives with lower total amount scheduled but a greater percent of suitable scheduled will have the most concentrated effects in terms of changing patch sizes, influencing edge and changing core representation. Those alternatives with the greater amounts of scheduled harvest but lower % of suitable scheduled will have less concentrated effects.

AFFECTED ENVIRONMENT
SNAGS AND COARSE WOODY DEBRIS

Snags and coarse woody debris are key components of forested ecosystems. Among other effects, dead wood influences ecosystem processes, provides essential habitat for animals ranging from insects to birds and mammals, and influences long-term soil structure (Simon, Schwab et al. 2002), (Graham, Harvey et al. 1994). The existing levels of snags and coarse woody debris are the result of historical natural process and disturbances as modified by forest management. Based on the 1999 Forest Inventory (Miles 2002), the MBNF has the equivalent of 1 new snag per 4 acres created annually.

Existing levels of coarse woody debris varies widely across the forest. Lower levels generally occur in harvested stands. Levels vary with the type of harvest and stand condition at the time of harvest. Debris levels in un-harvested stands can vary greatly depending on tree species, fire frequency, insect or disease activity and wind occurrence.

ENVIRONMENTAL CONSEQUENCES
SNAGS AND COARSE WOODY DEBRIS

Future patterns of abundance of snags and coarse woody debris will vary by allocation to different management prescriptions. In management areas where natural processes predominate, the level of snags and coarse woody debris will, at times, approach ecosystem maximums. Stand replacement fires, insect and disease incidents will create high density snag patches in some areas that will eventually become high density patches of coarse woody debris. Wildfires that may occur in these high density snag/coarse woody debris patches would then likely consume most of the snags and woody debris and leave these sites at minimal levels of snags and coarse woody debris. The following discussion of Fire, Insects, Diseases has more information on the effects of fire and insects.

The MBNF currently has approximately 26.5% of the forest allocated to MAs where natural processes and disturbances are the major forces creating snags and coarse woody debris.

On the MBNF, salvage harvest would most often occur within areas allocated to renewable resource management and already roaded. Salvage harvest can occur on both suitable and unsuitable forested lands and is dependent upon market conditions, product potential (from snags), site access and distance to market.

Timber harvest units will be designed to retain snags and snag recruits in accordance with the ranges specified in the standards. Retained snags and snag recruits are designated as wildlife trees and will be left on site if blown over. Final timber harvest units will be designed to retain coarse woody debris well distributed in accordance with the ranges specified in the standards. Un-merchantable trees will generally be left standing to replace downed wood that is expected to be lost during site preparation treatment or if existing material does not meet the desired tonnage. In these areas, the level of snags and coarse woody debris will at least meet standards and guidelines immediately following management actions. In spruce-fir outside of interface areas, the wildlife value of retained dead downed wood will be promoted by (1) by leaving limbs attached (to keep the log suspended), (2) providing complex structure (like jackstrawed piles), and (3) avoiding roller chopping whenever possible. Standards and guidelines will, over time, increase snags in past and proposed harvest areas.

All of the alternatives have standards and guidelines that provide for minimum levels of snags to be maintained in harvested units. These standards (except for alternative A) represent a substantial increase in the amount of this component of the ecosystem over the current Plan. Alternatives B-F have requirements for the following levels of snags to be retained:

- Spruce/fir: 6-10 snags with 8-12 recruits;
- Lodgepole pine: 1-2 snags with 8-12 recruits;
- Ponderosa pine: 1-2 snags with 2-4 recruits;
- Aspen: 1 snag with no requirements for recruits.

Recruitment snags are a key component to maintaining an adequate level of snags in the future. As a harvested stand matures, these live trees (recruitment snags) may remain standing and man increase in size before dying.

Standards for coarse woody debris are also increased from current standards and are based on Graham *et al.* (Graham, Harvey et al. 1994). The 1985 plan called for 50 linear feet/acre at 12 inches in diameter for spruce/fir (approximately 1 ton/acre) and 33 linear feet/acre at 10 inches in diameter for lodgepole pine (approximately 0.5 ton/acre). Proposed standards for Alternatives B-F call for 10-15 tons/acre in Spruce/Fir with the majority in diameters over 10 inches in lengths of 25 feet.

Lodgepole is similar but would have the majority of trees in diameters over 6 inches. Ponderosa pine would require 5-10 tons/acre with all of the trees over 10 inches in diameter. These figures compare to 16 to 113 pieces/acre depending on size and species and 400-1300 linear feet/acre. Standards and guidelines for retention of snags do not apply to prescribed fire. Prescribed fire in aspen may remove most or all snags and live trees (potential snags) within burn areas. Historic wildfires would also have removed most or all snags and live trees within burn areas in aspen cover types.

Graham *et al.* (Graham, Harvey et al. 1994) indicate that at least 5 tons per acre in ponderosa pine and 7-15 tons/acre in lodgepole pine and spruce/fir cover types are needed to maintain long-term site productivity. These values are based upon expected decomposition and length of time between timber harvests. Tinker (Tinker 1999)and Tinker and Knight (Tinker and Baker 2000) indicate that if several successive rotations occur in the same stand using 1985 Forest Plan Standards, levels will be lower than after the same number of fires on comparable sites.

The amount of timber scheduled for harvest will influence the amount and distribution of snags and coarse woody debris. On land scheduled for timber harvest, it is expected that snags and coarse woody debris will be retained at levels prescribed by standard and guideline requirements, but would probably represent the low range of that which occurs under natural conditions. Reduced levels as a result of harvesting in order from highest to lowest will be Alternatives A, B, C, D DEIS, D FEIS, E, and F.

Snags and coarse woody debris will be found at higher levels elsewhere on the landscape in those Management Areas that have natural processes as the primary agent of vegetation change. In these Management Areas, the level of snags and coarse woody debris will correspond to those found in less intensively managed ecosystems. Snags may still be felled and/or removed from these areas but should occur relatively infrequently based upon Management Area desired conditions, standards and guidelines. Alternative F (74%) would have the highest levels of snags and coarse woody debris based on the percentage in management areas in which natural disturbance processes are the dominant agent of vegetation change. Alternatives A (20%), B (28%), and C (37%) would have the least. Alternatives D DEIS (48%), E (48%) and D FEIS (45%) would have similar amounts in the middle of the range.

Firewood gathering is an additional impact on the levels of snags and coarse woody debris. Firewood gathering on the Forest is relatively low (2 MMBF/yr) and generally concentrated near open roads. Most firewood collection occurs within about 150 feet of an open road. There are 92,739 acres within 150 feet of open roads (8.6% of the MBNF). Most, but not all of these acres, are within forested areas. This level represents a maximum potential of access for firewood cutting. However, many of these roads are not accessed for firewood cutting because they are remotely located, of poor quality, and infrequently used. Forest-wide standards and guidelines limit firewood cutting in riparian habitats. In addition, road decommissioning would further reduce the amount of area available for firewood cutting. During the first decade, Alternatives A through D propose decommissioning 180 miles; Alternative E - 750 miles and Alternative F-1210 miles. The location and specifications for roads to be decommissioned will be determined in project-level planning and decisions. (There is more information on road decommissioning in Chapter 3 Travel Management section.)

Removal of dead standing trees that pose a safety hazard occurs in campgrounds, administrative sites and along roads. Felling of these snags also contributes to a reduction in snag abundance, but is generally minor in scope. If these snags are felled and not removed from the site, they will contribute to coarse woody debris.

Snow, wind and decay can also influence the residence time of snags on a site. The longer snags remain standing, the greater the abundance and distribution of snags across the landscape. Strong winds frequently blowdown snags left in harvest units, if not protected from the wind. Within MA 5.15, guidelines call for retaining approximately 20% of the interior of the unit in clumps, or fingers of un-harvested trees that will contribute to forest-wide standards for snag retention and distribution of future downed wood. These interior units are designed to emulate unburned areas that occur in natural fire disturbances and will reduce snag and snag recruitment loss to wind.

Cumulative Effects

Approximately 130,000 acres have been harvested on the Forest in the last 50 years (12.3% of MBNF, 15.3% of forested acres). On these lands, amounts of snags and coarse woody debris and the potential for both in the next 50 years, have been reduced and/or altered from values expected most frequently under natural disturbance regimes. Where silvicultural practices maintained large trees on the site (shelterwood, group selection, thinning), snags may have increased in the years following harvest.

The following table presents a summary of the snag and snag potential alterations from previous harvesting and proposed actions.

Table 3-47. Snag and snag potential alterations from past harvest and proposed actions on the MBNF.

	Alterrnatives						
	A	**B**	**C**	**D DEIS**	**D FEIS**	**E**	**F**
Past Harvest Acres/% of MBNF							
Past Harvest*	132,937 12.3%	132,937 12.3%	132,937 12.3%	132,937 12.3%	132,937 12.3%	132,937 12.3%	132,937 12.3%
Proposed Regeneration Acres/% of MBNF							
Proposed Harvest decade 5	54,872 5.1%	58,680 5.4%	50,068 4.6%	45,312 5.0%	53,972 5.0%	40,873 3.8%	11.930 1.1%
Cumulative Past +Proposed Harvest Acres/% of MBNF							
Past + Proposed Regeneration	187,809 17.3%	191,617 17.7%	183,005 16.9%	178,249 16.4%	186,909 17.2%	173,810 16.0%	144,867 13.4%
Roads, Trails and Developed Sites Acres/% of MBNF**							
Cumulative end Decade 5	7,111 0.7%	6,901 0.6%	7,257 0.7%	7,257 0.7%	7,359 0.7%	6,901 0.6%	6,741 0.6%
Acres Prescribed Fire in Aspen/% of MBNF							
Cumulative end decade 5	17,500 1.6%	24,500 2.3%	24,500 2.3%	28,000 2.6%	28,000 2.6%	28,000 2.6%	15,400 2.6%
Total % MBNF							
Cumulative End of Decade 5	212,420 19.6%	223,018 20.6%	214,762 19.8%	213,507 19.7%	222,268 20.5%	208,711 19.2%	167,008 15.4%

Source: S-Tables and historic records. Not all activities have occurred on forested lands, so % of MBNF is displayed.

**Cumulative past harvest acres from 1951+ as documented in RIS database*

***Does not include decommissioning as it will take greater than 100 years to develop new snags along decommissioned roads.*

The amount of timber scheduled for harvest will influence the amount and distribution of snags and coarse woody debris. Over the longer-term (next 200 years), an estimate of the amount of land affected by timber harvest can be made by adding past harvest to the predicted harvest on lands that are suitable and scheduled for timber harvest. Some stands may have more than one harvest entry. The following table displays the historic harvest, the scheduled harvest, the cumulative total and the cumulative total as percent of forested.

Table 3-48. Acres of land scheduled for timber harvest over next 200 years.

Alternative	Acres Historic Harvest last 50 years	Acres Scheduled for Harvest Next 200 years	Cumulative Total Acres Harvest at Year 200*	Cumulative Total as % of Forested
A	130,000	339,873	469,873	54.2%
B	130,000	332,786	462,786	53.4%
C	130,000	318,295	448,295	51.7%
D-DEIS	130,000	300,520	430,520	49.7%
D-FEIS	130,000	286,120	416,120	48.0%
E	130,000	266,346	396,346	45.7%
F	130,000	147,469	277,469	32.0%

*Source: SPECTRUM model. *Some of these acres may have more than one regeneration harvest over 200 years.*

The areas with scheduled timber harvest may have different levels of snags and coarse woody debris than un-harvested areas but standards and guidelines for retention should balance the managed and unmanaged areas more than in the past.

AFFECTED ENVIRONMENT
KEY ECOSYSTEM PROCESSES

Succession is slow in Rocky Mountain coniferous forests because of the short cool growing season (Knight 1994). Decomposition is also limited by the cool and sometimes dry climate (Knight 1994). Under some circumstances decomposition under snow can approach rates during summer (Fahey 1983). Forest level growth, nutrient cycling and decomposition processes have been modified by land uses or disturbances. Graham *et al.* (Graham, Harvey et al. 1994) indicate that at least 5 tons per acre in ponderosa pine and 7-15 tons/acre in lodgepole pine and spruce/fir cover types are needed to maintain long-term site productivity. These values are based upon expected decomposition and length of time between timber harvests which are similar to those identified for the MBNF. Tinker (Tinker 1999) and Tinker and Knight (Tinker and Baker 2000) indicate that if several successive rotations occur in the same stand using 1985 Forest Plan Standards, levels will be lower than after the same number of fires on comparable sites.

Water is not evenly distributed on the Forest. High elevations are generally much wetter than lower elevations. More moisture falls on the west side of the Continental Divide than the east side. This distribution of water influences the spatial pattern of aquatic and riparian ecosystems. Water uses and diversions have affected the distribution of water on the MBNF and the quantity and timing of water available for ecosystems downstream of the MBNF (see Biological Analysis Appendix I for more details on downstream effects on Threatened and Endangered Species). The introduction of fish species may be affecting the ecological functions of aquatic ecosystems (See Chapter 3 - Aquatics Section for details).

The lack of certain extirpated large predators may be influencing ecological functions on the MBNF. Wolves and aspen abundance (Ripple and Larsen 2000), (Ripple, E.J.Larsen et al. 2001) and grizzly bears and meadow ecology (Tardiff and Standford 1998), (Mattson and T. Merril 2002)are examples of such effects. The extirpation of the American bison may have affected grassland patterns and aspen abundance (Knapp, J. M.Blair et al. 1999). The extinction of the Rocky Mountain Locust may have changed vegetation patterns and nutrient cycles in the grass and shrub areas, and changed nutrient accumulation in glaciers and snow fields (Lockwood, L.D. Debrey et al. 1994), (Lockwood and L.D. Debrey 1990), (Schell 1994).

ENVIRONMENTAL CONSEQUENCES
KEY ECOSYSTEM PROCESSES

Management actions that retain or create early successional stages change the direction or timing of successional processes. Management actions that reduce snags and coarse woody debris also affect decomposition processes. These effects are discussed in the section on composition and the section on snags and coarse woody debris.

Some of the direct effects of maintaining healthy growing conditions can be described by the maintenance of nutrients and nutrient cycling processes on site. The fertile elements of a forest site are stored in the soils, the trees and vegetation on the site and in the detritus which decays on the soil surface (Zinke, Strangenberger et al. 1982). Large proportions of some nutrients (nitrogen and phosphorus) in the forest are contained in trees and leaf litter. Larger amounts of fertility are stored at the tops of the tree trunks, in the branches, twigs and the foliage, smaller amounts are in the main trunk.

Soil organic matter (including charcoal from fires) and humus provide chemically active cation exchange sites that cycle nitrogen, potassium and calcium. The welfare of soil microorganisms depends on organic matter because it provides both a suitable environment and the carbon compounds provide a source of energy (DeBano 1991). Mycorrhizae (symbiotic fungal organisms that grow on roots) play an important role in mobilizing phosphorus from organic matter (Coats and Collins 1981). The microbiological populations of a forest soil are largely responsible for its relative quality and productivity within the limitations of the site (Harvey, Jurgensen et al. 1979).

Within ecosystems where fire has a role in decomposing vegetative materials, nitrogen can become tied up in partially decomposed litter (detritus) (McKelvey, Skinner et al. 1996). Monoterpenes (pine oils) present in needle litter can inhibit nitrogen cycling by microorganisms (White 1994a), making ecosystems more dependent upon the fire process to cycle nutrients. Nitrogen is a key element for plant growth and sites may experience reduced productivity when nitrogen is tied up

in accumulated duff and fuels. In addition, fire can cause a decrease in the acidity of forest soils, making some nutrients more available to trees and forest vegetation (Hungerford, Harrington et al. 1991). If silvicultural operations result in a small reduction in site production with each entry, then rotations must be long enough to restore productivity over the length of the rotation, if productivity is to be maintained (Coats and Collins 1981). Rotations sufficiently long for recovery of nutrients depend upon site characteristics and range from 100-300 years (Coats and Collins 1981), (Harvey 1982). (Tinker and D.H. Knight 2001). Impacts to the soil, such as disturbance, compaction displacement, puddling or removal of woody material decrease long-term site productivity (Powers 1990a; Powers, Alban *et al.* 1990b; Powers, Alban *et al.* 1990c; Amaranthus and Steinfeld 1997). Tinker and Knight (Tinker and D.H. Knight 2001) indicated that coarse woody material and nutrient cycling would decrease after several rotations under MBNF 1985 Forest Plan coarse woody debris guidelines. Fahey *et al.* (Fahey, J.B. Yavaitt et al. 1985) documented coarse woody debris as a nitrogen storage area during the first 110 years of stand development for stands on the MBNF. Hunt *et al.* (Hunt, E.R. Ingham et al. 1988) indicate that both above ground plant production and decomposition are nitrogen limited at certain sites on the MBNF.

Changes in decomposition and nutrient cycling can change the growth of vegetation and the composition of vegetation as some plant species are more adapted to low nutrient environments and others adapted to high woody debris environments.

Timber harvest and prescribed fire can reduce nutrients and woody material. The amount of timber harvest and prescribed fire by alternative was displayed in the previous section on composition. Timber harvest removes bole material which is generally low in nutrients but high in woody fiber. Prescribed fire mostly burns fine fuels (leaves, needles and branches) which are generally high in nutrients but much lower in woody fiber value. Some nutrients are more readily volatilized by heat (nitrogen) while others generally remain on site in the ash (phosphorus and potassium) but can be removed by wind or water erosion following fire (Coats and Collins 1981).

Standards and guidelines for snags and coarse woody material maintain snags and coarse woody material at levels that will maintain ecosystem functions. Rotation ages for timber management on lands determined to be suitable for timber management will maintain long-term site productivity. Impacts to soil from ground disturbance are limited by watershed conservation practices included in the forest-wide standards and guidelines. These standards and guidelines have been designed to maintain long-term site productivity. Wildfire, insects and diseases can also change decomposition and nutrient cycling. The effects of these processes are described in the following section.

Alternatives which would have the least potentially adverse impacts on nutrient cycling processes are Alternatives F, E, and D DEIS and D FEIS respectively.

Alternatives A, B, and C would have the greatest potential adverse effects based on the percentage of areas where natural processes could be interrupted.

Management actions that compact or move snow can change water distributions and timing and change growing conditions for vegetation (Bilbrough C.B., J.M. et al. 2000), (Williams, Brooks et al. 1998), (Neumann and H. G. Merriam 1972) and affect wildlife habitat , (Jarvinen and Schmid W. D 1971), (Schmid 1972), (Keddy, Spavold et al. 1979). Changes in snowmelt affect the growth of vegetation at high elevations where snowpack is controlling factor for vegetation growth (Knight, Anderson et al. 1975). The effects of snow compaction are discussed in detail in the Wildlife section and Aquatics section of Chapter 3 and in Appendix D.

Cumulative Effects

Approximately 130,000 acres have been harvested on the Forest in the last 50 years (12.3% of MBNF, 15.3% of forested acres). On these acres, the nutrient cycling processes and long-term site productivity may have been affected by management actions that reduced coarse woody debris and/ or changed soil characteristics beyond current thresholds for soil damage or long-term site productivity.

Motorized winter recreation has historically been allowed to occur on 92% of the MBNF, although there may not be evident effects of motorized winter recreation on all acres as not all of that area is snow covered or accessible to snowmobiles or other over-snow vehicles during the winter. Alternative F has the greatest reduction in the area available for winter recreation. Alternatives A-E continue to allow motorized winter recreation on a large percentage of the MBNF (A 92%, B 87%, C 84%, D DEIS 69%, D FEIS 71% and E 63%).

AFFECTED ENVIRONMENT: DISTURBANCES-FIRE, INSECTS, DISEASES, WIND

Fire is thought to be the most significant natural disturbance agent in high elevation forests of the Rocky Mountains. Wildfire has been an important influence on the patch and landscape structure, forest density, species composition and age of shrubland and forest vegetation throughout the MBNF. The management of wildfire and prescribed fire are discussed in the Fire and Fuels Section of this chapter. Insects have also been an important influence on the patch and landscape structure of the MBNF. The effects of insects are discussed in the Insects and Diseases section of this chapter.

The role that fire plays in an ecosystem is summarized by fire regime descriptions (Laverty and Williams 2000). These regimes are discussed in the fire and fuels section.

Although alterations in structure have been more apparent in ponderosa pine than in other forest cover types, the majority of ponderosa pine on the MBNF is still in mature low density stands.

Ponderosa pine stands at low elevations on the Laramie Peak range had more frequent fire than occurs today. Brown and Shepperd (Brown and W.D. Shepperd 2001) and Brown *et al*. (Brown, Ryan et al. 2000) discuss historic patterns of fire frequency for the Ashenfelder Basin area of the Laramie Peak Range and note that that area had longer fire free intervals than other areas studies within the Rocky Mountain region.

However, both insect epidemics and wildfires have affected the Laramie Peak Range since these observations. An extensive mountain pine beetle epidemic occurred between 1988 and 1994. Documents from the Cold Spring Ecosystem Management Project (USDA FS Douglas Ranger District 1998) stated that there was extensive tree mortality on 7,500 acres due to that epidemic. The changes from this epidemic are reflected in the RIS data.

Recent fires on the Laramie Peak Ranger District encompassed 16,194 acres of ponderosa pine. An analysis of possible change indicated that following these fires, stand structure reflects expected conditions under natural disturbances regimes.

The observed alteration in the frequency of fire (prior to recent fires) may have had several effects. Ponderosa pine can withstand fire burning around its base, but it experiences higher mortality from fire that reaches the crown and destroys the needles. Denser understories can carry fire into the crowns of mature and old pines, killing them. Stands that would have been perpetuated as a mosaic of old forest for centuries may now be subject to stand replacing burns that, if intense, can kill every tree. Alterations that are most likely to affect habitat for wildlife species are the denser stand structure at low elevations (i.e., near the grassland ecotone) and changes in the type and frequency of fire.

Observed alterations in structure may be due to fire suppression, however Dillon *et al*. (Dillon, Knight et al. 2003) suggest that ponderosa pine in this area is subject to several different fire regimes and likely exhibit dense multi-story structure under some circumstances, with natural disturbance regimes. Shinneman and Baker (Shinneman and W.L. Baker 1997) indicate that ponderosa pine forest can be subject to non-equilibrium dynamics and exhibit both open canopy structures and dense canopies under different fire regimes.

In addition, as litter on the forest floor has grown deeper (from accumulation of needles and other organic material)(Dillon, Knight et al. 2003), a ground fire that moves through will smolder longer. The deeper flammable ground cover can lead to fire conditions that destroy portions or all of the cambium of mature and old trees. Where the cambium is not killed around the entire circumference, the tree will have a fire scar and continue to live. Fires that burn in deep duff may burn in a way that

was not typical of fires in the past, and may reduce habitat components for species that require large trees.

Ponderosa pine trees that survive a ground fire can develop resin at the base. When the tree dies, the snags may stand for many decades. Trees that are not "hardened" by several ground fires and lack this resin develop into snags that rot at the base and fall within a few years (Arno pers. comm.).

In the past, when fire burned in ponderosa pine, patches of trees were killed or damaged. These burned trees provided habitat for bark beetles and woodborers that provide food for woodpeckers (especially the Lewis'). Other animals and plants benefit from downed wood. With less frequent fire, understory vegetation persists longer. Shrubs become woody and produce less nourishing forage for ungulates.

Insects and disease contribute to disturbance processes in the forested ecosystem. They are relatively widespread across the Forest. Bark beetles can act as a stand replacement process similar to fire but at times may occur at low levels that affect small groups of trees and influence within stand structure more than landscape structure. Changes in stand composition and structure can be changed relatively rapidly by insect attacks.

Diseases (dwarf mistletoe, root and other root/heart rots, aspen decline) mostly operate within stands and influence growth and structure of individual trees. Dwarf mistletoe is noted for reducing tree growth and ultimately the supply of forest products but also provides wildlife habitat structure and food not found in areas without mistletoe. Dwarf mistletoe frequently works more slowly than insects and may take decades to change forest stand composition or structure. In the earliest surveys of the Rocky Mountains, the distribution of severe mistletoe damage was described as scattered and localized. Johnson *et al.* (Johnson, Hawksworth et al. 1978) reported that 60% of all lodgepole pine on the MBNF were infected with dwarf mistletoe. Infections occur primarily on unharvested stands or stands which were selectively cut.

There were 844 acres of wind damage identified in aerial damage surveys over the last 5 years for the MBNF. In 1997, just south of the MBNF, a windstorm felled trees over 13,000 contiguous acres (Routt Divide blowdown). This type of wind incident is historically rare on the MBNF. Smaller events are more common. The wind risk rating for the MBNF is lower than for the Routt National Forest (Kane, B.G. Brown et al. 1999). Many blowdown events in forested stands are associated with the edges of timber harvest units, where wind patterns have been changed by the removal of trees.

ENVIRONMENTAL CONSEQUENCES
DISTURBANCES –FIRE, INSECTS, DISEASES, WIND

Disturbance processes from fire, insects and diseases will continue to occur across the forest in all alternatives. As discussed in the previous section on composition changes from natural disturbances, natural disturbance processes are most likely to occur in a similar amount and pattern to the recent historical period. Natural disturbance patterns are and will continue to be reflective of existing conditions and levels of insect and disease activity and risk of increases based on forest conditions.

The degree to which natural disturbance processes occur is dependent primarily on the unpredictable impacts from climatic and local weather conditions. Natural disturbance patterns are reflective of existing conditions and levels of insect and disease activity and risk of increases based on forest conditions. Climate patterns that would influence the occurrence of natural disturbance patterns are not likely to change suddenly or drastically in the implementation period for this plan (10-15 years). These climate patterns are not expected to produce conditions that exceed those described as part of the historic range of variability (Griggs 1938.), (Griggs 1946),(Kipfmueller and W. L. Baker 2000). Other climatic events that can create extreme conditions (such as the Hale magnetic cycles, El nino -southern oscillation or volcanic eruptions (Fye and M.K. Cleaveland 2001)) are unpredictable. Natural disturbances are unpredictable in the short term (10-15 years) because of the fluctuations from year to year. Therefore this analysis focuses on a longer period of 50 years. A wider variety of climate change is possible over longer periods. Other possible outcomes that deviate significantly from those presented this are also noted or described.

Active management is not expected to entirely prevent native disturbance processes. However, timber salvage activities in management areas with renewable resource management emphasis may utilize some of the timber mortality from wildfires, insects and disease. Since cumulative effects have been based upon the patterns of human uses and natural disturbance patterns, where natural disturbance processes occur in area where salvage harvesting may be expected, this has been shown as part of the predicted harvesting.

Based on these assumptions, the potential influence of wildfire, insects and diseases in order from most to least would be Alternatives F, E, D DEIS, D FEIS, C, B and A respectively.

Those alternatives with the greatest allocation to development of renewable resources will use the greatest amount of suppression and control of fire, insects and diseases. Forested areas are most accessible and suppression actions easiest to implement in areas where there are system roads. The highest density of system roads occurs in the areas managed for renewable resource production. Alternatives A, B, and E have the largest areas where direct suppression would be used and where insect and diseases would be actively suppressed or controlled.

Until the summer of 2002, only small areas of recently burned forest occurred in the ponderosa pine cover type. The Hensel fire (and others) burned through 16,194 acres of ponderosa pine most of which has not had post fire management actions that removed trees. This increased that available post-fire wildlife habitat in ponderosa pine.

Alternative F, E, D DEIS and D FEIS have the largest areas where retention (without salvage) of burned areas and post-fire environments would meet the desired future conditions. These conditions would benefit woodpeckers (especially the Lewis'). Other animals and plants would also benefit from the legacy of downed wood.

Cumulative Effects

Fire frequency, intensity and size can influence the nature of forest development, ecosystem processes and abundance of native species.

It is impossible to predict exactly the levels to which natural disturbances may occur. Tree establishment can be delayed where forest sites are subjected to fire repeatedly (Gray and Franklin 1997).

There are additional discussion of the effects of natural disturbances on composition, structure, old growth, fragmentation, snags and coarse woody debris in previous sections.

AFFECTED ENVIRONMENT
DISTURBANCE REGIMES-LAND USES

Since the 1860s, the Medicine Bow National Forest has been a source of timber products. The earliest harvests used tie drives on the streams to move the timber to the source of demand. Later harvests moved the wood via roads constructed throughout the forest. The cutting and removal of trees from the forest environment and the transportation systems used have changed the composition, structure, and function of the forest and the riparian areas from that which existed before (Von Ahlefeldt and Speas 1996). Prior to the turn of the century, domestic stock grazed throughout the Medicine Bow National Forest. The initial grazing occurred with few constraints. Since the incorporation of the area into the National Forest System, grazing has been subject to increasing regulation and control (Thybony, Rosenberg et al. 1985). There is more information on grazing and non-forest vegetation in the previous section on composition changes and in Chapter 3 – Livestock – Big Game and Chapter 3 Vegetation.

Fire suppression has been mandated across the MBNF by the 1985 plan. Insect suppression has occurred more frequently since the increased availability of insecticides after World War II. There is more information on the effects of suppression on vegetation composition in the previous section on composition

changes and potential natural vegetation and on fire and fuel management in Chapter 3 – Fire and Fuels Management.

Gold was discovered in 1856 in the Medicine Bow Mountains. Copper mining occurred in the Rudefeha area. Mining and the effects of previous mining are still present today. There is more information on this in Chapter 3 – Minerals.

Water diversions began in 1851 and now occur on many streams. Other water projects include trans-mountain diversions and construction of large reservoirs. Fish introductions began 1874 and fish stocking has occurred since 1890.

Recreation uses have occurred since the early 1920s, and continue to increase in diversity and amount. There is more information on past and present recreation uses of the MBNF in Chapter 3 – Recreation.

ENVIRONMENTAL CONSEQUENCES DISTURBANCE REGIMES-LAND USES

Effects from Special Areas (RNAs, Recommended Wilderness, SIAs and Wild and Scenic Rivers

Allocations of special areas such as SIAs, RNAs, Wilderness areas, proposed Wilderness areas and Wild and Scenic rivers will have an impact on the composition, structure, landscape pattern and disturbance processes for the MBNF. Within RNAs, Wilderness areas and Wild and Scenic Rivers, growth and succession will be evident with natural disturbance processes as the primary agent of vegetation change. Wilderness and proposed Wilderness areas encompass large unroaded areas that will contribute to the continuity of the landscape (provide limits to fragmentation from human disturbance processes).

Special Interest Areas with emphasis on cultural or historical structures would have an emphasis of protection of the items of interest.

Additionally, all of these areas may include plant communities of scientific or biological importance, which contribute to the overall biological diversity on the Forest.

Designation of special areas by alternative in order of most to least acres are Alternatives F, E, D FEIS, D DEIS, B, A, and C. There is additional information on special areas in Chapter 3 – Research Natural Areas, Chapter 3 – Special Interest Areas, Chapter 3 – Wild and Scenic Rivers, and Chapter 3 – Wilderness.

Effects from Insects and Diseases and Suppression and Control Actions

The effects of insects and diseases are discussed in previous sections and in the section of this chapter on insects and diseases.

Effects from Fire and Fire Suppression

The effects of fire and fire suppression are discussed in previous sections.

Effects from Timber Management

The effects of timber harvest are discussed in previous sections of the Biological diversity discussion.

Effects from Livestock Grazing and Big Game Use

Grazing by both livestock and wildlife is a disturbance agent of the herbaceous cover. Its exact effect on composition depends on a number of factors, including the amount of grazing, timing, seral stage of the vegetation, and other environmental parameters. Some meadows, grasslands, and shrublands were grazed more heavily in the early 1900's than previously, but current management practices appear to be creating conditions that are similar to those that occurred commonly under native grazing pressure, thereby, facilitating restoration of these ecosystem types (Dillon, Knight et al. 2003).

Grazing under standards and guidelines, tends to maintain current structural stages for longer periods of time (changes structural stage residence times) but does not change structural stages in the manner that prescribed fire would. Grazing in willow habitat has been shown to alter structure (Knopf, J. A. Sedgwick et al. 1988) however, these structural alterations would still rarely be intensive and extensive enough to change structural stage classification.

The Supplemental Tables in Chapter 2 display the active livestock grazing allotments and permitted livestock use by alternative. Alternative F has the fewest active grazing allotments and the lowest level of livestock use. Alternative F would have that greatest amount and extent of older structural stages in non-forest vegetation.

Alternatives A through E all have the same number of active allotments and livestock use. Those alternatives with greater numbers of allotments and greater amounts of livestock use may have the greatest and the most widespread effects on composition and structure of vegetation. Undesirable impacts from livestock grazing will be mitigated through annual grazing allotment administration and through review and modification of annual operating plans.

There is additional information in Chapter 3 – Vegetation Rangeland section. Overall, however, proposed management is likely to result, in 50 years, in proportional representation of various non-forest vegetation structures very similar to those currently present. There is additional information on the effects of grazing on threatened, endangered and sensitive plants in Appendix I –Biological Assessment and Biological Evaluation.

Effects from Recreation Uses and Management

Although recreation has minor affects on cover type composition and habitat structure stage, recreation creates noise and disturbances that affect wildlife (see Wildlife Section for details). Motorized recreation that occurs off-trails can degrade and or destroy vegetation and wildlife. Winter recreation, primarily motorized, creates snow compaction that affects the environment beneath the snow and the early season growing conditions for plants underneath the snow. Recreation activities that compact or move snow can change water distributions and timing and change growing conditions for vegetation (Bilbrough C.B., J.M. et al. 2000), (Williams, Brooks et al. 1998), (Neumann and H. G. Merriam 1972) and affect wildlife habitat (Jarvinen and Schmid W. D 1971), (Schmid 1972), (Keddy, Spavold et al. 1979). Changes in snowmelt affect the growth of vegetation at high elevations where snowpack is controlling factor for vegetation growth (Knight, Anderson et al. 1975). Where the snow is compacted on a yearly basis, this can create changes in vegetation patterns that would persist for decades (Knight, Anderson et al. 1975). Further effects of snow compaction are discussed in detail in the Wildlife section and Aquatics section of Chapter 3.

The allocation of different areas to different recreation uses will influence the amount and types of effects from recreation on biological diversity. Those alternatives with the greatest amounts of motorized recreation will be associated with the highest use levels. In order of most potential affects to least based on acres allocated to summer and winter motorized use are: Alternatives A, B, E, C, D FEIS, D DEIS and F.

Effects from Minerals and Oil and Gas Production

Mining activities change vegetation on disturbed sites, create noise and disturbances that can affect wildlife. Mineral activity is presently concentrated in a few scattered areas of the MBNF. The Ferris Haggerty Mine reclamation is on-going in private property within the MBNF forest boundary.

36 CFR §228 requires the mining claimant to file an operating plan or notice of intent for proposed mining activities. The plan must include environmental protection measures. These measures can mitigate most of the potential impacts to biological diversity.

Oil and gas production can also change vegetation on disturbed sites and disturb wildlife. Mitigation measures necessary to protect other resources from ground-disturbing activities are addressed before the lease is issued. Oil and gas development can introduce petroleum products into the environment. Although there are micro-organisms capable of degrading petroleum products on site, these organisms are generally not abundant in the environments of the MBNF. Oil and gas production would have project planning associated with proposals and can have

some of the impacts mitigated through application of standards, guidelines, and project design features.

Future impacts from minerals and oil and gas leasing on biological processes are expected to be minimal based on the low potential for oil and gas development and recent history of minerals development on the Forest. Also, standards and guidelines and site-specific project analyses will mitigate potential adverse effects.

Effects from Travel Management

Many of the effects of travel management on NFS lands is discussed in previous sections of this Biological Diversity discussion. RS 2477, an 1866 statute that offered to grant rights of way over unreserved public lands was repealed in 1976. However rights of way that existed prior to this date may still be claimed. Some counties and western states are claiming RS 2477 rights of way through federal lands. Although, there are not currently any RS 2477 right of way claims for the MBNF. Any claims associated with this statute could influence the amount and type roads and trails on the MBNF.

Cumulative Effects From Land Uses

Most of the forest was used for hunting and gathering prior to the arrival of Euro-Americans. With the arrival of Euro-Americans, land uses changed. The early years of timber harvest before the National Forest was created covered extensive areas of what is now the MBNF. This timber harvest occurred with few, if any constraints. These areas are now progressing through the growth and forest maturation process.

The early mining and water diversions occurred with few constraints upon them. Many of these areas have exhibited major recovery and revegetation. Certain areas can still be found where there is little, if any recovery from the disturbance.

There is very little historical oil and gas production on the forest. Eleven exploratory wells, all plugged and abandoned, were drilled on the Forest between 1954 and 1983. In 1995, the MBNF had 12 active oil and gas leases all of which expired without drilling activity by the year 2000. There are presently no oil and gas leases on the MBNF. The Forest has experienced limited seismic exploration, and received a proposal for seismic exploration on the eastern portion of the Snowy Range in 2002.

All of the Forest is allocated to some type of land use. Some uses such as backcountry non-motorized recreation have minimal impacts to biodiversity. The acres allocated to Research Natural Areas will have the fewest cumulative land uses. Alternatives F and E, in decreasing order, provide the greatest allocation to Research Natural Areas. Alternatives B, C, A, D DEIS and D FEIS will have the greatest number of acres affected by land uses.

Introduction of non-native and invasive species tend to destabilize plant communities and ecosystem processes. Land uses that disturb vegetation and create bare ground, can provide both the seed source and the available site for noxious weeds and

invasive species. Currently there are 36,014 acres (3.3% MBNF), known to be infested with noxious weeds. Those alternatives that maintain the greatest amount of acres in roads, trails, and developed sites will have the greatest on-going infestations of noxious weeds and invasive species. Alternatives A and B and the benchmark Alternative H provide for high levels of motorized and mechanical land uses.

The allocation of lands to different management areas and their associated uses will influence ecosystem patterns and processes. The allocation of land to management areas varies among the different mountain ranges of the MBNF. The Snowy Range will have highest levels of MAs with emphasis on human disturbance processes. Alternative C has the greatest Allocation of MAs that emphasize human disturbance processes on the Snowy Range. The Sherman Mountain Range (Pole Mountain) has the fewest differences in allocations among the alternatives.

Since the forest ecosystems on each mountain range are relatively isolated from each other, migration and/or dispersal of wildlife is not assured between mountain ranges. The Snowy Range and Sierra Madre are immediately adjacent to National Forest System Lands in Colorado which provide for migration and dispersal of some species. The Sherman Mountain Range (Pole Mountain) and the Laramie Peak Range are considered extensions of the Colorado Front Range but are not connected to Colorado Front Range by continuous forest ecosystems or by similar ownership patterns (NFS or other federal land agencies).

Management scenarios and natural process associated with different management areas could create changes in migration or dispersal habitat specific to a mountain range that would not be readily mitigated or compensated for by management scenarios on other mountain ranges.

Alternatives that have an array of management scenarios on each mountain range are least likely to create changes that are all of the same direction or pattern. If features about management actions or scenarios (repeatedly creating the same effect) pose a currently unknown risk to wildlife or plants, then risks would be mitigated by more diverse management scenarios.

Alternative F followed closely by Alternatives D DEIS and E, which display the most balanced distribution of MA with emphasis on human or natural disturbance processes across all four mountain ranges. Alternative D FEIS displays reduced Renewable Resource Management and reduced Special Designation Management allocations on Laramie Peak from the D DEIS, otherwise it is similar to D DEIS.

Ongoing projects on state land within or adjacent to the MBNF such as timber harvest and or prescribed burning can change vegetation patterns on these lands and change the context (fragmentation, connectivity, edge effects) of vegetation on the MBNF. Proposed land exchanges would serve to consolidate ownership patterns reducing some of these effects and transferring other effects to the exchanged parcels and the surrounding NFS lands.

Proposed transmission corridors could create permanent openings in forested stands and changed the context (fragmentation, connectivity, edge effects) of surrounding vegetation. Transmission corridors through grasslands, shrublands and forestlands can create pathways for non-native and invasive species to move into new areas.

Single Species Analysis

This Single Species Analysis discloses the viability determinations of selected species that have been determined to require special attention due to unique habitat requirements or threats to their continued viability.

These species, their individual habitat requirements and threats and the analysis of how well each EIS alternative provides for those requirements or mitigates those threats is analyzed in Appendix I and summarized here. The expected viability of each species was based on a combination of:

- The species' characteristics (abundance, distribution, trend in population, trend in habitat, dispersal ability);
- The species' sensitivity to Forest Service management and activities on the Forest; and
- Management direction in the Revised Plan.

The need to evaluate these species is based on the U.S. Fish and Wildlife Service requirements contained in letters dated October 29, 2001, February 12, 2003 and July 22, 2003, for federally listed and proposed species. The U.S. Fish and Wildlife Service (USFWS) also documented the need to consider species occurring downstream in the Colorado and Platte River systems. The U.S. Fish and Wildlife

In addition to species protected under ESA and regulated by the USFWS, the Rocky Mountain Regional Forester list of Region 2 sensitive species and the viability findings are contained in this chapter.

Summary of Threatened and Endangered Species with Habitat on the Medicine Bow National Forest

Federally listed threatened and endangered species are those plant and animal species formally listed by the U.S. Fish and Wildlife Service under authority of the Endangered Species Act of 1973, as amended. An endangered species is defined as one, which is "in danger of extinction throughout all or a significant portion of its range." A threatened species is defined as one "that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range…" (FSM 2670.5 (81) and FSM 2670.5 (211), respectively). A proposed species is defined as one in which "information now in possession of the FWS (that) indicates that proposing to list the species as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and

threats are not currently available to support proposed rules." (FSM 2670.5). Candidate species are those for which sufficient information on biological vulnerability and threats to support proposals to list them as endangered or threatened is on file and that a finding for listing is warranted, but a proposed rule is precluded at this time by work on other higher priority listing actions.

Threatened and endangered species that occur on the forest are the Canada lynx, the bald eagle, and Preble's jumping mouse. The following table displays information about the viability finding for each of these species.

Table 3-49. Effects determinations for Threatened (T), Endangered (E), Proposed (P) Species occurring on the MBNF by alternative.

Species	A	B	C	D DEIS	D FEIS	E	F
Animals							
Canada lynx (T)	LAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
Preble's meadow jumping mouse (T)	LAA*	LAA*	LAA*	LAA*	LAA*	LAA*	LAA*
Critical Habitat for Preble's jumping mouse	AM	AM	AM	AM	AM	AM	AM
Bald eagle (T)	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA

NE – No Effect; NLAA – Not Likely to Adversely Affect; LAA – Likely to Adversely Affect; NLTJ – Not likely to jeopardize continued existence or adversely modify proposed critical habitat; LTJ – Likely to jeopardize continued existence or adversely modify proposed critical habitat; AM – Adversely modify critical or suitable habitat.

**This determination is based on possible short-term loss of individuals during habitat improvement projects.*

Implementing Alternative A is likely to adversely affect the Canada lynx. Alternative A represents the 1985 Plan, which was developed and approved prior to the lynx listing as a threatened species. It does not contain conservation measures necessary to protect lynx. Alternatives B-F result in a not likely to adversely affect determination for lynx. The "likely to adversely affect" determination for the Preble's meadow jumping mouse and the determination of adverse modification to critical habitat is based on possible short term loss of individuals during habitat improvement projects. Alternatives A-F result in a not likely to adversely affect bald eagle determinations. The detailed assessments of these species are in the Biological Assessment (Appendix I).

Summary of Threatened and Endangered Species that are Extremely Rare or Not Present on the Medicine Bow National Forest

The U.S. Fish and Wildlife Service (USFWS) has documented the need to consider the following species, however these species were found to be extremely rare or not present on the MBNF (Hazlett 1997), (Hazlett 1998), (Burke 2000), (Fertig and Thurston 2003), (Strauss 1996), (Fertig 2002), (Fertig and Beauvais 1999).

Table 3-50. Effects determinations for Threatened (T), Endangered (E) and Proposed (P) species that are extremely rare or not present on the Medicine Bow National Forest by alternative.

Species	A	B	C	D DEIS	D FEIS	E	F
Animals							
Black Footed Ferret (E)	NE	NE	NE	NE	NE	NE	NE
Wyoming Toad (E)	NE	NE	NE	NE	NE	NE	NE
Plants							
Ute ladies' tresses (T)	NPH	NPH	NPH	NPH	NPH	NPH	NPH

NE – No Effect; NLAA – Not Likely to Adversely Affect; LAA – Likely to Adversely Affect; NLTJ – Not likely to jeopardize continued existence or adversely modify proposed critical habitat; LTJ – Likely to jeopardize continued existence or adversely modify proposed critical habitat; NPH – no populations or habitat on MBNF.

**This determination is based on possible short-term loss of individuals during habitat improvement projects.*

The detailed assessments of these species are in the Biological Assessment (Appendix I).

Summary of Species with Habitat Downstream that may be Affected by Activities Altering Water Yield from the Medicine Bow National Forest

The U.S. Fish and Wildlife Service (USFWS) has documented the need to consider the following species that occur downstream of the MBNF in the Platte and Colorado River Basins. The USFWS has taken the position in its Section 7 (ESA) consultations that Federal Agency actions resulting in water depletions are likely to adversely affect the following species and to adversely modify their critical habitat.

Table 3-51. Effects determinations for Threatened (T), Endangered (E) and Proposed (P) species that may be affected by activities altering water yield from the Medicine Bow National Forest by alternative.

Species	A	B	C	D DEIS	D FEIS	E	F
Platte River Species							
Animals							
Whooping Crane (E) and critical habitat	LAA	LAA	LAA	LAA	LAA	LAA	LAA
Bald Eagle (T)	LAA	LAA	LAA	LAA	LAA	LAA	LAA
Eskimo Curlew (E)	LAA	LAA	LAA	LAA	LAA	LAA	LAA
Interior Piping Plover (T) and critical habitat	LAA	LAA	LAA	LAA	LAA	LAA	LAA
Interior Least Tern (E)	LAA	LAA	LAA	LAA	LAA	LAA	LAA
Plants							
Western Prairie Fringed Orchid (T)	LAA	LAA	LAA	LAA	LAA	LAA	LAA
Fish							
Pallid Sturgeon (E)	LAA	LAA	LAA	LAA	LAA	LAA	LAA
Colorado River Species							
Fish							
Colorado Pike Minnow (E) and critical habitat	LAA	LAA	LAA	LAA	LAA	LAA	LAA
Razorback Sucker (E) and critical habitat	LAA	LAA	LAA	LAA	LAA	LAA	LAA
Bonytail (E) and critical habitat	LAA	LAA	LAA	LAA	LAA	LAA	LAA
Humpback Chub (E) and critical habitat	LAA	LAA	LAA	LAA	LAA	LAA	LAA

NE – No Effect; NLAA – Not Likely to Adversely Affect; LAA – Likely to Adversely Affect; NLTJ – Not likely to jeopardize continued existence or adversely modify proposed critical habitat; LTJ – Likely to jeopardize continued existence or adversely modify proposed critical habitat; NPH – no populations or habitat on MBNF.

The detailed assessments of these species are in the Biological Assessment (Appendix I).

Summary of Other Off-Forest Species Subject to Effects

The U.S. Fish and Wildlife Service (USFWS) has documented the need to consider the Ute Ladies' Tresses. It was determined that the Ute Ladies' Tresses and potential habitat only occurs off of NFS lands but may be affected by management actions on the MBNF. (Hazlett 1997), (Hazlett 1998), (Burke 2000), (Fertig and Thurston 2003), (Strauss 1996), (Fertig 2002), (Fertig and Beauvais 1999). In addition, the

Colorado Butterfly Plant, a threatened plant, occurs in similar habitat in similar locations (Burke 2000), (Fertig and Thurston 2003), (Fertig and Thurston 2003).

Table 3-52. Effects determinations for Threatened (T), Endangered (E) and Proposed (P) species that occur off Forest and may be affected by activities on the Medicine Bow National Forest by alternative.

Species	A	B	C	D DEIS	D FEIS	E	F
Plants							
Ute ladies' tresses (T)	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
Colorado Butterfly Plant (T)	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA

The detailed assessments of these species are in the Biological Assessment (Appendix I).

Summary of Candidate Species

The U.S. Fish and Wildlife Service (USFWS) has documented the need to consider the Black-tailed prairie dog, the western yellow-billed cuckoo, the western boreal toad and the slender moonwort which are candidate species. The black-tailed prairie dog is a candidate for federal listing, but no habitat or occurrences are known to occur on the Medicine Bow National Forest.

Table 3-53. Effects determinations for Candidate (C) species by alternative.

Species	A	B	C	D DEIS	D FEIS	E	F
Animals							
Black-tailed prairie dog (C)	NI	NI	NI	NI	NI	NI	NI
Western Yellow-billed Cuckoo (C)	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Western boreal toad (C)	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Plants							
Slender Moonwort (C)	MAII	MAII	MAII	MAII	MAII	MAII	MAII

PVC – potential viability concern; NI – no impact; BI – beneficial impact; MAII – may adversely impact individuals but not lead to trend toward federal listing; LFL- Likely to result in a loss of viability on the planning area, in a trend to Federal Listing or a loss of viability rangewide.

*** The specific causes for declines in boreal toad populations (southern population) in the Medicine Bow N.F. are not yet known; multiple-use activities cannot be included or excluded as contributing factors in the decline.*

The detailed assessments of these species are in the Biological Assessment (Appendix I).

Summary of Sensitive Species that Occur on the MBNF

The need to evaluate these species is based on their occurrence on the Regional Forester's Sensitive Species List (USDA 2003) and their occurrence on the MBNF.

Sensitive species are those plant and animal species, designated by the Regional Forester, whose population viability is a concern on National Forests and Grasslands within the Region. Sensitive species may also be those species whose current populations and/or associated habitats are reduced or restricted or their habitats and/or populations are considered vulnerable to various management activities, and special emphasis is needed to ensure they do not move towards listing as threatened or endangered. This list was updated in late 2003 and species on it are assessed in this section.

The 1993 Regional Sensitive Species Lists and updates to 2001 were used in the DEIS. Species that were analyzed in the DEIS but not included here due to changes in the list are:

- Larimer Aletes (*Aletes humilis*)
- Clustered Lady's-Slipper Orchid (*Cypripedium fasciculatum*)
- Sidesaddle Bladder Pod (*Lesquerella arenosa* var. *argillosa*)
- Alpine Feverfew/Wyoming Feverfew (*Parthenium alpinum*)
- Laramie False Sagebrush (*Sphaeromeria simplex*)
- Dwarf shrew (*Sorex nanus*)
- Ringtail (Bassariscus astutus)
- Common Loon (*Gavia immer*)
- Osprey (Pandion haliaetus)
- Merlin (Falco columbarius)
- Greater Sandhill Crane (*Grus canadensis tabida*)
- Golden-crowned Kinglet (*Regulus satrapa*)
- Fox Sparrow (Passerella iliaca)
- Brown Creeper (Certhia americana)
- Pygmy Nuthatch (*Sitta pygmaea*)
- Tiger salamander (*Ambystoma trigrinum*)

There are 27 animals, 5 fish, 1 mollusk, 1 insect, and 24 plant species that are known to occur or are documented in the vicinity of the MBNF and similar habitat occurs on the MBNF (Mills and Neighbours 1995; Scholl and Smith 2001).

A description of each species and what is known of the current and historical distribution of that species on the Forest in included in Appendix I Biological Evaluation. Sighting locations on the Forest were mapped on the GIS computer mapping system with assistance from the Wyoming Natural Diversity Database,

Wyoming Game and Fish Department, among others. The sighting records are included in the planning record.

Sensitive species known to occur, suspected to occur, or which have occurred on the Forest were refined from the Regional Forester's list (USDA 2003), based on information obtained from the Wyoming Game and Fish Department, the Wyoming Natural Diversity Database and others.

Species that are listed on the Regional Sensitive Species list are analyzed in detail in the Biological Evaluation (Appendix I). Many species are predicted to be affected by all alternatives at either the "no impact" or the "may adversely affect individuals but not lead to a trend toward federal listing" level. The habitat restoration emphasis in Alternative E or the increase amount of natural processes in Alternatives F, D DEIS, D FEIS, C, and E, in decreasing order may have a beneficial effect on a few species tied to ponderosa pine or post-fire habitat.

The expected outcomes for alternatives on wolverine were assessed in terms of "contribution to viability of the larger population," since the habitat on the Medicine Bow National Forest is not large enough to support a viable population of wolverines.

The sensitive amphibians (wood frog and northern leopard frog) are considered of viability concern on the Forest. However, this determination arises from the global declines in amphibians for uncertain reasons and the local presence of chytrid fungus (*Batrachochytrium dendrobatidis*). It is not clear that Forest Service actions are contributing to the decline of these species. Apart from habitat protection and attempts to reduce transmission of disease by humans, it is not clear what can be done to improve the likelihood of persistence of these species.

For some species (like bats and shrews), there is a lack of basic information (like presence/absence or distribution on the forest). This contributed to the low estimate of "certainty" associated with the predicted outcomes for those species. (See Appendix I for more information on estimates of certainty.) For other species (such as subnivian small mammals), the effects of management are not fully known.

For species such as marten, goshawk, boreal owl, and downed-wood-dependent species acres of treatment and natural processes were modeled, but the cover type and the spatial and temporal pattern of these disturbances were not. As a result the certainty associated with the persistence of two species (northern goshawk and American marten) is classified as "very low" for some alternatives. (See Biological Evaluation – Appendix I for details).

The effects to each sensitive species by alternative are summarized in the following table.

Table 3-54. Impact determinations for sensitive species occurring on the MBNF by alternative.

	Alternatives						
Sensitive Species	**A**	**B**	**C**	**D DEIS**	**D FEIS**	**E**	**F**
Mammals							
Pygmy shrew	MAII*	MAII*	MAII*	MAII	MAII	MAII	MAII
Fringed myotis	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Townsend's big-eared bat	MAII	MAII	MAII	MAII	MAII	MAII	MAII
American marten	LFL	MAII*	MAII*	MAII	MAII	MAII	MAII
Wolverine	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Northern River Otter	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Birds							
Northern goshawk	MAII*	MAII	MAII*	MAII	MAII	MAII	MAII
Ferruginous hawk	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Peregrine Falcon	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Northern Harrier	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Columbian sharp-tailed grouse	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Greater Sage Grouse	MAII	MAII	MAII	MAII	MAII	MAII	MAII
White tailed Ptarmigan	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Mountain plover	NI	NI	NI	NI	NI	NI	NI
Boreal owl	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Short-eared Owl	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Flammulated owl	MAII	MAII	MAII	MAII	MAII	MAII/BI	MAII
Yellow-billed Cuckoo	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Lewis' woodpecker	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Black Backed Woodpecker	MAII*	MAII*	MAII*	MAII	MAII	MAII	MAII
American Three-toed woodpecker	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Olive-sided flycatcher	MAII	MAII	MAII	MAII	MAII	MAII	MAII/BI

	Alternatives						
Sensitive Species	**A**	**B**	**C**	**D DEIS**	**D FEIS**	**E**	**F**
Brewer's Sparrow	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Sage Sparrow	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Loggerhead Shrike	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Amphibians							
Northern leopard frog	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Wood frog	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Fish							
Colorado River cutthroat trout	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Mountain Sucker	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Flannelmouth Sucker	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Hornyhead Chub	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Plains Minnow	NO	NI	NI	NI	NI	NI	NI
Insects							
Hudsonian emerald	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Mollusks							
Rocky Mountain capshell	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Plants							
Laramie columbine	NI	NI	NI	NI	NI	NI	NI
Park milkvetch	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Leathery grape-fern	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Lesser panicled sedge	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Bristly-stalked sedge	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Livid sedge	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Yellow ladies" slipper	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Round leaf sundew	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Boreal spikerush	MAII	MAII	MAII	MAII	MAII	MAII	MAII

	Alternatives						
Sensitive Species	**A**	**B**	**C**	**D DEIS**	**D FEIS**	**E**	**F**
Slender-leaved buckwheat	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Slender cotton-grass	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Hall's fescue	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Rabbit ears gilia	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Simple kobresia	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Colorado tansy-aster	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Kotzebue's grass of parnassus	MAII	MAII	MAII	MAII	MAII	MAII	MAII
White larchleaf beardtongue	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Rocky Mountain cinquefoil	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Nagoon berry	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Silver willow	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Autumn willow	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Low spike-moss	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Lesser bladderwort	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Great spurred violet	MAII	MAII	MAII	MAII	MAII	MAII	MAII

PVC – potential viability concern; NI – no impact; BI – beneficial impact; MAII – May adversely impact individuals, but not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing or a loss of species viability rangewide; LFL- Likely to result in a loss of viability on the planning area, in a trend to federal listing, or in a loss of species viability rangewide. NP -- Not present.

* *Very high levels of uncertainty are associated with the outcome.*

The detailed assessments of these species are in Appendix I --Biological Evaluation.

Summary of Species of Local Concern that Occur for the MBNF

In addition to species that are sensitive at the Regional scale, each Forest has the discretion to consider assessing species that may be of "local concern." These species may be doing very well on some administrative units, but be less successful on others and in need of careful attention. Local endemics, even if not known to be at risk, may be worth added analysis if small population size and/or isolation make the populations vulnerable. The following species will be prioritized for collecting information about their distribution on the Forest:

- Pika
- Bighorn sheep
- Brown-capped rosyfinch
- Brown creeper

We have occurrence information about the following plant species of local concern. Goals, objectives, strategies and standards and guidelines will result in protection of these species during ground disturbing activities.

Moschatel
American alpine lady fern
Dissected bahia
Alpine kittentails
White river kittentails
Clustered lady slipper
Showy draba
Flat-top fragrant goldenrod
Bigelow's prairie gentian
Oak fern
Thread rush
Northern white rush
Narrowleaved bladderpod
Bigelow's grounsel
Slender-leaved lovage broad-leaved twayblade
Marsh felwort
Saffron groundsel
Streambank groundsel
White scorpion-weed
Rocky Mountain phacelia
Flatleaf pondweed
Western goldenweed
Porter's aster
Western trillium
Squashberry

Noxious, Invasive, and Non-native Species

Introduction – Non-native plant and animal species can adversely affect species composition and ecosystem structure/function. Non-native wildlife and fish species can displace native species in ecosystems, can compromise their population viability across a landscape, or even potentially affect native species resulting in a trend toward listing as threatened or endangered. This can occur in both terrestrial and aquatic ecosystems These species can be plants or animals, but, currently, non-native plants are the biggest threat to the resource values on the Forest.

Under certain conditions, some plant and animal species cause unacceptable economic or environmental damage. As a result, management activities on National Forest System lands sometimes include control and management of damage caused by noxious weeds and non-native plants and animals.

Non-native plant management on the Forest is coordinated with county vegetation management efforts. In the future, if non-native animal species become an issue, management would be closely coordinated the Wyoming Game and Fish Department and the Colorado Division of Wildlife (if applicable).

Legal and Administrative Framework

The following laws and policy and direction from the Forest Service Directives System in Forest Service Manuals (FSM) and Forest Service Handbooks (FSH) pretaining to control and management of noxious and non-native species are listed here but not limited to:

- Federal Noxious Weed Act of 1974
- February 3, 1999 Executive Order on Invasive Species
- FSM 2060 Ecosystem Classification, Interpretation, and Application
- FSM 2070 Biological Diversity
- FSM 2080 Noxious Weed Management
- FSM 2150 Pesticide-Use Management and Coordination
- FSH 2090.11 Ecological Classification and Inventory Handbook
- FSH 2109.14 Pesticide-Use Management and Coordination Handbook
- FSH 2509.13 Burned-Area Emergency Rehabilitation Handbook
- Wyoming State List of Noxious Weeds

Key Indicators

- Acres infested with noxious weeds
- Acres of noxious weeds treated

Resource Protection Measures

Many invasive plants (such as smooth brome or Kentucky bluegrass), though not necessarily considered noxious, can convert native vegetation to non-native species associations.

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 and onto lands adjacent to National Forest System 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 National Forest System 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.

Forest plan standards and guidelines are designed to maintain and improve natural vegetative conditions and native plant and animal communities and habitats.

The Forest will continue to conduct a noxious weed management program that will minimize the spread of state-listed species that implements an integrated program focusing on prevention, early detection, and timely treatment of priority species.

AFFECTED ENVIRONMENT

Noxious Weeds

Noxious weeds as officially defined are plants designated thusly by the Secretary of Agriculture or by the responsible State official and that generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease, and is new to or not common to all or part of the United States. In a general sense, they are plants that are usually not native to the area in which they are growing and whose growth is so rapid, dominant, or toxic that they out-compete native plants, often taking over complete sites or ecosystems over time. They seldom have any natural predators, hastening their spread. They are usually forbs, but also include grasses (downy brome, crested wheatgrass), shrubs (caragana), and trees (saltcedar, Russian olive).

Noxious weeds alter plant composition and are detrimental to ecosystem functions and processes such as nutrient cycling and energy flow. Soil texture is changed, affecting soil moisture regimes. Serious weed infestations degrade soil stability. Surface runoff and sediment yield can be increased substantially.

Noxious weeds most commonly get established in areas where ground-disturbing activities (coupled with import of non-native seed) have occurred and created even very small areas of bare soil and where a seed source is already present or in some

way is brought in to the area. Once established, they often spread into adjacent stands of native vegetation. Areas where noxious weeds are expected to occur in higher densities are road systems, timber harvest skid trails and decking/landing sites, campgrounds, recreation trails and trailheads, areas of livestock concentration, concentrated wildlife use areas such as wintering grounds, utility corridors, mineral development sites, water transportation ditches, and stream systems.

The last forestwide effort to inventory noxious weeds was completed in 1995. Results from that inventory showed nine species infesting over 36,000 acres.

Table 3-55. Summary of noxious weed species present on the Forest (1995).

Noxious Weed Species	Priority for Treatment *	Brush Cr–Hayden RD	Laramie RD	Douglas RD	Forest Total
Leafy Spurge	1	160		2,420	2,580
Spotted Knapweed	1	2		600	602
Yellow Toadflax	1	505	125	55	685
Dalmatian Toadflax	1		300		300
Hoary Cress (Whitetop)	2	5			5
Musk Thistle	2	4,620	255	1,000	5,875
Houndstongue	3	50	25	60	135
Canada Thistle	3	15,700	3,120	6,862	25,682
Common Burdock	3			150	
Total Acres		21,042	3,825	11,147	36,014

* Priority 1 indicates weeds of highest priority for treatment and possible eradication. Prevention of establishment from adjacent lands is given the highest priority.

Priority 2 indicates weeds that are increasing; efforts are to prevent new infestations and to contain or reduce existing populations.

Priority 3 indicates weeds that are so common and widespread that eradication is no longer possible.

Overall, weed populations have probably increased by at least 10% in the last seven years. New species and locations are mapped when they are located, and acreages of old populations are updated as they are treated, but an updated forestwide inventory has not been conducted. It is currently possible to treat about 1,000–1,500 acres each year, using the above guidelines to set management priorities.

Brush Creek/Hayden District: Since the 1994-1995 wide-scale inventory, a number of new spotted knapweed populations have been discovered, and ox-eye daisy has rapidly expanded its number of infested acres in and along the highway right-of-way from below Ryan Park to several miles above the Forest boundary.

Laramie District: Leafy spurge has been aggressively treated near the North Platte River, preventing further expansions in the water-influence zone. Isolated stands of hoary cress and St. Johns wort have been located. Dalmatian toadflax populations have exploded on Pole Mountain. Caragana is invading riparian zones.

Douglas District: Canada thistle populations increased exponentially after the Murphy Ridge fire. Yellow toadflax populations are expanding. Purple loosestrife has been found invading a riparian area on adjacent private lands.

Recreational horse use has contributed extensively to population expansions and new weed infestations in the past, some of that noticeably in wilderness areas. Many users, especially during hunting seasons, would bring in their own hay for feed rather than rely on the presence of existing, native forage; if the hay contained weed seed or plant parts, new populations were often started.

A statewide Weed-Free Hay Closure Order for all National Forests, signed by the Regional Forester in 1994, restricted the use of hay and other forage items such as pellets and cubes to products certified to be free of noxious weeds. New and expanding weed populations in designated wilderness areas from recreational users and outfitter/guides were of particular concern since they can eliminate native plants and compromise the wilderness character and resource values. The Weed-Free Hay Closure Order has been very successful in preventing new infestations.

An environmental assessment for Management of Noxious Weeds, completed in 1996, uses an integrated management approach: manual and mechanical treatments, herbicide application, and use of biological agents (such as insects and goats) (USDA Forest Service 1995b). Management and control efforts, also conducted by Forest employees, are spearheaded by cooperative efforts with three County Weed and Pest Control Districts and follow direction set forth in the USDA, Forest Service Guide to Noxious Weed Prevention Practices.

Prevention and education efforts have been stepped up, both for members of the public as well as identification techniques for Forest employees. Noxious weeds are introduced, and spread, in any number of ways: spring runoff; wind; wildfire; birds; big game and other wildlife; livestock; seeds and plant parts brought in or transported on road maintenance, fire control, and timber harvesting equipment; innocent gardeners trying a pretty new variety in their spring flower bed (yellow toadflax, oxeye daisy, camomile, purple loosestrife); and recreationists and recreational vehicles of all kinds. The greatest expansion of weed populations occurs along highways and Forest roads.

Fire-fighting equipment coming in from all over the country now routinely are washing undercarriages at municipal or portable wash stations. Timber sale contracts require similar cleansing of equipment coming in from areas known to contain noxious weed populations (USDA Forest Service 2000c). Reseeding efforts after ground-disturbing activities such as fire, road construction, and timber harvest require the use of seed (and mulch) to be free of noxious weed seed (or plant parts). A Weed-Free Hay Closure Order, in effect statewide since 1994 for all National Forest System lands, restricts the use of hay and other forage items such as pellets and cubes to products certified to be free of noxious weeds (USDA Forest Service 2000c). It has been markedly successful in preventing new infestations

New and expanding populations in designated wilderness areas are of a particular concern since they can eliminate native plants and compromise the wilderness character and resource values. On-going management approvals are in place for noxious weed treatment in Savage Run and Platte River Wilderness Areas.

Informing people as to the identity, methods of spread, and undesirable/dangerous results of noxious weeds in ecosystems remains the single most effective way to prevent or control expansion of non-native plants on the Forest. Management and treatment efforts continue to be carried out, targeting the most explosive and competitive species first in the attempt to maintain the diversity of native species in forest and rangeland vegetation.

Summary of Existing Condition: Noxious weed populations on NFS lands have probably increased by at least 10% in the last seven years. They are introduced, and spread, in myriad ways. These weeds replace native plants and can jeopardize whole ecosystems—natural vegetation in wilderness areas, riparian zones, native meadows, roads and trails. Prevention and education efforts—as well as an integrated management system of biological, chemical, manual, and mechanical control—are absolutely essential to controlling their establishment and spread.

Invasive and Non-Native Plant Species

The Kentucky bluegrass cover type represents areas where non-native vegetation is the dominant cover. This grass cover type currently occupies 0.1% of the MBNF. In addition, non-natives may be present in other cover types but do not make up the dominant cover. Other cover types noted to have non-natives present include sagebrush, willow, wheatgrass, fescue and other grasses (Knight 1994; Jones and Ogle 2000). Busing *et al.* (1999) also note the presence of non-natives in Aspen cover types in the Rocky Mountains. Cheatgrass currently occurs on the MBNF and is noted for changing ecosystem structure and function in sagebrush rangelands in the Great Basin (Billings 1994).

Animals and Fish

Brook trout is an example of a non-native species that significantly impacts native fish populations. Coordinated management with WG&F and CDOW is extremely necessary to minimize the effects on native species as well as T/E/S species.

ENVIRONMENTAL CONSEQUENCES

Noxious Weeds

General Effects

Noxious weeds are generally plants not native to the area in which they are growing and whose growth is so rapid, dominant, or toxic that they out-compete the native plants, often taking over complete sites or ecosystems over time. They most commonly get established in areas where ground-disturbing activities have created even very small areas of bare soil and where a seed source is already present or in some other way is brought in to the area. They are introduced or spread by people, vehicles, animals, birds, wind, water, and fire.

Alternative A shows that weed infestations are believed to occupy about 40,000 acres (an estimated 10% increase of the 1995 inventory tally of 36,000 acres); about 1,200 acres can be treated each year. Treatment priority is given to species where infestations are new and eradication is still possible and species where additional infestations can be prevented and existing populations contained.

Alternatives that plan for greater amounts of human presence and human-caused disturbance, and/or that plan for allowing the greatest amounts of natural disturbance, will generally provide the greatest chances for noxious weed species to be introduced and for existing populations to increase further.

Direct and Indirect Effects

Effects from Fire and Fuels Management

Wildfire has the greatest potential of any use or activity to spread noxious weeds, simply because of the sheer number of acres that can be affected by fire. Wildfires and resultant suppression activities often create large areas of bare soil and areas of reduced vegetation cover, both of which provide ideal conditions for weeds to spread rapidly, especially if populations already exist in or adjacent to the burned area.

Suppression and support equipment and crew vehicles brought in from all over the country can carry weed seeds and plant parts on or in vehicles. Portable sprayers are now available to wash undercarriages and equipment so that new infestations will at least be confined to the area of the wash pad facility or base camp and not spread to the entire fire area.

Prescribed fires generally have a somewhat reduced chance of spreading weeds because burns take place under planned conditions and generally create a mosaic of vegetative patterns rather than extensive areas of contiguous blackened acres.

It is common for large acreages of new invasive plant populations to become established after a wildfire event. Burned Area Emergency Rehabilitation (BAER) funds can be requested for weed control, both for suppression and restoration needs.

Generally, the more acres burned by fire, the greater the possibility of spread of existing and new weed species, although effects are nearly always extremely variable, depending on fire regime, behavior, severity, and extent. It is impossible to predict the number and size of wildfires that might be experienced, although alternatives that favor larger acreages of late seral tree stands (E and F) can be expected to increase the potential for more wildfires and thus higher populations of noxious weeds. The use of prescribed fire for fuels treatment and vegetative management is greatest in Alternatives D DEIS, D FEIS, and E, then in B and C. Alternative F has slightly less than current levels of prescribed fire. Although the use of prescribed fire has a reduced chance of spreading noxious weed seeds, most fires still result in new weed infestations.

Effects from Insects and Disease Management

There are no effects associated with the insects and diseases themselves, but if efforts are made to control outbreaks, effects from vehicles/equipment are the same as discussed in Fire Management above.

Effects from Recreation Management

Recreational activities are probably responsible for the greatest annual increase in spread of existing weed populations simply because of the sheer number of people (and their vehicles) that visit the Forest each year (see the discussion under Fire Management above for how weeds are brought in on vehicles). Most of this spread occurs along roads (see Travel Management below). Weed seeds and plant parts are brought in on vehicle undercarriages and tires, off-road vehicles, horse trailers, boots and shoes, camping and fishing equipment, etc. (see the discussion on recreational horse use in Livestock Grazing and Big Game Use below) .

Any activities that create bare or disturbed soil provide ideal conditions for invasive species establishment, including roads and roadsides, trails and trailheads, parking lots, developed and dispersed camping sites, popular fishing locations, heavy-use areas around summer homes, ski runs, and construction areas.

Higher levels of summer recreation use, especially motorized use, increase populations of noxious weeds. Alternative B provides for the greatest amount of backcountry motorized summer use, followed in order by Alternatives A, C, and E, D FEIS, D DEIS, with F last.

Effects from Special Area Allocations

Special area designations tend to reduce the amount of use by people and associated disturbances (except perhaps in wild and scenic river corridors), so generally the possibility for introduction and spread of noxious weeds is less in these areas (barring natural disturbance). Alternative E has the greatest amount of special areas, followed in order by F, D FEIS, D DEIS, B, and C. Alternative A has the least.

Effects from Travel Management

As discussed under Recreation Management above, most of the spread of noxious weeds takes place along roads. Personnel on the White River National Forest have stated they can control 90% of the noxious weed expansions and introductions on the Forest each year by managing just the weeds in roads and road rights-of-way.

Unauthorized off-road vehicle travel has a high potential to introduce weed populations into new areas. Alternative B provides for the greatest amount of backcountry motorized summer use, followed in order by Alternatives A, C, and E, D FEIS, D DEIS, with F last.

Decommissioning of roads has the effect of reducing areas populated by weeds – in the long run (the actual effort to put them "to bed" increases areas of bare soil and favorable growing conditions in the short run). In all alternatives, the miles of road decommissioned is greater than the number of miles constructed or reconstructed. The alternatives with the highest number of miles planned for decommissioning are F and then E; all other alternatives have constant miles planned. Decommissioned and old roads still require regular monitoring due to any remaining disturbance and the past import of seeds.

Effects from Facilities Maintenance

Road maintenance activities also tend to increase noxious weeds; blading through existing weed populations can move plant parts to new locations, allowing them to start new infestations. Knowledge of which species can expand in this manner, and controlling them first or avoiding them during road blading, can help to reduce the impact. Alternatives D DEIS, D FEIS, and E provide for the highest miles of roads maintained annually, followed by equal, but lower, miles in A, B, and C; Alternative F has the lowest miles of roads maintained annually.

Effects from Wilderness Management

Treatment of weed populations in wilderness areas must be accomplished without the use of motorized or mechanized equipment. The preferred method of treatment is often pulling or hand-grubbing the plants, packing them into plastic bags, and hauling them from the area. However, control or eradication is only possible for a small minority of the species using this method because the deep-rooted perennial nature of most species requires the use of herbicides for successful long-term management. Backpack or pannier-loaded horseback sprayers are often the most effective method available. Noxious weeds replace native plant species and are capable of invading or eliminating whole plant communities, completely compromising wilderness values. The key is annual treatments when originally-discovered populations are small, and attempting to eradicate them from the area. Following process and direction in the "Weeds in Wilderness Guidebook," Region and Forest wilderness managers review and approve herbicides as a management tool in wilderness.

Recreation use often increases when wilderness areas are formally designated; with increased human use comes the potential for increased weed populations. Alternative F has the greatest amount of existing and recommended wilderness, followed by D DEIS, D FEIS, and E. Alternatives A and C retain the same amount of wilderness as at present; B is less than current acres.

Effects from Roadless Area Management

The effects are very similar to those for Special Area Allocations (see above). Designation as roadless may reduce long term import of seed via vehicles, but also increases the complexity of management of roadless area existing weed populations.

Alternative E has the greatest amount of acreages retained as roadless, followed by D DEIS, D FEIS, F, C, and A. Alternative B reduces slightly the acres of roadless areas remaining at present.

Effects from Heritage Management

In general, there are no effects from heritage management. However, if known sites are evaluated (involving soil disturbance through pit excavations, for example) for possible nomination to the National Register, noxious weeds could be brought in by people and vehicles during operations and could infest the site(s). In general, the effects from managing heritage resources are anticipated to be very minor in scope or acreage and will be consistent across all alternatives.

Effects from Mineral and Energy Development

Effects are similar to those for Recreation (see above) if mineral operations or leases result in exploration activity and if sites go into production. Production sites (including frequent presence of maintenance vehicles) as well as installation of pipeline collection or delivery systems all create areas of disturbed soil, providing ideal sites for noxious weed infestations. All alternatives provide for a greater degree of possible mineral development and leasing than exists at present, with Alternative B having the most acres open to mineral development and leasing (97% of Forest acreages), followed in decending order by Alternatives C, D FEIS, D DEIS, E, and F.

Effects from Utility Corridors

Installation of overhead voltage lines and buried electric, cable, telephone, or other utility system lines creates areas of bare soil and effects similar to Mineral and Energy Development. In general, effects are consistent across all alternatives.

Effects from Livestock Grazing and Big Game Use

Permittee livestock—cattle, sheep, and horses—can introduce noxious weeds by transporting seeds in their hair/wool or in digestive systems if coming from or trailing through an area already infested with weeds. Similarly, they can start new

populations by ingesting plants and moving seeds to new areas through fecal deposits; this more often occurs with horses and sheep who will consume several species, like thistles, after seedheads are already produced.

Horses used by outfitter/guides can also be a source of weed delivery from infested private lands, and new populations can be started at their camps and in the areas and along the trails they are permitted to use. Special Use Permit clauses require that operators comply with the regional weed-free hay closure order (Noxious Weed Implementation Plan).

Livestock can also be used as a very effective control method for some noxious weeds. Goats are the most notable example. Having been trained to prefer certain species, they are extremely effective in reducing leafy spurge. Cattle are effective in reducing Canada thistle populations in some areas as they prefer to graze the plant just as it begins to flower, thus preventing seedset.

Livestock grazing levels are highest in Alternative A, followed by B, C, D DEIS, D FEIS, and E, and F has the lowest.

Big game animals can introduce and spread noxious weeds in the same way that domestic livestock can—by ingestion or by carrying seeds in hair and fur. Overall, the effect from big game is probably far larger since Wyoming Game and Fish population estimates indicate about 5-6 times as many big game animals use the Forest as do domestic livestock.

Big game populations may be largely independent of alternative because the Forest provides summer range, which is seldom the limiting factor in population numbers. However, since the animals need both food and cover elements in their habitat, alternatives providing a mixture of both forage and cover enhancement opportunities may provide better overall big game habitat and possible higher numbers: Alternative C would be highest, followed by D DEIS, D FEIS, E, A, B, and F.

Effects from Rangeland Vegetation Management

The combined acres of vegetative treatment for rejuvenating aspen, maintaining native meadows, and treating sagebrush and other shrublands to improve wildlife habitat will remain mostly constant across all alternatives. However, projects that create possible areas of bare soil—prescribed fire in aspen or ponderosa stands or mechanical treatment for conifer encroachment—create the possibility of introducing or expanding noxious weed populations; in such cases, mitigation is required to prevent or control weed populations.

Effects from Forest Vegetation Management

Activities associated with timber harvest create areas of disturbed or bare soil. Skid trails, decking and landing sites, and areas treated with dozers or roller-choppers for reforestation efforts create opportunities for noxious weeds to start or expand.

Timber sale contracts require cleansing of equipment coming in from areas known to contain noxious weed populations, and may be applied to log haul trucks, skidders, and other off-road equipment as needed. Any reseeding efforts after harvest require the use of seed (and mulch) free of noxious weed seed (or plant parts).

The order of the alternatives with timber harvesting activies, from most to least, are: B, followed by D DEIS, C, A, D FEIS, E, and F.

Effects from Land Exchanges

Land exchanges could result in a potential loss or gain of noxious weed infestations on the federal lands, depending upon the size and location of the exchange and whether either the offered or selected lands contained existing populations.

In general, there will be little effect from possible land exchanges, and little or no variation across the alternatives. However, if an exchange results in a subdivision, or development where human activity will be greatly increased, the likelihood of new infestations of noxious weeds will also be greatly increased.

Effects from Wildlife and Fisheries Management

Wildlife species, in general, can transport noxious weed seeds in the same ways big game and livestock can. Some species of birds make it possible for certain plant seeds to germinate by first passing through their digestive tracts; in such instances, the seeds are unable to germinate without going through this process (called scarification). Animals may collect and store weed seeds such as thistles, contributing to expansion of populations as they germinate in future years.

Wildlife or fisheries enhancement projects that disturb the soil surface (such as fish structures) can increase weed populations. However, there will generally be little effect from such projects and little variation across the alternatives.

Effects from Threatened/Endangered/Sensitive Species Management

Management of TES species will have a consistent effect on noxious weed introductions and possible population expansions for all alternatives, unless the habitat needs for a specific species were to require management (and possible ground disturbance) for early seral conditions that could result in increased weed acres. In general, the habitat requirements in and around each known or discovered TES species location will be protected, restored, or enhanced.

Effects from Species Viability Management Requirements

In general, management to meet the needs of the full range of species will be consistent across all alternatives. However, effects would be similar as for TES species management stated above if any efforts involve ground-disturbing activities.

Effects from Soil and Watershed Management

Soil and watershed restoration or improvement projects are designed to improve condition of the land – in essence to repair or restore areas of disturbed conditions. There could be a greater disturbance to the land in the short run as the project/treatment is implemented – which could also increase the possibility of noxious weed expansions – but overall reduction in areas of bare soil should occur in the long run. The greatest number of soil and water improvements is planned in Alternative B, followed by C, D DEIS, D FEIS, E, and A; F plans the least. Alternatives E and F plan the greatest amount of stream or riparian restoration, then D DEIS and D FEIS; A and C are next; and B plans the least.

Effects from Social and Economic Considerations

Noxious weeds are very expensive to treat, with costs that can easily exceed a hundred dollars per acre in accessible areas and 3 to 4 times that in remote or wilderness locations. Of even greater concern is the loss of native species diversity and lost productivity in native plant communities, riparian areas, or even hay and cultivated fields that can result from expansive weed populations. Alternatives with the greatest potential for exansion of weed populations, and needed treatment, create the greatest potential economic impact and social concern; in order, from greatest to smallest, they are Alternative C and B. Alternatives A, D DEIS, D FEIS, and E all have moderate amounts, while Alternative F has the least.

Effects from Communities of Interest

It is important to communities that noxious weeds be treated and that weed populations on the Forest not be allowed to infect adjacent and downstream private lands (as it is equally important that coooperative efforts prevent private land infestations from migrating to federal lands). This is especially true for counties and communities dependent upon irrigated crops. They cannot afford to have leafy spurge, Canada thistle, purple loosestrife, and similar water-loving noxious weeds infesting irrigation systems and being spread throughout thousands or tens of thousands of acres of irrigated crop and hay lands. Effects are and alternative comparisons are similar to those for Social and Economic Considerations above.

Cumulative Effects

Certain noxious weed populations like Canada thistle will almost certainly continue to expand, regardless of the alternative chosen, due to natural increase of existing populations from all the complex ways these species are spread. However, other species like leafy spurge, oxeye daisy, and other species that occupy limited area (plus other species that are not yet here) will be managed to the extent possible to stop the spread.

Existing noxious weed populations will continue to spread onto adjacent or intermingled private and other agency lands; similarly, populations from other-

ownership lands will continue to spread onto the Forest. Both conditions require coordination with country weed and pest offices to manage populations and their effects regardless of land ownership and property boundaries.

Alternative C has the greatest possibility for spread of weed infestations with its focus on increased recreational activities while maintaining mostly current levels of commodity production. Treatment needs are estimated at 1,600 acres per year, a 25% increase over current levels.

Alternative B is estimated to increase populations and treatment needs by about 15% because of a slight increase in commodity production while maintaining high levels of recreation opportunities.

Alternatives D DEIS, D FEIS, and E, with slightly more balanced mixes of all multiple use activities and values, are expected to be about the same as Alternative A with the rate of spread of weed populations and resultant needed treatment (current estimated populations cover 40,000 acres, with an annual treatment of 1,200 acres).

Alternative F is estimated to have the lowest noxious weed population expansion rates and need for treatment over time – with a possible 15% reduction from current levels. This is because of a substantial reduction in commodity outputs as well as recreation opportunities, and a large increase in special area allocations with areas of reduced human activity and use. A more aggressive wildfire control program will limit expansion areas and minimize weed risk in the short term, the gradual buildup of fuels over time will result in eventual large, severe fires which will be more detrimental in terms of weed risk.

Invasive and Non-native Plant Species

Introduction of non-native and invasive species tends to destabilize plant communities and ecosystem processes. Some non-native species are simply competitive with native species; others secrete allelopathic substances that are toxic to other plants and can remove native vegetation from the site.

Land uses that disturb vegetation and create bare ground, can provide both the seed source and the available site for invasive species. Alternatives that maintain the greatest amount of ground in roads, trails and developed sites will have the greatest on-going infestations of (noxious weeds) and invasive species. Alternatives A and B provide for high levels of motorized and mechanical land uses.

Renewable resource uses that have project planning associated with them can have impacts mitigated through application of standards, guidelines and project design features. Grazing impacts can be mitigated through review and modification of annual operating plans. Recreation use does not undergo project planning. However, areas, roads, trails, or sites can be closed when there is apparent resource damage. There are few standards and guidelines to mitigate the effects of recreation.

Fire and Fuels Management

Introduction: The Fire Management program for the Medicine Bow National Forest has two broad goals:

1. Protect and enhance resources by reducing the risk of unplanned and unwanted wildland fire through wildfire prevention/education programs, fuels treatment, prescribed fire, and implementation of the appropriate management response to all wildland ignitions.
2. Meet Forest management goals and objectives with the use of prescribed fire and the management of natural fires.

Fire is thought to be the most significant natural disturbance agent in high elevation forests of the Rocky Mountains (Dillon and Knight 2000). Wildfire has been an important influence on the structure, density, species composition, and age of shrubland and forest vegetation throughout the Medicine Bow National Forest.

An accurate and detailed description of "natural" fire regimes is difficult because we lack detailed fire histories for a large extent of the Medicine Bow National Forest. However, some local research on fire occurrence and fire history (Von Ahlefeldt and Speas 1996) and historic range of natural variation (Dillon and Knight 2000) is available. In addition, there is an abundance of literature describing fire regimes for vegetation types found throughout the Rocky Mountains.

Prescribed fire has been used on the Forest for the past several decades. Acreage burned annually has varied widely, from lows of a few hundred acres to more than 2,000 acres. Historical burning has been implemented to meet a variety of resource objectives, including fuels reduction, wildlife habitat improvement, rangeland improvement, etc. Most burning has taken place in the many shrubland communities on the Forest, with a limited amount of understory burning in ponderosa pine vegetation types.

In response to the National Fire Plan, the Forest is currently placing emphasis on the planning and implementation of fuels treatments in Wildland Urban Interface (WUI) areas. The wildland fire threat to homes is commonly termed the wildland urban interface. This term refers to an area or location where a wildland fire can potentially ignite homes. In its simplest terms, the fire interface is any point where the fuel feeding a wildfire changes from natural (wildland) fuel to man-made (urban) fuel. For this to happen, wildland fire must be close enough for its flying brands or flames to contact the flammable parts of the structure (Cohen, 1999). A list of at-risk communities, identified by the State of Wyoming and the Forest is listed in the Environmental Consequences section below.

The Medicine Bow National Forest has recently updated its Fire Management Plan. The 1985 Medicine Bow National Forest Land and Resource Management Plan does not provide opportunities for wildland fire use (the management of natural ignitions to meet resource objectives). It is anticipated that upon the signing of the Record of Decision of this forest plan revision, the current Fire Management Plan will be updated and opportunities for wildland fire use/appropriate management response will be addressed across the forest. The ROD is the decision document for the appropriate management response identified for each management area, and the Fire Management Plan is the implementation document.

Currently, all wildland fires receive an immediate initial attack response. The Forest is served by two interagency dispatch centers. The Casper Dispatch Center located in Casper, Wyoming serves the Douglas Ranger District and Thunder Basin National Grassland. The Rawlins Dispatch Center serves the Laramie and Brush Creek/Hayden Ranger Districts.

Changes between Draft and Final

The same models were used in the final as were used in the draft. The two major changes were in condition class and Appropriate Management Response (AMR) acres by alternative. In the condition class analysis, the AML was changed to reflect the need to move unmanaged ponderosa pine from condition class two to condition class three. In addition, the AMR assigned to each management area was refined and the subsequent acreage associated with each AMR, by alternative, changed as well.

Legal and Administrative Framework

The 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.

The 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.

The Reciprocal Fire Protection Act – May 27, 1955 (42 U.S.C. 1856): Authorizes reciprocal agreements with federal, state, and other wildland fire protection organizations.

The 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.

The 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.

The Clean Air Act of 1977 (42 U.S.C. 1857): Provides for the protection and enhancement of the nation's air resources.

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 National Forest 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.

Other publications include *The Wildland and Prescribed Fire Management Policy: Implementation Procedures Reference Guide* (and its January 2001 update) and (2) the National Fire Plan. The first publication represents an effort by federal wildland fire management agencies to establish standardized procedures to guide immediate implementation of the policy described by the 1995 Federal Wildland Fire Management Policy and Program Review; it is used by the Forest Service as a guidance document. The National Fire Plan places an emphasis on protecting people and sustaining resources in fire-adapted ecosystems.

Key Indicators

- Appropriate Management Response.
- Condition Class.
- Acres of timber harvest.

AFFECTED ENVIRONMENT

Fire Regimes and Condition Class

A fire regime is a generalized description of the role fire plays in an ecosystem. Systems for describing fire regimes may be based on the characteristics of the disturbance, the dominant or potential vegetation of the ecosystem in which ecological effects are being summarized, or fire severity based on the effects of the fire on dominant vegetation (Agee 1993).

In its simplest form, a fire regime can be described by frequency and intensity or severity. Fire frequency is determined by ignition sources and burning conditions (primarily fuel moisture and wind). Although related, intensity is more an indicator of resistance to control and severity is a measure of ecological impact (i.e. to organisms, tree mortality, etc.). However, the term "intensity" is commonly used synonymously with severity in describing a fire regime. For example, a ponderosa

pine stand which "historically" may have burned at relatively frequent intervals (i.e. less than 35 years) with relatively low surface fire intensity would be characterized as having a high frequency – low severity fire regime.

There are many methods for quantifying and describing fire regimes. The method used here is the same as used in the National Fire Plan (USDA Forest Service 2000d). Five combinations of fire frequency, expressed as fire return interval and fire severity, are defined in the following table. Groups I and II include fire return intervals in the 0 to 35 year range. Group I would include (on the Medicine Bow NF) ponderosa pine and dry-site Douglas fir. Group II includes the dryer grassland types and shrubland communities. Groups III and IV include fire return intervals in the 35-100 plus year range. On the Medicine Bow, Group III would include species such as aspen, limber pine, and younger and more open stands of lodgepole pine. Fire regime Group IV would include older dense stands of lodgepole pine. Group V is the long-interval (infrequent), stand-replacement fire regime. On the Medicine Bow NF, this group is composed of Engelmann spruce and subalpine fir.

Table 3-56. Fire regime groups, frequencies and severity.

Fire Regime Group	Frequency (Fire Return Interval)	Severity
I	0-35 years	Low severity
II	0-35 years	Stand replacement severity
III	35-100+ years	Mixed severity
IV	35-100+ years	Stand replacement severity
V	>200 years	Stand replacement severity

Within the fire regime groups listed in the table above, dominant cover species respond to fire occurrence and intensity in different ways. It is important to note that intensity is more an indicator of resistance to control, measured in BTUs per foot per second, and severity is a measure of ecological impact (i.e. to organisms, ecosystems, etc.). The effect of fire on the Forest's dominant cover species is briefly addressed below (adapted from the Fire Effects Information System 2002):

Engelmann spruce (*Picea engelmannii*) – Engelmann spruce is easily killed by both surface and crown fire. It is susceptible to fire because it has (1) thin bark that provides little insulation for the cambium, (2) a moderate amount of resin in the bark which ignites readily, (3) shallow roots which are susceptible to soil heating, (4) low-growing branches, (5) a tendency to grow in dense stands, (6) moderately flammable foliage, and (7) heavy lichen growth. Most crown or canopy fires will kill Engelmann spruce trees. This species is also susceptible to surface fire as the fine fuels that often concentrate under mature trees burn slowly and girdle the thin-barked bole or char the shallow roots. Some of the larger Engelmann spruce may survive light surface fire, but these often die later due to infection by wood-rotting fungi that enter through fire scars.

Subalpine fir (*Abies lasiocarpa*) - Subalpine fir is one of the least fire-resistant western conifers and is easily killed by both surface and crown fire. It is susceptible to fire because it has (1) thin bark that provides little insulation for the cambium, (2) bark which ignites readily, (3) shallow roots which are susceptible to soil heating, (4) low-growing branches, (5) a tendency to grow in dense stands, (6) highly flammable foliage, and (7) moderate to heavy lichen growth. Subalpine fir forests are normally subject to highly destructive canopy fires that occur at 100-year or longer intervals. Such fires typically kill all subalpine fir trees. Subalpine fir is also susceptible to surface fires because fine fuels that often concentrate under mature trees burn slowly and girdle the thin-barked bole.

Lodgepole pine (*Pinus contorta var. latifolia*) - Lodgepole pine is more damaged by surface fire than species with thicker bark such as ponderosa pine or Douglas fir. Because its thin bark has poor insulating properties, many trees are killed from surface fires as a result of cambial heating.[4] However, some trees may survive a low-intensity surface fire which will thin the stand. In northwestern Wyoming, there are numerous trees with two or three fire scars in open lodgepole pine stands.

Lodgepole pine seeds are well protected from heat inside closed cones (serotinous). The percentage of lodgepole pine trees with serotinous and/or semi-serotinous cones varies considerably throughout the Rocky Mountains. Having both serotinous and semi-serotinous cones allows lodgepole to regenerate following both high and low-intensity fires.

Ponderosa pine (*Pinus ponderosa var. scopulorum*) - The effect of fire on ponderosa pine is related to tree size, fire intensity, and stand density. Low-severity surface fire usually kills trees less than 3 to 5 years of age or less than 6 inches (15 cm) diameter breast height (DBH), and mortality in the 6- to 30-inch (15-76 cm) DBH class is not unusual. Mortality in the larger sized trees is usually a function of scorch height or crown fire. Trees in dense stands and trees infected with dwarf-mistletoe are most susceptible to mortality, particularly in the smaller size classes No record of southwestern dwarf mistletoe (Arceuthobium vaginatum var. cryptopodom) exists in Wyoming, however, lodgepole pine dwarf mistletoe (Arceuthobium americanum) and limber pine dwarf mistletoe (Arceuthobium cyanocarpum) occasionally infect ponderosa pine on the Medicine Bow N.F.). Pole-sized and larger trees are resistant to low-severity surface fires. Thick bark affords protection against cambial damage, and foliage and buds are usually elevated away from the flame zone. Heavy

[4] The cambium is a layer of living, meristematic cells between the wood and inner most bark of a tree. The cambium allows for fluid and nutrient movement between the roots and leaves of the tree. On thin-barked tree species, the cambium layer is easily damaged by heat from fire.

accumulations of litter at the base of trees increase the duration and intensity of fire, making trees more susceptible to scarring.

Limber pine (*Pinus flexilis*) - Limber pine is often killed by fire due to its relatively thin bark. The degree of stem scorch usually determines the extent of fire injury to trees. Young trees are usually killed by any fire that scorches their stems. Mature trees with thicker bark may survive. The vulnerability of this species to fire is reduced where it is found in open stands with light surface fuels and sparse undergrowth.

Rocky Mountain Douglas-fir (*pseudotsuga menziesii var. glauca*) - The effects of fire on Rocky Mountain Douglas-fir vary with fire intensity and tree size. Saplings are often killed by surface fire because their low-branching allows fire to transition from the surface into the crown. Photosynthetically active bark, resin blisters, closely spaced flammable needles, and thin twigs and bud scales are additional characteristics that combine to make saplings vulnerable to surface fires. Rocky Mountain Douglas-fir saplings are more susceptible to mortality from surface fires than ponderosa pine saplings are. Chance of survival generally increases with tree size. Because they have thicker bark and larger crowns, large trees can withstand proportionally greater bole and crown damage than small trees.

Quaking aspen (*Populus tremuloides*) - Small-diameter quaking aspen are usually top-killed by low severity surface fire. Research indicates that as DBH increases beyond 6 inches (15 cm), quaking aspen becomes increasingly resistant to fire mortality. Large quaking aspen may survive low severity surface fire, but usually shows fire damage. Moderate severity surface fire will top-kill most quaking aspen, although large-stemmed trees may survive. Some charred stems that survived low or moderate severity fire initially have been observed to die within 3 or 4 post fire years. High intensity surface fire top-kills quaking aspen of all size classes. Low to moderate intensity surface fire does not damage quaking aspen roots as they are insulated by soil. A high intensity fire, especially where fuel loading adds to fire residence time, may kill roots near the soil surface or damage meristematic tissue on shallow roots so that they cannot sprout. Deeper roots are not damaged by intense fire and retain the ability to sucker (sprout). Even when quaking aspen are not killed outright by fire, the bole may be sufficiently damaged to permit the entrance of wood-rotting fungi. Basal scars which lead to destructive heart rot can be made on aspen by low intensity surface fire. Basal fire scars may also permit entry of borers and other insects which can further weaken the tree.

Gambel oak (*Quercus gambellii*) – Gambel oak is extremely fire tolerant and generally sprouts vigorously from stem bases or from underground lignotubers and rhizomes following fire. Recovery time varies with fire intensity, climatic factors and site characteristics. Gambel oak habitat and community structure affect susceptibility to fire. Tree forms are less likely to be top-killed in a low

severity fire compared to shrubs with branches closer to the burning surface fuels.

Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*) – Wyoming big sagebrush ignites readily and produces a very hot fire. Regeneration is slow to re-establish on a burned area, especially when compared to other big sagebrush subspecies, mainly because of the relatively drier sites it occupies.

In southwestern Montana, Wyoming big sagebrush seedlings were still absent from a prescribed burn site 6 years after fire. In the Missouri River Breaks of central Montana, wildfire removed the Wyoming big sagebrush from a Wyoming big sagebrush/bluebunch wheatgrass community, and it was not found during vegetation sampling 14 years after the fire. Total coverage at that time was 50% grasses, with the remainder consisting of forbs and bare ground. Shrub cover was minimal. Locally, experience indicates that re-establishment of sagebrush following a burn is dependent on the percentage of the stand killed, and location of the seed source. If the burn results in a mosaic pattern that is somewhat patchy, where sagebrush seed sources are present throughout the burn area, re-establishment is fairly rapid and successful. However, where all the plants are removed over a large area, reestablishment is slow.

Antelope bitterbrush (*Purshia tridentata*) – Reports conflict on antelope bitterbrush's ability to sprout in response to fire. Geographic and ecotypic variation is considerable. Sprouting is common in eastern Idaho, occasional in Utah, and rare in Oregon, California, and Nevada. Some research indicates that antelope bitterbrush above 7,500 feet (2,250 m) elevation is resistant to fire due to low fuel loads. Locally, on the Medicine Bow, post fire plant response (sprouting) has been excellent with bitterbrush following spring burns. This is attributed to the higher soil moistures present at that time of year.

In addition to the five fire regimes outlined in the National Fire Plan, three condition classes have been developed to categorize the **current** condition class with respect to each of the five historic Fire Regime Groups. Current condition is defined in terms of departure from the historic fire regime, as determined by the number of missed fire return intervals, with respect to the historic fire return interval, and the current structure and composition of the system resulting from alterations to the disturbance regime. The relative risk of fire-caused losses of key system components increases for each respectively higher numbered condition class, with little or low risk at the Class 1 level.

Table 3-57. Condition class[1] descriptions.

Condition Class	Fire Regimes
1	Fire regimes are within the historical range and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within their historical range.
2	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased). This results in moderate changes to one or more of the following: fire size, intensity and severity and landscape patterns. Vegetation attributes have been moderately altered from their historical range.
3	Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, intensity, and severity and landscape patterns. Vegetation attributes have been significantly altered from their historical range.

[1]Current conditions are a function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure. One or more of the following activities may have caused this departure: fire suppression; timber harvesting; grazing; introduction and establishment of exotic plant species, insects, or disease (introduced or native); or other past management activities.

The following table summarizes condition class by fire regime as currently identified on the Medicine Bow National Forest. The figures were derived through the use of GIS (Arc Info using AML), using species and structural stage as the determining variables.

The condition class analysis was, in part, based on information presented in the following literature: (Arno, 1976), (Alden, 1988), (Baker,1925), (Barrett, etal.,1982), (Brady, 2001), (Brown, et al., 1986), (Crane, 1982), (Davidson, et al., 1959), (DeByle, et al., 1987),(Gruell, 1985), (Gruell, et al., 1974), (Jenkins, et al., 1998), (Jourdonnais, et al., 1990), (Meinecke, 1929), (Shepperd, 1981).

Table 3-58. Fire regime and condition class.

Fire Regime	Condition Class	Acres	Vegetation Type
Non-NFS	N/A	304,307	N/A
N/A	N/A	34,898	Riparian/lakes/rock
1	2	15,344	Ponderosa pine (managed), Douglas-fir, Gambel oak, pinion/juniper
1	3	91,148	Ponderosa pine (unmanaged)
2	1	67,900	All grass communities
2	2	115,296	Shrublands (i.e. sagebrush and bitterbrush)
3	1	93,963	Limber pine and open-grown lodgepole pine (< 40% canopy closure)
3	2	83,630	Aspen
4	1	390,146	Lodgepole pine with in B & C structural stage (>40% canopy closure)
5	1	191,688	Spruce/fir
	Total	**1,388,320**	

Fire Hazard Analysis

The potential for wildland fire is measured in terms of fire hazard and resistance to control. Wildland fire hazard can be directly related to age, stand structure, and live and dead fuel loads and their resulting effects on fire behavior. In an effort to model fire behavior, fire managers have developed fire behavior modeling systems. Two of the most commonly used are the NFDRS (National Fire Danger Rating System) and the FBPS (Fire Behavior Predication System) models.

NFDRS is used as an indicator of potential fire behavior across analysis areas which may include many thousand of acres. FBPS is useful for more site-specific applications. The FBPS model illustrates the differences in fuels and how they react to such factors as wind, humidity, and topography after natural or management ignited fire.

Output from the FBPS can be rated based on relative resistance to fire suppression activities. The classifications used are usually low, moderate, high, and extreme and are routinely a function of flame length and rate of spread. Low resistance to control typifies fires that are relatively easy to suppress in the shortest time frames. Fires in the low hazard category may correspond to the shortest flame length and intensity levels; however, they may exhibit rapid rate of spread or erratic behavior when subjected to extreme ranges of low humidity and/or high wind speeds. High-resistance fuels typically consist of the older age conifer fuel types with significant fuel load or shrub lands with extreme fuel load (e.g., older stands of oak brush). These fuels can often produce extreme flame lengths and fire intensities where the capability of direct fire suppression actions is exceeded.

In an effort to model fire hazard on the Medicine Bow NF, a forest-wide analysis was completed using GIS (Geographic Information System), FlamMap (Finney 1998) and RMRIS (Rocky Mountain Resource Information System). FlamMap is a computer program that produces fire behavior values (e.g., rates of spread, flame lengths) based on weather and physical characteristics of the ground and allows the user to produce fire behavior maps.

The objective of this hazard analysis is to quantify flame length, using 90th percentile weather[5], across the landscape. Flame length is a function of fireline intensity. It is used to estimate how difficult it is to control a fire and whether the fire will torch, spot, or crown (move from the ground into the tree tops) (Pyne, Andrews et al. 1996).

Flame lengths are grouped into four categories: (1) low – flame lengths four feet or less, (2) moderate – flame lengths greater than four feet and less than or equal to eight feet, (3) high – flame lengths greater than eight feet and less than or equal to ten feet, and (4) extreme – flame lengths eleven feet and greater. These groupings are commonly used fire behavior thresholds and are further described in the table titled "Hazard and flame length summary."

Methods for Determining Fire Hazard

Fire hazard can be directly related to age, stand structure, and live and dead fuel loads and their resulting effects on fire behavior. Differences in fuels and how they react to such factors as wind, humidity, and topography are also considerations.

The following information was collected for use in FlamMap: GIS was used to create a fuel model layer. Crown base height (CBH), crown bulk density (CBD), and stand height were determined for each forested fuel model identified on the forest. Live and dead fuel moisture levels and wind speed and direction were determined using historical RAWS weather station data processed with Fire Family Plus.

Fuel models are mathematical descriptions of fuel properties that allow the user to realistically estimate fire behavior (Anderson 1982). GIS was used to create a fuel model layer (for example, fuel loading, fuel bed depth) based on the standard Fire Behavior Prediction System (FBPS). The following table lists the FBPS fuel models identified on the Forest.

[5] 90th percentile weather represents days when the fire danger is very high to extreme—a combination of low humidity, high temperature, and high winds. It should be noted that percentiles can be approximated to seasonal fire behavior nomenclature where 90th percentile equates to "drought conditions".

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Table 3-59. FBPS fuel models.

Fuel Model	Description	Acres
0	Rock, water, riparian & non-FS Lands	306,759
1	Short grass	143,994
2	Timber with grass understory	128,704
4	Shrubs (6 feet)	1,458
5	Brush (2 feet)	28,455
6	Dormant brush	327
8	Closed timber litter	652,232
9	Hardwood litter	61,108
10	Timber (litter and understory)	58,674
11	Logging slash	6,609

Crown base height (CBH), crown bulk density (CBD), and stand height were determined for each timbered fuel model identified on the forest. This data enables the model to calculate surface to crown fire transition, as well as crown fire behavior.

Fuel moisture is another important component for evaluating fire hazard. Fuel moisture is the amount of water in a fuel, expressed as percent per dry weight (National Interagency Fire Center 1994). Moisture content influences how quickly a fuel will ignite and how well it will burn. When the moisture content of fuels is high, fires don't ignite easily and burn poorly if at all. When the moisture content is low, fires start easily and forces like wind can cause rapid spread at high intensities (Pyne, Andrews et al. 1996).

Wildland fuels and fuel moisture are broken into two categories: live and dead plant material. Living vegetation—grasses, forbs, shrubs, and trees—may actively contribute to a fire's energy or may retard the spread and intensity. In live fuels, moisture content changes seasonally, exhibiting higher moisture content during spring green-up and lower moisture content during fall curing. Dead fuel moisture is a function of weather conditions and the way fuel reacts to changes in weather is a function of composition (e.g., duff, needles, leaves, sound wood, rotten wood) and size (depth of the duff, diameter of the wood).

Dead fuels can be classified according to the time it takes them to gain or lose moisture in response to wetting or drying cycles, which varies with size (diameter) and other factors of the fuel. Timelag is defined as the time it usually takes a dead fuel to reach 63% of the difference between its current moisture content and

equilibrium moisture content[6] with its environment. Dead fuels are grouped into four size classes based on their timelag: 1-hour fuels, 10-hour fuels, 100-hour fuels, and 1,000-hour fuels (see following table).

Table 3-60. Timelag classes and fuels diameter.

Timelag Class	Fuel Diameter
1-hour	¼ inches or less
10-hour	¼ to 1 inches
100-hour	1 to 3 inches
1,000-hour	> 3 inches

The 1-hr fuels (grasses, small; twigs, pine needles) gain or lose moisture faster than 10-hr, 100-hr, or 1,000-hr fuels. They dry out faster and reach their equilibrium moisture content more rapidly. When it is dry, they ignite and burn readily if they have dried to a point below their respective moisture of extinction. Conversely, an increase in atmospheric moisture (precipitation, fog, high humidity) can keep them from igniting or burning if their percent fuel moisture is above their moisture of extinction. These fuels contribute the most to fire intensity at the flaming front. In contrast, 1,000-hour fuels are considered a heat sink and not a heat source primarily due to their low surface to volume ratio. Although they may not contribute directly to fire intensity at the flaming front, they increase fire intensity and duration following passage of the flaming front.

Surface wind speed is often the most critical weather element affecting fire behavior and fire danger. It is also the most variable and, consequently, the hardest to evaluate. Winds that persist for one minute and momentary gusts both affect fire behavior. For the analysis, both the probable maximum one-minute wind speed and probable momentary wind gust were used because both play important roles in fire behavior. Probable maximum 1-minute windspeed was used because winds that persist for one minute can affect gross fire behavior, including rate of spread and fireline intensity, thereby affecting surface to crown fire initiation and transition. Probably momentary wind gust was used because gusts can produce large, temporary fluctuations in flame height and can easily trigger crowning or throw showers of embers across the fireline.

Live and dead fuel moisture and wind speed and direction values were obtained using historic weather data from the Sawmill Park and Esterbrook Remote Automated Weather Stations (RAWS). The Sawmill Park RAWS represents the Laramie (except Pole Mountain) and Brush Creek/Hayden Ranger Districts; the Esterbrook RAWS represents the Douglas Ranger District and Pole Mountain unit of

[6] Equilibrium moisture content is the moisture content attained when a fuel is subjected to a constant temperature and humidity condition until there is no more exchange of moisture occurring between the fuel and its environment.

the Laramie Ranger District. The following table summarizes the fuel moisture levels and wind speeds for the 90th percentile weather from the two remote automated weather stations (RAWS).

Table 3-61. Range of fuel moisture levels and wind speeds from the Sawmill Park and Esterbrook RAWS.

RAWS	1-hr fuel moisture level % by wt.	10-hr fuel moisture level % by wt.	100-hr fuel moisture level % by wt.	Probable max. 1-min wind speed mph	Probable momentary gust mph
Sawmill Park	4-6	5-9	7-11	15-17	23-25
Esterbrook	3-5	5-9	10-13	15-18	23-26

This percent range of fuel moisture levels indicates extreme fire conditions on the Forest. The wind speeds, by themselves, are not problematic. However, when combined with the very low fuel moisture level, fires are more likely to display extreme behavior—characteristics beyond those exhibited by most fires. Although very few fires exhibit extreme behavior, those that do are more difficult to suppress.

Fuel models, crown base height (CBH), crown bulk density (CBD), stand height, fuel moisture levels, and wind speeds were input into FlamMap and used to obtain flame length. As previously mentioned, flame length is used to estimate how difficult it is to control a fire and whether the fire will torch, spot, or crown. The following table displays hazard ratings, flame lengths, and the implications for fire suppression.

Table 3-62. Hazard and flame length summary.

Hazard Rating	Flame Length (feet)	Fire Suppression Interpretation
Low	Less Then 4	Fires can generally be attacked at the head or flanks by persons using hand tools. Handline should hold the fire.
Moderate	4.1 to 8.0	Fires are too intense for direct attack on the head by hand crews. Handline cannot be relied on to hold fire. Equipment such as dozers, engines, and aircraft retardant can be effective. Fires are potentially dangerous to personnel and equipment.
High	8.1 to 10.9	Fires may present serious control problems, i.e., torching, crowning, and spotting. Control efforts at the head will probably be ineffective.
Extreme	Greater >= 11	Crowning, spotting, and major fire runs are probable. Control efforts at the head of the fire are ineffective.

The following two tables display acres in the fire hazard rating class calculated for the probable maximum 1-minute wind speed, 17 mph, and the probable momentary gust, 25 mph. The effect of these two different windspeeds is particularly noticeable in the high and extreme hazard classes. Acres in both these classes are significant because the classes indicate resistance to fire suppression efforts. 20-foot winds

refer to the standard height for wind measurements used by land management agencies in the U.S. Wind speeds are measured 20 feet above the surface, adjusted for vegetation depth (Rothermel 1983).

Table 3-63. Acres in each fire hazard rating class by mountain range for 17 mph winds.

17 mph, 20-foot winds				
Unit	**Low**	**Moderate**	**High**	**Extreme**
Laramie Peak	137,150	31,116	12,183	0
Pole Mountain	13,975	33,529	7,710	0
Snowy Range	376,114	116,196	20,176	2
Sierra Madre	251,367	70,670	10,998	1,478
Total	778,606	369,707	51,067	1,480

Table 3-64. Acres in each fire hazard rating class by mountain range for 25 mph winds.

25 mph, 20-foot winds				
Unit	**Low**	**Moderate**	**High**	**Extreme**
Laramie Peak	132,905	16,151	2,822	28,574
Pole Mountain	13,845	27,674	45	13,652
Snowy Range	374,999	82,606	33,956	20,928
Sierra Madre	249,109	25,390	45,885	14,129
Total	770,858	151,821	82,708	77,463

The hazard rating analysis has some limitations. Since CBD, CBH and tree height were only calculated on the "average" site for each cover type and subsequent fuel model, the analysis underestimates fire behavior at the upper end for each fuel model, especially is it relates to surface to crown fire initiation, transition and canopy fire behavior. The hazard rating analysis underestimates the number of acres in the extreme, high, and moderate hazard classes, with acreages the latter two being most effected by surface to crown transition and canopy fire behavior.

Fire Risk Analysis

To further evaluate fire's relationship to overall forest management and protection, fire hazard must be related to risk. Risk relates to the source and number of ignitions which could have resulted from either human-caused or natural (i.e. lightning) ignitions. Fire risk is simple to calculate; however, it is often difficult to predict, especially where fire starts are human-caused.

Fire risk is the simple measure of fire starts on a per 1,000-acre basis over a ten-year period (per decade). The fire risk value corresponds to a likelihood of fire starts per 1,000 acres per decade. The following are risk ratings and range of values used to categorize risk.

Low Risk: 0 to 0.49 – This projects a fire every 20 or more years per thousand acres.

Moderate Risk: 0.5 to 0.99 – This projects one fire every 11 to 20 years per thousand acres.

High Risk: ≥ 1.0 – This level projects at least one fire every 0 to 10 years per thousand acres.

The risk analysis used historical fire data from 1970 to 1999. Fire locations were plotted and overlaid on a Forest map. Fire occurrence appeared to be somewhat similar and homogeneous in five distinct geographic areas. The geographic areas and associated fire risk are listed in the following table.

Table 3-65. Fire risk analysis (1970 – 1999) for five areas on the Medicine Bow National Forest.

Analysis Area	Acres	Number of Ignitions	Lightning Ignitions	Human-caused Ignitions	Fire Risk
Pole Mountain	55,582	96	39%	61%	0.6 – Moderate
Snowy Range	532,443	339	34%	66%	0.2 – Low
Sierra Madre Range	362,210	92	50%	50%	0.1 – Low
Laramie Peak (west portion)	153,160	20	90%	10%	0.1 – Low
Laramie Peak (east portion)	284,612	385	90%	10%	0.5 - Moderate

ENVIRONMENTAL CONSEQUENCES

General Effects

The structure and condition of the vegetative ecosystems on the Medicine Bow National Forest are dynamic. Climate, insect and disease activity, natural processes, and human activity all play a role in vegetative condition, structure, live and dead fuel loading, and subsequent fire behavior.

In **Group 1** fire regimes (including ponderosa pine and dry-site Douglas fir), absence of frequent fire and/or management activities would allow for an increase in surface fuel loading in the form of seedling/sapling trees, shrub vegetation, and an overall increase in stand density. This increase in understory fuel load and subsequent higher surface fire intensity would create conditions where surface-to-crown fire transition could occur more frequently. Once a fire transitions into the canopy, the increase in stand density would facilitate canopy fire behavior and stand replacement conditions. Where this type of fire behavior occurs in "large" areas or patches, sites are usually slow to regenerate, primarily due to the fact that tree species associated with this fire regime group are primarily adapted to surface fire, not canopy, fire.

Group II includes the drier grassland types and shrubland communities. These vegetation communities are important food sources for many wildlife species. Following a fire, this vegetation type usually responds by producing a heavy grass and forb component. Where sprouting vegetation (e.g., bitterbrush and serviceberry) is present, young shoots usually revegetate the site. However, absence of fire in these communities is usually indicated by the presence of older, decadent vegetation. Fire behavior in the younger communities with a high grass component typically has fairly rapid rates of spread with relatively short flame lengths. In the older decadent stands that have experienced an absence of fire, flame lengths and fire line intensity are much higher than in the burned communities.

Re-colonization of a burned area by shrub species is dependent on several factors, the more important being the size of the burned area, species present, and intensity of the burn. If sprouting vegetation was present before the burn and the burn was "relatively" cool so the roots of sprouting species remained undamaged, re-colonization of sprouting shrubs will be rapid. If the soil experienced intense heating where roots were damaged, sprouting will be limited. Re-colonization of the burned area by seed disseminating species, such as sagebrush, is dependent on the number and location of residual plants, climatic conditions, and/or the size of the burned area.

Groups III and IV include fire return intervals in the 35-100 plus year range. Specifically, on the Medicine Bow National Forest, fire regime **Group III** would include species such as aspen, which might have a conifer component. Aspen usually occurs in pure stands. After an extended absence of fire and as the stand ages, conifers such as Engelmann spruce, subalpine fir, and lodgepole pine can begin to encroach. Aspen stands may be replaced by conifers in the absence of fire. Fire has been the most important disturbance factor influencing change in structural stages and composition, and minimizing competition by conifer species. Pure aspen stands are susceptible to mortality of above-ground stems from low intensity surface fires. However, aspen stands do not ignite easily, and specific fuel, weather, and site conditions are necessary before a fire can ignite and spread. Generally, fires in young aspen stands are low intensity surface fires, unless high fuel loads are present. Older stands are more susceptible to higher intensity fires, due to increased fuel

loads and the presence of conifer invasion. Aspen is well adapted to fire and re-colonizes a site readily after the above-ground portion of the tree is killed.

Fire Regime Group IV includes older dense stands of lodgepole pine. Lodgepole pine is typically an early-seral tree species that establishes as a result of fire. Lodgepole pine can be the persistent seral stage vegetation on sites with relatively frequent disturbances or the climax vegetation on sites with regular disturbances. On the Medicine Bow National Forest, fires in lodgepole pine have been both surface and stand replacement canopy fires. Young dense stands containing accumulated downfall and ladder fuels associated with spruce and fir have high potential to support a stand-replacement fire. Conversely, after a burn that removes most large fuels, young pole-size stands of pure lodgepole pine have a low potential to initiate crown fire. When a lodgepole pine stand becomes mature or over-mature, tree growth and vigor declines markedly and the likelihood of a mountain pine beetle epidemic increases. Insect epidemics kill many trees that begin falling in a few years, and within 10 to 15 years large amounts of dead woody fuels accumulate that greatly adds to the potential of stand-replacement fire (Langowski 2002).

Group V is the long-interval (infrequent), stand replacement fire regime, which is composed of Engelmann spruce and subalpine fir on the Medicine Bow National Forest. Mean fire return intervals in spruce-fir forests range from 100 to 400 years. In the event of an extended absence of fire, these species tend to maintain themselves in stable communities until changed by an external force, such as fire and/or insect or disease activity. After fire, spruce and fir are replaced by lodgepole pine, aspen, or grassy parks, which slowly trend towards climax spruce-fir if left undisturbed.

Fire Use and Appropriate Management Response

Fire has played, and will continue to play, a role in the structure, occurrence, and condition of vegetative communities on the forest. Under the 1985 Medicine Bow Land and Resource Management Plan, the only management response to an unplanned wildfire ignition is a suppression strategy. One of the objectives of this revision is to establish a range of acceptable Appropriate Management Response (AMR) actions. AMR actions are incorporated into the standards and guidelines for each management area prescription (Plan Chapter 2). The three strategies allowed under each AMR are defined below:

> **Direct Control** is associated with urban development and high value areas and is defined as the immediate and complete extinguishments of a wildfire. Quick decisive suppression action needs to be taken throughout the fire season. Usually this control is restricted to new fire starts, to steady-state fires that have not reached large sizes and to selected portions of large fires. Direct control also includes exposure protection in which critical resources, such as houses, are shielded from the fire.
>
> Fuels treatment for hazard reduction and pre-suppression planning is a high priority where this strategy is utilized.

Perimeter Control is a strategy that seeks to confine the active zone responsible for fire spread. In the perimeter control, the appropriate management response considers site-specific values at risk. Firelines, whether natural or constructed, are used to confine the active zone of spreading fire. Direct or indirect fireline locations are selected to minimize the combined cost of suppression and the values that could be lost in the fire. The benefits of the fire's effects will be evaluated when determining fireline location. The time of season and forecasted weather may also strongly affect fireline location.

There are many fuel management opportunities in perimeter control areas. Strategies for ecosystem restoration and maintenance may meld ideally with strategies for hazardous fuel reduction. Near private property, fuels projects are likely to be directed at defensible space to protect structures; in the more remote areas, ecological values will be emphasized.

Prescription Control emphasizes wildland fire for resource benefits. This strategy uses unplanned ignitions within specific geographic areas, allowing fire to play its ecological role. Under prescription control, fire is considered to be controlled as long as it burns within specified geographic boundaries and predetermined burning indices. Parameters for this strategy are contained within a written prescription documented in the Fire Management Plan. Fires that are within prescription and advancing management goals in the prescription are allowed to burn. Where a fire jeopardizes investments or other critical resource values, a suppression response is expected. Prescribed fire is appropriate in prescription control areas.

On the Forest, every area with burnable vegetation will have an AMR assigned to it. AMR parameters are outlined in the FMP (Fire Management Plan). When the FMP has been completed and approved, all ignitions will receive the full extent of management options available, depending upon resource management objectives presented in the FMP. These options range from monitoring with minimal on-the-ground actions to intense suppression actions on all or portions of the fire perimeter. The appropriate management response is developed from analysis of the local situation, which includes values to be protected (i.e. WUI, infrastructure, wildlife habitat, etc.), management objectives, external concerns, and land use. The Forest Plan is a decision document, where the Fire Management Plan is an implementation document. The current AMR options for each management area are displayed in the first table below. The AMR for each alternative, expressed in acres and percent, is displayed in the second table below.

Table 3-66. Appropriate management response by management area.

Prescription or Perimeter	Perimeter or Direct	Prescription, Perimeter, or Direct	Direct
1.13	4.22	2.1	7.1
1.2	4.3	3.24	8.21
1.31	5.11	3.5	8.22
1.33	5.12	3.51	8.3
1.41	5.13	3.54	8.6
1.5	5.21	3.56	
2.2	5.4	3.57	
3.21	5.41	3.58	
3.31	5.42	4.2	
3.32		4.31	
3.33		5.15	
3.34			

Table 3-67. Appropriate management response (acres/percent) by alternative.

Alt.	Prescription or Perimeter		Perimeter or Direct		Prescription, Perimeter or Direct		Direct	
	Acres	%	Acres	%	Acres	%	Acres	%
A	132,473	12	777,609	72	167,267	15	7,265	1
B	191,812	18	628,453	58	256,711	24	7,638	1
C	286,412	26	447,443	41	343,121	32	7,638	1
D DEIS	316,263	29	255,013	24	505,700	47	7,638	1
D FEIS	312,668	29	292,934	27	471,596	43	7,192	1
E	225,334	21	302,950	28	549,065	51	7,265	1
F	444,246	41	275,306	25	357,797	33	7,265	1

Note that current direction allows for a change in tactics from a wildland fire use strategy to a confinement strategy. For example, in the Forest Plan, an AMR for prescription control may be assigned to a particular wilderness area. During subsequent development of the FMP, however, it may be determined that direct control is a more suitable AMR because of the small size of the wilderness area and/or the presence of values at risk. However, one may not deviate from a containment strategy, such as direct control, to a fire use strategy, such as prescription control.

Acres of Fuels Treatment (mechanical and prescribed burning) by Alternative

Based on the historic funding level experienced by the Forest, the current objectives of the Medicine Bow Land and Resource Management Plan (also Alternative A), and the management objectives for each alternative, an estimate was made for the number of acres of fuels treatment needed annually under each alternative, primarily based on values at risk. The acreage figure assumes a mix of 70% prescribed burning and 30% mechanical treatments, and includes acres under planning. The mechanical treatments will be centered around high-value areas and/or communities at risk. Any fuel breaks constructed along urban interface, or other high-value areas, will require maintenance. The type and interval of the maintenance will be determined during project level planning. The at-risk communities identified by the either by the State of Wyoming or by the Forest Service, that are located within the Forest boundary or adjacent to the Forest boundary are listed in the following table. The entire State of Wyoming list is located in Appendix B. Additional communities on this list occur outside the Forest boundary, are not shown below or on the Forest Plan Map, and still may require fuel treatments.

Fuel treatments in WUI (Wildland Urban Interface) areas are usually accomplished using mechanical treatments, prescribed fire or combinations of both. The objectives of the treatments are to (1) modify surface fire intensity to limit fire behavior to the surface and (2) modify the tree canopy such that it will not support passive, active or independent fire behavior. Mechanical treatments can include the removal of smaller-understory trees, including seedlings, saplings and post/pole sized material and/or larger sawlog sized trees. The post, pole, and sawlog sized material usually has commercial value whereas the smaller seedling/sapling sized material currently does not. Site-specific treatment objectives are determined during analysis at the project level.

Table 3-68. Communities at Risk

Ranger District	Communities at risk
Laramie	Albany, Centennial, Corner Mountain Estates, Foxborough, Foxpark, Keystone, Lake Creek Resort, Mountain Home, North Fork, Rambler Mine Estates, Somber Hill, Town of Morgan, Vedauwoo Springs
Douglas	Camp Grace, Cottonwood Park, Esterbrook, Fletcher Park, Friend Park, Harris Park
Brush Creek/Hayden	Battle Lake Subdivision, Stemp Springs, Oberg Pass, Overlook, Rambler, Ryan Park, Water Valley Ranch, White Rock Estates

The table below displays the percentage of acres of Fire Regime 1 and 2, Condition Classes 2 and 3, and acres of high and extreme hazard classes (see Existing Condition section) being treated annually for each alternative. It is important to note

that, while prescribed burning results in benefits to the fuels profile and/or condition class, many times the main goal of the burn will be to improve wildlife habitat or range condition.

Table 3-69. Acres of fuel treatment annually by alternative.

	Alternative						
	A	B	C	D DEIS	D FEIS	E	F
Acres of Treatment (Experienced Budget)	2,500	3,500	3,500	4,000	4,000	4,000	2,200
Maximum Percent of fire regime 1 & 2 and Condition Class 2 & 3 Treated per Decade	0.9%	1.2%	1.2%	1.4%	1.4%	1.4%	0.8%
Maximum Percent of High and Extreme Hazard Ratings Treated per Decade	5%	7%	7%	8%	8%	8%	4%

Acres identified for treatment under Alternative A display an average level of treatment under the 1985 Medicine Bow Land and Resource Management Plan. Alternative B and C show a 1,000-acre increase over the historic average. This is primarily due to the increased emphasis placed on fuel treatments by the National Fire Plan, both in urban interface zones and across the landscape. Alternative D DEIS, D FEIS, and E have a 500-acres increase above Alternatives B and C. This was primarily due to the proposed increase in Special Interest Areas (SIA) under those alternatives, the added level of protection from wildfire they would require, and a need to respond to a higher emphasis on returning fire back to fire dependent ecosystems. Acres proposed for fuels treatment under Alternative F are reduced significantly from the other alternatives. This is primarily due to the increase in special designations (i.e. proposed wilderness) and the reduced allowable sale quantity (ASQ), which reduces commodity values at risk. The actual level of fuels treatment, in any given year, is dependent on funding levels.

Acres Burned by Wildfire

The exact number of acres burned by wildfire in the future is difficult to predict. This is primarily due to annual variation in ignition sources and the flammability of fuels, which, in part, is a function of climate.

In an effort to predict the number of acres that will be burned in the future, over a decade, the fire probability analysis program PROBACRE (Wiitala 1999) was utilized. This program assesses the risk of catastrophic consequences from a single or series of wildfire events. PROBACRE calculates the probability of a major single event, or multiple fire events, and the long-term probability that a combination of fire events, both large and small, would result in a total burned area in excess of a particular (user-specified) number. All probabilities are calculated from information on annual frequency of fires by size class.

The PROBACRE analysis period was 10 years. The probability analysis was completed for each FMZ (Fire Management Zone) and for the Forest as a total. Output from PROBACRE is summarized in following four tables:

As an example, on the Laramie Peak and Pole Mountain units, there is a 99 to 100% probability that fires will cumulatively burn more than 1,000 acres during the ten year analysis period. There is an 82% probability that fires will cumulatively burn more than 2,500 acres during the ten year analysis period (see following table).

Table 3-70. Probability analysis for Laramie Peak and Pole Mountain.

Probability of exceeding the	10	acre threshold in	10	years is	1.00000
Probability of exceeding the	100	acre threshold in	10	years is	1.00000
Probability of exceeding the	500	acre threshold in	10	years is	1.00000
Probability of exceeding the	1,000	acre threshold in	10	years is	0.99669
Probability of exceeding the	2,500	acre threshold in	10	years is	0.81832
Probability of exceeding the	5,000	acre threshold in	10	years is	0.67563
Probability of exceeding the	10,000	acre threshold in	10	years is	0.67004
Probability of exceeding the	15,000	acre threshold in	10	years is	0.30998
Probability of exceeding the	25,000	acre threshold in	10	years is	0.10394
Probability of exceeding the	50,000	acre threshold in	10	years is	0.00442

For non-wilderness areas in the southern part of the Forest, the probability that a fire will be greater than 500 acres is 99 to 100%. Fires greater than 1,000 acres are somewhat less likely (94%). There is a 31% probability that fires will exceed 5,000 or 10,000 acres and fires larger than 15,000 acres are unlikely.

Table 3-71. Probability analysis for the southern part of the Forest, non-wilderness.

Probability of exceeding the	10	acre threshold in	10	years is	1.00000
Probability of exceeding the	100	acre threshold in	10	years is	1.00000
Probability of exceeding the	500	acre threshold in	10	years is	0.99941
Probability of exceeding the	1,000	acre threshold in	10	years is	0.94170
Probability of exceeding the	2,500	acre threshold in	10	years is	0.43176
Probability of exceeding the	5,000	acre threshold in	10	years is	0.30937
Probability of exceeding the	10,000	acre threshold in	10	years is	0.30851
Probability of exceeding the	15,000	acre threshold in	10	years is	0.05297
Probability of exceeding the	25,000	acre threshold in	10	years is	0.00538
Probability of exceeding the	50,000	acre threshold in	10	years is	0.00000

For wilderness areas in the southern part of the Forest, the probability that a fire will be greater than 10 acres is 99%. There is a 62% probability that fires will exceed 100 acres. Fires greater than 500 acres are unlikely (<1%).

Table 3-72. Probability analysis for the southern part of the Forest, wilderness.

Probability of exceeding the	10	acre threshold in	10	years is	0.99271
Probability of exceeding the	100	acre threshold in	10	years is	0.62368
Probability of exceeding the	500	acre threshold in	10	years is	0.00328
Probability of exceeding the	1,000	acre threshold in	10	years is	0.00000
Probability of exceeding the	2,500	acre threshold in	10	years is	0.00000
Probability of exceeding the	5,000	acre threshold in	10	years is	0.00000
Probability of exceeding the	10,000	acre threshold in	10	years is	0.00000
Probability of exceeding the	15,000	acre threshold in	10	years is	0.00000
Probability of exceeding the	25,000	acre threshold in	10	years is	0.00000
Probability of exceeding the	50,000	acre threshold in	10	years is	0.00000

Direct and Indirect Effects

Effects from Timber Management

Timber harvest will affect the fuel profile and subsequent fire behavior. Effects to fire behavior and the fuel profile are both positive and negative.

The primary stand attributes that influence crown fire initiation and spread are surface fuel loading, crown base height and canopy bulk density. Silvicultural systems can be designed to affect one or all of these attributes. At a minimum, timber harvest affects canopy bulk density, which in turn affects canopy fire spread. After timber harvest, a fire may still transition into the crown of an individual tree (i.e. passive crown fire). However, the movement of fire through the canopy (i.e. active or independent canopy fire) will be inhibited by the reduced crown bulk density. A crown bulk density of 0.10 kg m^{-3} appears to be the critical threshold for sustained crown fire spread (Langowski 2002).

Fire can propagate vertically through the canopy when surface fire intensity exceeds a critical level. How slash is treated plays a role in post harvesting surface fire intensity. If slash is left on the site, it can be expected that there will be an increase in surface fire intensity. However, if slash is treated by piling, lopping and/or burning, the effect can be mitigated.

Properly designed timber harvest units can be beneficial in terms of modifying the fuel profile to allow for successful initial attack operations. Harvest units can affect fire spread across the landscape, and, if properly designed, can provide suppression forces with anchor points and safety zones.

Some might argue that the increased activity associated with timber harvesting operations would increase the risk (i.e. occurrence) of wildland fire. However, although there is an increase in activity associated with timber harvest operations, much of this activity is mitigated in the timber sale contract. Specifically, the timber sale contract contains provisions that ensure that equipment is outfitted with the proper spark arrestors, fire extinguishers are on equipment and with saws, and cigarette smoking is limited to enclosed or cleared areas. Timber sale contract provisions also address blasting, welding, storage of flammable materials and campfire protection.

Given that properly designed timber harvest units can have a beneficial affect in terms of fuels, alternatives with the highest ASQ would have the most benefit in terms of fire and fuels. Alternative A has the highest ASQ, followed by Alternatives B, C, D DEIS, D FEIS, and E. Alternative F has the lowest ASQ and allows for more natural processes to occur.

Effects from Travel Management

The number of accessible roads is a double-edged sword in terms of travel management and fire suppression. While roaded access to an area increases the risk of human-caused ignition, the same roads provide access for fire fighting personnel and equipment. They help reduce response times and provide access during extended attack. An increase in the number of roads in an alternative would increase access, which increases the potential for human-caused fires. Over time, this potential increase in fire activity could require an additional engines and/or crews. On the other hand, if the number of roads accessing an area was significantly reduced, one of the current engines might be replaced by a helicopter module or an initial attack hand crew.

The Forest fire organization will respond to fire occurrence and travel management issues, especially where they affected access, through the National Fire Management Analysis System process; thus, it is difficult to rate one alternative over another from a fire and fuels standpoint based on travel management issues alone.

Effects from Wilderness and Research Natural Areas

The objectives of fire management in wilderness are (1) to permit lightning caused fires to play, as nearly as possible, their natural ecological role within wilderness, and (2) to reduce, to an acceptable level, the risks and consequences of wildfire within wilderness or escaping from wilderness (Forest Service Manual 2300).

Implementation of a fire management strategy is guided by the Fire Management Plan, Operational Wildland Fire Use Plans and individual Wildland Fire Implementation Plans. Wildland Fire Use may not be applicable to all wilderness areas and RNA's on the Forest. The larger the area, the more feasible it will be to allow for wildland fire use. Therefore, from a wildland fire use standpoint, the alternatives with the most acres of wilderness, proposed wilderness, and research

natural areas, especially where they are adjacent to each other, would be the most advantageous for the implementation of a wildland fire use program.

Alternative F has the largest amount of proposed RNAs, followed by Alternative E and D FEIS. Alternative D DEIS has proposed RNAs, but all are located within wilderness areas. Alternative F also has the largest amount of proposed new wilderness, followed by D DEIS, D FEIS and E, in that order. No additional wilderness is proposed in alternatives A, B, or C.

Effects from Livestock Grazing

Grass and forbs are the primary carriers of surface fire in open forest stands, shrublands and grassland communities. By removing or reducing the grass and forb fuel load through grazing, surface fire intensities are reduced. How much surface fire intensities are reduced is somewhat subjective and a function of how much of the grass and forb production is removed through grazing.

Grazing would have the most effect on reducing fire behavior in fire regimes I and II, which include ponderosa pine, Douglas fir, Gambel oak, juniper, all-grass communities and shrublands, including sagebrush and bitterbrush. The other long-interval fire regimes have a minimal grass/shrub component and notice little effect from grazing.

Alternatives A through E will continue at the current level of grazing. Alternative F includes a 25% reduction in grazing. Alternatives A through E all provide the greatest benefit from a fuels standpoint.

Effects to Fire and Fuels from Insects and Disease

Insect and disease outbreaks in forested communities have an effect on the fuels profile and the effectiveness of fire suppression efforts. The presence of dead and dying trees affects both fire behavior and suppression operations.

After a tree is killed by insects or disease, the needles die and persist for several years, depending upon the species. This situation creates conditions that are conducive to surface to crown transition and canopy fire spread. Whether a fire transitions into the crown or remains on the surface is a function of three variables: surface fire intensity, crown base height, and foliar moisture content (Van Wagner 1977). In a healthy stand, during normal climate condition, foliar moisture content is relatively constant. Throughout the season, during a normal year, foliar moisture content averages around 100 percent. However, when a tree is killed, its needles die and respond to climate like a one-hour fuel. It is common for one-hour fuel moistures to drop to 4 or 5% during dry periods with low relative humidity (summer and fall). As a result, while the dead needles still persist on the twigs, the tree is much more susceptible to torching than when in its green condition.

Over time, the needles gradually fall from the tree and are worked into the surface duff layer. This does add to the surface fuel load but, since the needles (and twigs)

become tightly packed over time, does not add a significant amount to the surface fire intensity.

Depending upon the species and the disease pathogens present, the dead trees gradually blow over and fall to the ground. Although these dead, windfall trees add significantly to the fuel load, they do not increase fire intensity at the flaming front. Fuels greater than three inches in diameter are considered a heat sink and not a heat source. This is primarily due to their low surface to volume ratio. Although they may not contribute directly to fire intensity at the flaming front, they increase intensity following passage of the flaming front. In addition, the presence of large fuels (greater than 3 inches diameter) increases residence time which influences fire effects. However, in terms of suppression operations, the down trees play a more important role. Both standing (snags) and blown-down trees inhibit line building and holding operations. The standing snags pose safety concerns and have the potential to burn out and fall on firefighters or over control lines. The blown-over snags add to line construction times, as additional chain saw work is required.

Alternatives where timber management is emphasized would have the most effect on limiting the spread of insect or disease outbreaks. Alternative A has the highest ASQ, followed by Alternatives B, C, D FEIS, D DEIS, and E. Alternative F has the lowest ASQ and allows for natural processes, such as insect and disease activity, to occur. As a result, Alternative A would be the most effective in reducing insect and disease related fire hazard, and Alternative F would be the least effective.

Cumulative Effects

This section is bounded by the life of the plan, which is approximately 15 years, and limited to the Medicine Bow National Forest and adjoining lands.

Prescribed burning and other fuels treatments have taken place within and adjacent to the Forest boundary by other agencies and landowners. BLM lands within and adjacent to the Forest have been the most active in implementing prescribed fire and fuels treatments. Most of the treatments implemented or currently planned by the BLM in the vicinity of the Forest were/are broadcast burning of shrublands with the objective being to improve rangeland health. Burning of shrublands, generally speaking, has a beneficial effect on the fuels profile and subsequent fire behavior. After the shrubs are removed by burning the area usually becomes re-vegetated with grass species. A fire in a post-burn shrub stand, where grass is the primary carrier of the fire, would exhibit lower flame lengths and fire intensity, but have a higher rate of spread. Burning of shrublands by the BLM has negligible effect on fire behavior on the adjacent Forest Service lands.

Conifer related insect and disease occurrence is expected to increase on the Forest. The major insects of concern are the mountain pine beetle, spruce beetle and fir engraver. The noticeable diseases are currently Armillariella root rot and white pine blister rust. Mortality caused by these insect and disease agents will have the

incremental effect of an increase in fire behavior (hazard) where the insect and disease related tree mortality is the highest (refer to write-up in Effects section).

Under all alternatives, the current condition classes across the forest will experience a net increase, for all vegetation communities, for all alternatives. This is based on the proposed levels of timber harvest, fuels treatment, and wildfire occurrence probability analysis. The increase in condition class will be smaller for those alternatives with higher timber harvest and fuels treatment levels.

The risk of ignition from lightning should remain constant under all alternatives. The risk of human-caused wildfire could increase, based on the expected increase in forest visitors and anticipated growth in the urban interface.

Insects and Disease

Introduction – Most insects and diseases of western coniferous forests are native components of these ecosystems and contribute in important ways to overall forest health. These organisms play a fundamental role in ecosystem processes such as nutrient cycling, stand density regulation through self-thinning, and forest succession. At times, though, forest insects and diseases cause problems when their impacts interfere with land management objectives.

Different insects and diseases affect the various forest tree species. Engelmann spruce is affected primarily by spruce beetle (*Dendroctonus rufipennis*). Lodgepole pine is affected primarily by the mountain pine beetle (*Dendroctonus ponderosae*) and dwarf mistletoe (*Arceuthobium spp*. -- parasitic plants). Subalpine fir is affected by the western balsam bark beetle. Aspen is affected by a variety of canker, stem, and root decays that are collectively known as aspen decline. Armillaria root disease has been observed on lodgepole pine, ponderosa pine, and subalpine fir, but is of minor concern on the Forest. Comandra blister rust has also been observed on lodgepole pine and ponderosa pine but is also of minor concern. White pine blister rust (*Cronartium ribicol*a) affects limber pine with the effects most prevalent on Pole Mountain (Jacobi and H. J. S. Kearns 2003). Various heart rots affect the different forest tree species. While they reduce merchantable volume in some instances, they also create structure for wildlife habitat (Sullivan 2003).

Insects and diseases contribute to disturbance processes in the forested ecosystem. They are fairly widespread over the Forest and the effects from their actions can last for long periods of time . Insects and disease, along with wildfire, have been viewed as having negative influences on the Forest. This will still be the case where management objectives conflict with insect and disease outbreaks. However, where management objectives recognize these outbreaks as part of the "natural" disturbance processes in the Forest, they are considered to be beneficial to the Forest's cycles of growth and decline and necessary to the maintenance of the Forest.

The salvaging of dead and dying trees and the suppression of damaging levels of insect and disease populations has been the most common response to high levels of insects and diseases in the past. Stand management is now regarded as a way to develop stands that are much more resistant to attacks by insects and disease. Where stand management cannot develop high levels of resistance or where it is not an appropriate management took, integrated pest management (IPM) strategies and techniques are applied. The IPM process involves the collection and synthesis 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 host resistance to pests) and direct control (which seeks

to reduce pest populations). Techniques include biological, chemical, mechanical, manual, and prescribed fire in prescriptions considered in the control of pest damage.

It is extremely difficult to determine the probability of insect and disease activity. The greatest problem of forecasting epidemics and outbreaks is the lack of historical data. There can be a large combination of factors or sequence of events (weather or comate, succession in vegetation ages and species, epidemic levels of insects and disease) that affect these disturbances.

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) – this regulation 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 – This section of the regulations 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 ASQ (allowable sale quantity) 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 population 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."

Key Indicators

- Acres infected with dwarf mistletoe.
- Acres infested with mountain pine beetle and acres with medium or high mountain pine beetle risk ratings.

- Acres infested with spruce beetle and acres with medium or high spruce beetle risk rating.
- Acres of insect and disease management intensities by management area.

Resource Protection Measures

Resource protection is accomplished through forest-wide and management area prescription standards and guidelines. Sanitation and salvage sales may be used to suppress insect and disease activity where necessary and allowed.

AFFECTED ENVIRONMENT

Insects and disease can affect the production of timber by killing and damaging trees. Many plants and animals evolved in response to natural disturbances and are adapted to live in an environment in which they occur. For instance, insects and disease and the conditions that favor them have shaped the structure, composition and have influenced some of the ecological functions of these forest communities such as accumulation and decomposition of dead materials. Dead trees can pose hazards in developed recreation areas and in large quantities can reduce the scenic quality.

Both existing occurrence and trend information are valuable for assessing the potential impacts of changes in insect and disease levels . The following table displays information regarding the incidence of insects and diseases over the last 5 years:

Table 3-73. Aerial observations of incidence of insects and diseases over the last 5 years.

	1996 Acres	1997 Acres	1998 Acres	1999 Acres	2000 Acres	2001 Acres
Insects						
Douglas-fir beetle		253	19	2	85	52
Spruce beetle		108				101
Mountain pine beetle	340	850	620	2,360	1,270	6,425
Western balsam bark beetle	1,769	26,782	2,959	15,710	7,277	29,400
Unidentified bark beetle					6	
Pine engraver		1	36			
Spruce budworm				526	623	776
Unidentified defoliators			69			15
Diseases						
Armillaria root rot				21		
Dwarf mistletoe	810	8,511	7,704	643	318	78
Unidentified disease			139			
Winter damage			19			
Other						
Aspen decline		2,756	70	33	142	499

Source: GIS summary of aerial reconnaissance flights.

Insect risk is medium high or high on greater than 22,687 acres across the forest (from 172,129 inventoried acres).

The following table displays the acres in medium high or high risk of insect attack by cover type:

Table 3-74. Medium high and high risk of insect attack for inventoried acres..

Cover Type	Risk Rating	Acres
Lodgepole pine	4	3
Spruce/Fir	4	15,080
Total For Risk Rating 4 (Medium High)	**4**	**15,082**
Lodgepole pine	5	1,906
Ponderosa pine	5	2,561
Spruce/Fir	5	3,137
Total for Risk Rating 5 (High)	**5**	**7,604**
Total For Risk Rating 4 and 5	**4 and 5**	**22,687**

Source: RMRIS database based on 172,129 inventoried acres. Based on Logan, Schmid and Mehl {1980} for Spruce-fir; Stevens, McCambridge, Edminster {1980} for ponderosa pine; and For Amman, McGregor, Cahill, Klein 1977} for lodgepole pine.

When similar insect risk rating procedures are applied to all acres by cover type, Insect risk is high on 153,073 and medium 354,533 acres across the forest. (The methodology for this analysis is displayed in Appendix B – Insect Risk Analysis.)

The following table displays the acres by level of risk of insect attack by cover type:

Table 3-75. Insect Hazard Using Hazard Rating Procedures

Cover Type	Risk Rating	Acres
Lodgepole pine	Low	148,911
Spruce/Fir	Low	48,014
Ponderosa Pine	Low	148,911
Lodgepole pine	Medium	384,884
Spruce/Fir	Medium	131,537
Ponderosa pine	Medium	227,996
Lodgepole pine	High	105,183
Spruce/Fir	High	6,149
Ponderosa Pine	High	41,741

Source: Hazard Rating based on RMRIS data –see Appendix B –Insect Risk Analysis for methods. Based on Schmid, Frye {1976} for Spruce-fir; Stevens, McCambridge, Edminster {1980} for ponderosa pine; and For Amman, McGregor, Cahill, Klein 1977} for lodgepole pine.

Two forest insects of major concern to the Medicine Bow National Forest are the mountain pine bark beetle (*Dendroctonus ponderosae*) and the spruce bark beetle (*Dendroctonus rufipennis*). These two bark beetles are well adapted to the ecology of their host trees, lodgepole and ponderosa pines and Englemann spruce, respectively, and to the environment in which these tree species occur. Stands in all three forest cover types may be modified strongly during outbreaks or during larger,

wide-scale epidemics of these two bark beetles. The mountain pine beetle and the spruce beetle have evolved with their hosts over long periods but in very dissimilar ways based, in part, on the life history of the host trees and on the environment in which these tree species occur.

The mountain pine beetle is the most important biotic agent of change of pine forests (Amman, McGregor et al. 1989). The beetle attacks and kills lodgepole and ponderosa pines as stands reach diameters favored by the beetle. Mountain pine beetle populations persist at low densities by infesting single trees that have been damaged by lightning or are diseased (Schmid and Mata 1996). Outbreaks tend to occur at intervals of fifteen to twenty years in older pine forests in the Rocky Mountains and may last for six to ten years in lodgepole pine (Cole and Amman 1980). In ponderosa pine, outbreaks may last from 2 to 5 years and epidemics may last for 7 to 14 years (Blackman 1931; McCambridge, Hawksworth et al. 1982). Over longer periods of time multiple outbreaks occur across a landscape of mature forests, renewing the forest cover at intervals between 50 and 100 years (Schmid and Amman 1992). Fire often facilitates the renewal and regeneration of pine forests following major mountain pine beetle outbreaks. Factors leading to outbreaks are not well understood, but are related to an increase in the number of trees exceeding 8 inches diameter at breast height (DBH). Factors leading to the collapse of a mountain pine beetle outbreak are related to the depletion of trees greater than 8 inches DBH. There have been 67,370 acres of ponderosa pine on Laramie peak that have been attacked by the mountain pine beetles since the 1980s. Of these, 45,276 acres have mortality levels that have affected stand conditions.

For older spruce forests, the spruce beetle develops to outbreak status relatively infrequently. The beetle is able to persist at low population levels in spruce forests by breeding in windthrown trees and trees dying from biotic agents, such as root diseases (Schmid and Frye 1977). Often, a triggering event or disturbance, such as a strong windstorm that blows over large numbers of spruce, creates conditions that lead to the rapid buildup of spruce beetle populations in the fallen trees. As broods of spruce beetles emerge from the fallen trees, they begin to attack and infest standing trees, initiating an outbreak. Epidemics develop as small spruce beetle outbreaks 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, Thier et al. 1999). Residual stand structure may look very different from those that existed prior to the epidemic (Schmid and Frye 1977; Veblen, Hadley et al. 1991b). 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). Epidemics may be more than 115 years apart and wide-scale epidemics may exceed 25 years or more (Veblen, Hadley et al. 1994). Factors leading to outbreaks are typically disturbance of older, large diameter stands of spruce. Factors leading to the collapse of spruce beetle outbreaks are usually the depletion of spruce from the stands.

Outbreaks caused by both bark beetle species are related to the development of older stands of conifers, particularly stands that contain high numbers of large diameter trees. On the Medicine Bow National Forest, significant portions of the forested landscape have conditions suitable for sustaining outbreaks of these two bark beetles at this time. There are 308,202 acres of Lodgepole pine in HSS 3C-5 (65% of total lodgepole pine) and 156,501 acres of Spruce/fir in HSS 3C-5 (81.6% of total spruce/fir).

In 2001, expanding outbreaks of mountain pine beetle reached epidemic status in northern Colorado. Just north in southern Wyoming, stands of lodgepole pine on the Medicine Bow National Forest have reached ages, sizes, and densities that favor the onset of mountain pine beetle outbreaks. A few lodgepole pine stands on the Medicine Bow National Forest supported expanding mountain pine beetle populations in 2000 and 2001. These small outbreaks may continue to increase for several more years due to the abundance of susceptible pine stands. If an outbreak of mountain pine beetle develops on the Medicine Bow National Forest, it may continue in outbreak status well into the implementation period of the new Forest Plan.

The western balsam bark beetle (*Dryocoetes confusus* Swain) infests a number of western conifers but is most significant in subalpine fir. It contributes to subalpine fir decline, which is a rather poorly understood problem in this species. It appears to be a significant problem on the Medicine Bow NF over the past few years; it can occur in larger diameter or small diameter trees. The decline appears to be associated with root disease and a variety of bark beetles, particularly the western balsam bark beetle. The beetle appears to have a 2-year life cycle. Attacking beetles introduce a virulent fungus (*Ceratocystis dryocoetidis*) 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 of time (USDA Forest Service 1977).

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 mistletoes (*Arceuthobium spp*.) are important parasitic plants of most western conifers, including limber and lodgepole pines in Wyoming (Johnson 1986). Forest-wide surveys indicate that dwarf mistletoe infests 60% of all lodgepole pine stands on the Medicine Bow National Forest (Johnson, Hawksworth et al. 1978). The Forest treated 7,970 acres between 1979 and 1986 and treated 6,848 acres between 1987 and 1991 to reduce dwarf mistletoe occurrence. Dwarf mistletoe is absent from ponderosa pine stands on the Medicine Bow National Forest although it is found infecting ponderosa pine in Colorado (Johnson 1986).

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.

Two rust diseases of some significance to conifers on the Medicine Bow National Forest are Comandra blister rust (*Cronartium comandrae* Pk.) and white pine blister rust (*Cronartium ribicola*). Comandra blister rust is a native rust fungus and is an occasional problem in lodgepole pine on the Medicine Bow National Forest (Johnson, Hawksworth et al. 1978). White pine blister rust, an introduced rust fungus, is increasing in limber pine stands on the Medicine Bow National Forest (Harris and Allen 1999). The Sherman (Pole) Mountain Range is the area of greatest effects of white pine blister rust on the MBNF (Jacobi and H. J. S. Kearns 2003).

ENVIRONMENTAL CONSEQUENCES

Direct and Indirect Effects

Management area prescription designation will greatly influence the occurrence of insect and disease activity.

Natural disturbance events and succession will continue to operate regardless of the alternative; however the amount of land upon which natural processes operate as the primary disturbance agents varies by alternative. Where natural processes are the predominant disturbance process, the control and suppression of insect and diseases is a less frequent occurrence. In the short term, this will result in an increase in insects and diseases. In the longer term, as natural processes operate with little restriction, the occurrence and magnitude of insect and disease activity will fluctuate over time and space. Since insect risk is medium high or high on greater than 22,687 acres across the forest (from 172,129 inventoried acres), and since insect damage is associated with population levels, forest structure and drought cycles, it is possible that many of these acres at high risk of insect damage would be attacked within 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 following table displays the allocation to management areas where natural processes are predominant.

Table 3-76. Allocation to management areas where natural process are predominant by alternative

	Alternatives						
	A	B	C	D DEIS	D FEIS	E	F
Natural Processes (% of MBNF)	20%	28%	35%	46%	45%	46%	72%

Source: MAs: 1.13, 1.2, 1.31, 1.33, 1.41, 1.5, 2.1, 2.2, 3.21, 3.24, 3.31, 3.32, 3.4, 3.5, 3.51, 3.54, 3.56, 3,57, 3.58.

The following table displays the acres and percent of the MBNF in each insect and disease response category by alternative.

Table 3-77. Response to insects and diseases.

	Alternatives						
	A	B	C	D DEIS	D FEIS	E	F
Rarely Used Acres/%	218,449 20.1%	302,200 27.9%	380,847 35.0%	501,380 46.2%	487,565 45.0%	500,200 46.1%	782,589 72.2%
Occaisionally Used Acres/%	88,695 8.2%	12,673 1.2%	42,884 4.0%	34,511 3.2%	23,442 2.2%	22,016 2.0%	0 0%
Routinely Used Acres/%	777,470 71.7%	769,741 71.0%	662,371 61.1%	548,723 50.6%	573,383 52.9%	562,398 51.9%	302,025 27.8%

Alternative A, B, and C (in order) have the greatest number of acres where direct suppression would be used and where insect and diseases would be actively suppressed or controlled. Alternatives D FEIS, E and D DEIS have a lower number of acres where insects and diseases would be actively suppressed or controlled. Alternative F has the fewest acres of suppression and control of insects and diseases.

Effects from Fire and Fuels Management

In wilderness, future decisions may provide for wildfires to burn within prescriptions. Decisions will be determined on a case-by-case basis. Fires can reduce stand density and make stands more resistant to insect attacks. Fires can also damage tree boles, providing entry for rot and disease as well as attracting insects to the damaged trees.

In other management area prescriptions in which timber harvest does not occur, fire suppression has allowed stand density to increase and fuels to build up. This has decreased the vigor and growth of the stands. All these factors increase stand susceptibility to insect and disease outbreaks. The objectives of the management are prescriptions will determine whether the outbreaks will be allowed to continue.

Effects from Timber Management

Timber harvesting and timber stand improvement provides an opportunity to implement an ecological approach for the prevention or reduction of serious pest outbreaks. Harvesting trees provides an opportunity to remove diseased and high-risk trees. On clearcuts and other final harvest sites, opportunities for long-term

protection and prevention of insect and disease outbreaks and restoration of forest health can be managed. Stands most susceptible to insect damage and most infected with mistletoe can be harvested and replaced with mistletoe-free young stands that are much less susceptible to insect damage. In stands scheduled for overstory removal, shelterwood, or uneven-aged management, individual suppressed or dying trees can be removed, thus increasing the overall growth and vigor of remaining trees. In commercial and pre-commercial thinning operations, susceptibility to insects and disease will 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 the attempt to slow or impede infestations from spreading. The degree to which these harvests are undertaken will 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.

Alternatives with the greatest allocation to Management Areas with renewable resource production emphasis will use the greatest amount of silvicultural treatments to reduce risk of infestations.

The following table displays the allocation of land to renewable resource uses by alternative:

Table 3-78. Allocation to renewable resource uses by alternative.

	Alternatives						
	A	B	C	D DEIS	D FEIS	E	F
Renewable Resource Mgt (% of forest)	55%	63%	53%	45%	44%	39%	25%

Source: MAs: 5.11, 5.12, 5.13, 5.15, 5.21, 5.4 and 8.6.

The amount of land in which susceptibility to insect damage decreases and/or where mistletoe infections are eliminated directly corresponds to the amount of land that will be harvested. The Regeneration Harvest and Prescribed Burning for Forest Regeneration table in the Biological Diversity section of this chapter displays the amount of land that will be harvested and subjected to prescribed burning for regeneration and upon which there is expected to be a reduced risk of insects and diseases. Alternatives vary in the extent of lower risk conditions that will result from planned regeneration harvests and prescribed burning over the next 10 years. After 50 years, human-induced forest with reduced risk of insects and diseases will very from 6% (Alternative F) to 13% of the forest (Alternatives B and D FEIS).

Effects from Wilderness Management

As land is allocated to proposed wilderness, the amount of suppression and control and silvicultural activities to reduce risk will decrease and the occurrence of insects and diseases will increase. The alternatives with the greatest allocation to proposed

wilderness are Alternative F, Alternative D DEIS, and Alternative E in decreasing order. There is more discussion of the allocation to wilderness in the Wilderness Section of this chapter.

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. Where roads are closed, suppression, control, and silvicultural treatments will be less feasible and/or more costly. Recreation activities and travel can contribute to the spread of exotic or nonnative insects or diseases.

Cumulative Effects

Historic wildfire suppression has affected stand density and structure and has contributed to an increased risk of insect and disease outbreaks on a greater number of acres.

Silvicultural treatments can partially offset the long-term effects of fire suppression. However, the treatment of small diameter materials is expensive and funds for this type of treatment are generally limited. Changes to vegetation from silvicultural treatments will be gradual. Eventual changes to diversity by timber management will decrease the risk that any one insect or disease will have catastrophic impacts. Salvage operations of insect and/or disease mortality will occur in management areas where timber production is emphasized or where needed to reduce hazards in high use recreation areas.

Standards and guidelines provide for the suppression and control of insect and or disease outbreaks within and adjacent to wilderness where the outbreak threatens values outside of wilderness. Decisions to suppress the outbreaks, to initiate salvage operations where allowed, or to allow the outbreaks to continue will use integrated pest management strategies and techniques and will be made on a case-by-case basis. Where allowed, silvicultural treatments on lands adjacent or close to wilderness areas can reduce the risk of insects or diseases threatening the lands outside of wilderness and/or proposed wilderness.

An analysis of age data shows that approximately 66% of the forested acres are over 100 years old. As forest stands age, they pass through different stages of susceptibility to insects and diseases. In general, 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 will greatly increase.

Alternatives that implement the greatest amount of risk reducing activities will have the greatest reduction in insect and disease activity. Alternatives B, C, A, and D FEIS and D DEIS in decreasing order implement risk reducing activities.

The timing and/or severity of these outbreaks cannot be predicted, nor is it possible to predict the vegetation management activity that might decrease or stop these outbreaks. Based upon existing risk levels, major insect and disease outbreaks are not expected to occur during the next 10-year plan period. However, climatic conditions, which are impossible to predict, could result in significantly higher levels than those currently occurring on the forest.

In all management area prescriptions, there will be some degree of acceptance or limits to the amount of natural insect and disease disturbance allowed due to the management objective for the areas and the severity of the incidence at that time. Case-by-case analysis will need to be made on a project level to determine action or no action.

The following table displays the potential cumulative occurrence of insects and diseases at the end of decade 5 based upon records of past occurrence of natural disturbances and allocation to management areas:

Table 3-79. Predicted cumulative insect disease occurrence.

	Alternatives						
	A	**B**	**C**	**D DEIS**	**D FEIS**	**E**	**F**
I&D Stand Replacement (acres)	9,266	12,806	16,845	21,940	20,655	21,894	33,920
I&D Stand Replacement (%)	0.9%	1.2%	1.6%	2.0%	1.9%	2.0%	3.1%
I&D Non-stand Replacement (acres)	6,151	8,537	11,230	14,627	13,770	14,596	22,613
I&D Non-stand Replacement (%)	0.6%	0.8%	1.0%	1.4%	1.3%	1.5%	2.0%
Total (acres)	15,377	21,344	28,076	36,567	34,425	36,491	56,534
Total (%)	1.4%	2.0%	2.6%	3.4%	3.2%	3.4%	5.2%

**See Appendix B Biological Diversity Analysis Process for information on how these numbers were developed. Because of the stochastic nature of natural disturbances and the particular assumptions forming the foundation of this model, results are extremely uncertain. These results should be regarded as one of many potential outcomes that could results from strict implementation of each alternative.*

Additional effects of insects and diseases are discussed in the Biological Diversity – Ecosystem Analysis Section of this chapter.

Vegetation – Rangeland

Introduction – The ecosystems and vegetation of the Medicine Bow National Forest are very dynamic. The processes of succession and associated 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 natural disturbance events will occur throughout the Forest, the degree to which they are allowed to occur will greatly influence the ability to predict future vegetative conditions at any given point in time.

Forest vegetation is discussed in the Biodiversity section of this chapter.

Legal and Administrative Framework

National Forest Management Act of 1976 (NFMA)

Code of Federal Regulations (CFRs) 36

- 219 Planning
- 222 Range Management
- 241 Fish and Wildlife

Policy direction from the Forest Service Directives System in Forest Service Manuals (FSM) 2400, 2200 Rangeland 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
- 2609.13 Wildlife and Fisheries Program Management Handbook

Key Indicators

- Acres of aspen by structure class or age class
- Acres of aspen plant communities treated to be moved to mid or early seral condition
- Acres of aspen plant communities and native meadows treated to reduce impacts from conifer encroachment

- Rangeland acres treated with prescribed fire to meet or move toward desired condition
- Acres of rangelands (uplands) meeting or moving toward desired condition
- Acres of riparian areas and wetlands meeting or moving toward desired condition
- Acres of sagebrush/shrublands meeting or moving toward desired condition
- Acres of big game winter range meeting or moving toward desired condition

Resource Protection Measures

Numerous forest-wide and management area prescription standards and guidelines exist concerning vegetation. Additional guidelines are also established for several Geographic Areas.

AFFECTED ENVIRONMENT

Vegetation on the Forest has been classified into several types, including both forest and non-forest types. As mentioned previously, forest vegetation types are discussed in the Biodiversity section of this chapter.

Rangeland Vegetation

Rangelands consist of grasslands, meadows, riparian areas, wetlands, alpine and subalpine areas, shrublands, aspen, open-canopy conifer forests, and, to a lesser extent, closed-canopy forests that remain capable of producing an herbaceous or shrubby understory. Rangelands have been traditionally considered the areas of non-forested lands although they should also be understood to include vegetation growing as under-story in the relatively open canopied conifer types. Rangelands are managed for a wide variety of values. Most commonly they are thought of in the context of their ability to provide forage for domestic livestock and big game animals; however, they also provide for a wide range of habitat needs (such as nesting or denning areas) for many wildlife species. In addition, they are highly valued for their abilities to capture and store water, for their recreational and scenic values, for their cultural and historic contexts, and even at times for their ability to produce a variety of products including firewood, posts and poles, and medicinal or other valued plant products.

There are 1,388,039 acres within the administrative boundary of the Forest, of which 1,084,615 are National Forest System acres (GIS database 2002). Of that total, about 410,000 are classified as primary or easily accessible rangelands with relatively high forage production. An additional 470,000 acres of lodgepole pine and 190,000 acres of spruce-fir could be technically considered in this category – only approximately 50,000 acres of timber stands exceed 70% canopy closure. However, only about 50% of these lodgepole stands currently are open enough to produce herbaceous

vegetation to any significant extent; the predominant ungulate use of understory vegetation in spruce-fir and lodgepole stands is for big game food and cover.

Table 3-80. Rangeland cover types for the Medicine Bow National Forest.

Cover Type	Total Acres	Percent of Total	Riparian Acres Only	Percent of Total
Grasses	65,291	16	8,948	26
Sedges and Rushes	2,666	0.5	384	1
Forbs	3,321	1	163	0.5
Sagebrush	93,354	23	4,848	14
Other Shrubs	22,087	5	1,104	3
Oakbrush	1,501	0.5	68	0
Willows	15,965	4	7,770	23
Willows and Cottonwood	408	0	194	0.5
Aspen	83,686	20	5,893	17
Rocky Mountain Juniper	70	0	1	0
Pinyon-Juniper	173	0	13	0
Limber Pine	11,633	3	242	1
Ponderosa Pine	95,950	23	3,817	11
Douglas-fir	10,297	3	630	2
Krumholz/Alpine	1,896	0.5	201	0.5
Unidentified	1,515	0.5	141	0.5
Subtotal of Rangelands	**409,813**	**100**	**34,417**	**100**
Lodgepole Pine	472,576		20,254	
Spruce-Fir	191,696		11,831	
Total Acres of Vegetation	**1,074,085**		**66,503**	
Rock, Talus, Scree	8,187		210	
Rights-of-way, urban or build-up	28		11	
Marsh, pond, lake/reservoir, stream	2,315		1,509	
Total Acres	**1,084,615**		**68,232**	

Source: Forest GIS database

Use by Domestic Livestock

The overall rangeland management status on the Medicine Bow National Forest is satisfactory as indicated by the information in the following table. Satisfactory rangeland management status occurs when the existing plant community is at, or is making acceptable progress towards, the desired plant community identified in the project planning process. Monitoring indicates that within active grazing allotments only 1% of the acres grazed by livestock are considered unsatisfactory. Unsatisfactory areas of rangelands are often those areas where livestock use is frequent and repetitive during the summer growing season, such as parks with gentle terrain, available water, and dry soils or short sections of riparian areas where two

streams converge. Riparian areas characterized by wet and boggy soils are often undesirable to livestock but are used substantially by a variety of wildlife species; these are usually in satisfactory status. The vast majority of uplands are in satisfactory status, with substantial forage production occurring in those areas that are not heavily forested (generally under 70% canopy cover). A few upland sites that received very heavy historical grazing pressures when livestock numbers were significantly higher are not yet in satisfactory status; they are very limited in size or number relative to the overall areas now capable of supporting sustained livestock use.

Table 3-81. Summary of 1998 Forest Service rangeland condition report (within allotments).

	Rangeland		Riparian Area Only	
	Acres	**%**	**Acres**	**%**
Monitored in FY98	109,279	39%	17,132	37%
Verified as meeting 1985 Plan objectives	113,029	28%	10,421	22%
Estimated as meeting 1985 Plan objectives	160,666	40%	19,859	44%
Verified as moving toward 1985 Plan objectives	17,684	5%	3,432	7%
Estimated as moving toward 1985 Plan objectives	80,190	20%	9,946	21%
Verified as not meeting 1985 Plan objectives	1,713	<1%	528	1%
Estimated as not meeting 1985Plan objectives	2,509	<1%	827	2%
Undetermined status	24,629	6%	1,332	3%
Total	**400,420**		**46,345**	

Source: Forest Service Rangeland Management Information System (FSRAMIS) database

Verified acres as identified in the preceding table are those where monitoring efforts have confirmed the result (they are meeting the objectives, moving toward them, or not meeting them). Estimated acres are those believed to be in that category, but not confirmed with the annual or recent monitoring efforts. For example, there were 1,713 acres verified in 1998 as not yet meeting plan objectives, but it was estimated that an additional 2,509 acres might not be meeting the vegetation objectives; together, the two comprised about 1% of all rangeland acres.

Of the 1,084,615 NFS acres on the Forest, about 1,055,000 acres are capable of being grazed by sheep (958,000 are suitable) and about 981,000 acres are capable of being grazed by cattle (895,000 are suitable). See Appendix B for the complete determination of capability and suitability for livestock grazing.

The 104 active grazing allotments on the Forest include a total of 1,208,763 acres, of which 995,877 acres are NFS lands (the other 18% are private and state lands). Accordingly, not all acres fenced into or included in allotments is either capable or

suitable. In addition, since about 400,000 of these acres are considered prime or easily accessible rangelands with relatively high forage production (see the preceding table), the average allotment has about 40% of the acres on which domestic livestock routinely make use of a portion of the available forage.

An additional 15 allotments are currently vacant (Term Grazing Permits are not issued for livestock use); the total for these areas is 63,666 acres, of which 46,099 are NFS acres (72%). These acres are not included in the totals in the preceding table; however, they are also believed to be in satisfactory status based upon inspections of these areas.

The remaining 53,162 acres of National Forest System lands are outside the boundaries of any kind of allotment, and any authorized grazing is exclusively by recreational visitor use and outfitter/guides (USDA Forest Service 1998b).

While a majority of the rangelands on the Forest are in active grazing allotments, livestock grazing actively takes place on only about 37% of the Forest, with an additional approximately 25% receiving occasional and incidental use by livestock (for example, the approximately 225,000-250,000 acres of lodgepole with limited forage in the under-story). The remainder is reserved for wildlife and recreational use. Standards and Guidelines further specify the portion of annual vegetation production on those lands that may be utilized by livestock, also leaving the remainder of annual growth – generally 50-60% – also available for other uses and values on that 37% of the surface acres.

Ultimately about 37% of the total acres on the Forest are actually used by livestock to any appreciable degree and on that acreage livestock are restricted to using an average of about 45% of the annual forage production. In reality, because of variability in palatability and in distribution of livestock across the landscape, actual use is lower than the 45%. Overall, livestock has available for use only about 17% of the annual forage growth. The remainder is reserved for wildlife habitat values, scenic or recreational values, plant and soil health and sustainability, biodiversity, and other values.

Aspen

There are currently about 83,686 acres of aspen cover type on the Forest – about 8 % of the total Forest acreage (10% of forested acres). The largest area of aspen occurs on the southwest slopes of the Sierra Madre range. On the Snowy Range, the Laramie Peak Range and on the Sherman (Pole) Mountain Range, aspen occurs primarily within riparian areas.

There are areas where browsing (notably by elk, but also by cattle) has been responsible for the loss of young trees and young stands across the landscape. Many of the stands, particularly on the Sierra Madre, show heavy hedging of young trees by elk.

Native Meadows and Parks

There are about 71,278 acres characterized by grasses and forbs on the Forest – about 7% of the total MBNF (and a large percentage of this total is found in the high-altitude open areas on the Snowy Range – 33,158 acres). These native meadows provide considerable amounts of forage for wildlife and livestock, and also provide "edge effect" as well as access to hiding and escape cover for big game animals on their summer ranges.

Effective fire suppression over the last several decades, in addition to changes in other uses, has resulted in conifers encroaching in, and reducing, many of the native meadow/park ecosystems (Knight 1994) (personal observations R. Mountain). See the Livestock Grazing and Big Game Use section of this Chapter for further discussion.

Shrublands

There are 132,862 acres of shrublands on the MBNF with the greatest amount occurring on the Sierra Madre (58,040 acres) and the Snowy Range (52,426 acres). The Laramie Peak Range has 12,111 acres and Sherman (Pole) Mountain has 10,285 acres. These shrublands provide forage for livestock and big game. See the Livestock Grazing and Big Game Use section of this Chapter for further discussion of how forage for livestock and forage for big game is managed in these areas.

Historic levels of wildfire, big game and livestock populations have all played roles in maintaining native shrubland ecosystems. Effective fire suppression over the last several decades, in addition to changes in other uses, has resulted in a reduction in quantity or quality of existing stands or a conversion of some acres to other types of vegetation. Most of the sagebrush stands (93,000 acres – about 9% of the Forest) and other shrub stands (22,000 acres – 2% of the Forest) are in mid- to late-seral status.

Reintroducing fire into these ecosystems, sometimes coupled with domestic sheep or cattle grazing, would increase the mix of habitat diversity or vegetative under-story to provide a broader range of wildlife species' habitat needs. Many species of shrubs are fire-resistant, and sprout vigorously after a burn; some species of sagebrush don't.

Ponderosa Pine

There are 95,950 acres of ponderosa pine on the MBNF (9% of the MBNF). Most of the ponderosa pine occurs on the Laramie Peak range (85,566 acres) and on the Sherman (Pole) Mountains (9,037 acres) with minor amounts occurring on the Sierra Madre range (30 acres) and the Snowy Range (1,317 acres).

Dillon, Knight et al. (Dillon, Knight et al. 2003) indicate that it may have historically occupied about that same amount of the landscape. The Biological Diversity Section of this Chapter discusses the alternations in structure that have occurred, the recent

insect epidemics and wildfires that killed many of the ponderosa pine trees on Laramie Peak and historic fire regimes that may have operated in these stands. Historical livestock and big game grazing intensity may have contributed to the reductions in fire frequency and intensity and have contributed to the alterations in structure (greater density of small trees).

The alterations in structure, where they have occurred have changed associated forage values. Where stands have become more dense from lack of frequent fire, forage values have decreased. Where insect and/or fire mortality has reduced tree density and re-invigorated previously decadent shrublands and/or grasslands, forage values have increased.

ENVIRONMENTAL CONSEQUENCES

General Effects

Alternative A would continue existing trends of moving rangeland vegetation towards later seral stages and with steady or improving trends. Alternative C would also maintain rangeland vegetative conditions very similar to the present. Alternative B will move about 5% of the vegetation from late to mid seral condition as a result of a 60% increase in the use of prescribed fire. Alternatives D DEIS and D FEIS, E, and F will increase the amount of late succession vegetation by 10%, 15%, and 24% respectively. Much of that will be achieved through reductions in the amount of timber management. Use of fire for fuels treatment is about double the current levels for Alternatives D DEIS, D FEIS, and E, but slightly less than current in F.

The combined acres of vegetative treatment for rejuvenating aspen, maintaining native meadows, treating sagebrush and other shrublands to improve wildlife habitat, and fire treatment in ponderosa pine to replicate natural stands will remain mostly constant across all alternatives. Management of noxious weeds or other undesirable plant species is often necessary to maintain native plant communities. Noxious weeds and invasive plants are discussed in the section on Non-native and invasives in this Chapter.

Effects to Rangeland Components

Aspen

Strategies and guidelines for every alternative include maintaining and restoring aspen. Aspen can be maintained or restored by renewable resource management activities, planned restoration actions or natural disturbances. Alternatives D FEIS, D DEIS and E will have the greatest maintenance and/or increase in the amount of aspen on the landscape. Without disturbance (natural or human) those acres within the aspen cover type that are successional to lodgepole pine or spruce/fir will not

remain in the aspen cover type. The estimated treatment of aspen with prescribed fire is discussed in the Biological Diversity Section of this Chapter.

Native Meadows and Parks

Active management such as burning or cutting can retard or prevent the conifer encroachment and slow the reductions in the acreage of native meadows and parks. This type of activity would occur most frequently in MA 5.15 where there is an emphasis on ecological restoration. This type of activity would occur as wildlife habitat restoration (see S-tables for estimated quantities). Alternatives E and F have the largest amount of planned wildlife habitat restoration. Alternatives D DEIS and D FEIS have the greatest amount within MA 5.15 which emphasizes restoration activities.

Prescribed fire in grasslands would also occur as wildlife habitat restoration (see S-tables for estimated quantities). The Biological Diversity Section of this Chapter discusses prescribed burning in grass and shrublands. Alternatives D DEIS, D FEIS and E have the greatest predicted amounts of prescribed burning in grass and shrublands with approximately 55% of the grass and shrublands having fire restored to ecosystem.

Shrublands

Reintroducing fire into these shrublands, sometimes coupled with domestic sheep or cattle grazing, would increase the mix of habitat diversity or vegetative under-story to provide a broader range of wildlife species' habitat needs. Many species of shrubs are fire-resistant, and sprout vigorously after a burn; some species of sagebrush do not.

Prescribed fire in shrublands would occur as wildlife habitat restoration (see S-tables for estimated quantities). The Biological Diversity Section of this Chapter discusses prescribed burning in grass and shrublands. Alternatives D DEIS, D FEIS and E have the greatest predicted amounts of prescribed burning in grass and shrublands with approximately 55% of the grass and shrublands having fire restored to ecosystem. Alternatives E and F have the largest amount of planned wildlife habitat restoration.

Less than 1% of the shrublands of the MBNF are within ¼ mile of urban interface zones. In these areas, shrub density and or structure may pose a fire risk to local communities and management actions may be implemented to reduce fire risk. Any fire risk reduction treatment in these areas would be additional to those represented above as prescribed fire in grass and shrublands.

Ponderosa Pine

Currently, upland livestock grazing effects are reduced to the level that they have little or no effect on fire frequency or intensity and thus little or no effect on preventing or slowing conifer recruitment in ponderosa pine.

None of the alternatives include large amounts of ponderosa pine habitat within the land base suitable for timber production. Reintroduction of fire into ponderosa pine stands would restore historic stand structure and maintain or improve forage values. Changes to existing structure of ponderosa pine habitat will be accomplished primarily through restoration projects. Management Area 5.15 emphasizes treating forested stands that return the area to habitat structural stages similar to HRV. Alternative D DEIS has the greatest number of acres of MA5.15. Alternatives D FEIS, C and E have the next greatest acres in MA5.15. Alternatives E and F have the largest amount of planned wildlife habitat restoration.

Effects from Fire and Fuels Management

Fire halts natural succession at least temporarily, and generally starts succession over again at an earlier seral stage than the vegetation was in prior to the fire. Wildfire will often be a greater disturbance (more often move succession to an early seral stage) than will prescribed fire because planned/managed fires are designed through the burning plan to use certain wind, temperature, and moisture conditions at the time of ignition to achieve specified vegetative conditions as a result of the prescribed fire. Effects are nearly always extremely variable, depending on fire regime, behavior, severity, and extent.

Fire maintains the diversity of vegetation across grasslands, retards or prevents conifer encroachment in meadows and parks, regenerates aspen stands, and is responsible for maintaining the mixture of vegetation necessary on shrublands for wildlife habitat diversity for such species as elk, deer, antelope, sage grouse, and many non-game species.

The use of prescribed fire for fuels treatment and vegetative management is greatest in Alternatives D DEIS and D FEIS, followed by Alternatives E, then by B and C. It is only slightly less than current levels in Alternative F. In general, the higher the use of prescribed fire, the greater the number of acres on which vegetative succession will be moved to an earlier seral stage.

The greatest effects from wildfire would be in Alternative F and E, as these alternatives provide for the greatest levels of natural disturbances. All other alternatives anticipate similar, and lower, levels of wildfire activity.

Effects from Insects and Disease

Infrequent insect outbreaks are a natural part of the ecosystem; grasshoppers and Mormon crickets are the most common types that occur periodically on rangelands on the Forest. The outbreaks can be anywhere from unnoticeable to most people to exceeding 200 insects per square yard. The outbreaks tend to be more prevalent during periods of drought. In general, since most insect infestations are short-lived (a year or maybe two in the same area), the effects on rangeland vegetation are a defoliation (partial or complete) of the current year's plant growth, but vegetative community succession is seldom affected. Diseases of rangeland vegetation do

occur on the MBNF. Most common are smut and rust diseases of grasses. However these diseases are infrequent, low intensity and currently have minimal effects on composition, structure or function of rangeland vegetation.

Effects from Recreation Management

Recreation use generally has little effect upon rangeland vegetation except in the case of repeated or continual uses such as camping, fishing, and hiking, or off-road vehicle use. 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, for example – but generally the number of acres impacted is a very small percentage of the total rangeland acres across the Forest. Since most alternatives tend to emphasize the same or less summer recreation opportunities than exist at present in Alternative A, there is little or no effect across the landscape with limited effects in some local areas.

Effects from Special Area Allocations

Special area designations tend to reduce the amount of human-caused disturbances, but many include natural processes are part of the management prescription. Succession of the included rangelands will proceed toward late seral conditions except where natural disturbances create early successional stages. RNAs are generally managed to promote "natural" succession and disturbance regimes while many of the SIAs tend to be managed to promote specific values.

Where the emphasis of the Special Interest Area is not focused on vegetation conditions, management actions may maintain conditions that would be unusual occurrences in terms of HRV. Alternative E has the greatest amount of special area allocations, followed in order by Alternatives F, D FEIS, D DEIS, B, and C. Alternative A has the least.

Effects from Travel Management

Effects are similar to those for Recreation (see above) except they occur on a greater number of acres (roads versus trails). Past road construction has had the effect of contributing 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 tend to create the largest impact on the health and sustainability of stream/riparian/wetland systems. Effects include lowered water tables, altered morphology, changed sediment regimes, and removal of canopy cover and other vegetation. Other uses then sometimes worsen the situation.

Alternative A provides for the greatest amount of motorized summer use, followed in order by Alternatives B, E, C, and D FEIS, D DEIS, with F. In all alternatives, the decommissioned road miles are greater than the number of miles constructed or reconstructed. The net result is little or no effect in changing rangelands vegetation

seral stage acres across the entire Forest. The alternatives with travel restrictions, from highest to lowest, are Alternatives F, D DEIS, D FEIS, C, E, B, and A. Unauthorized off-road vehicle travel contributes to disturbance and in moving rangeland vegetation to an earlier seral condition.

Effects from Wilderness Management

The effects are very similar to those for Special Area Allocations (see above).

In addition, management of fires in wilderness influences existing vegetative communities, seral stages, and structure. Management of noxious weeds or other undesirable plant species is often more difficult in wilderness areas but there are also fewer sources to introduce noxious weeds. Noxious weeds are discussed in the Non-natives and Invasives Section of this Chapter.

Alternative F has the greatest amount of existing and recommended wilderness, followed by D DEIS, D FEIS, and E. Alternatives A and C retain the same amount of wilderness as at present; B is less than current acres.

Effects from Roadless Area Management

The effects are very similar to those for Special Area Allocations (see above). Alternative E has the greatest amount of acreages retained as roadless, followed by D DEIS, D FEIS, F, C, and A. Alternative B reduces slightly the acres of roadless areas remaining at present.

Effects from Oil, Gas, and Mineral Development

Effects are similar to those for Recreation (see above) if leases result in exploration activity and if any sites then go into production. The amount of rangeland vegetation that could move to an earlier seral stage is dependent upon the amount of exploration and resultant production, but is expected to be minimal across the Forest. All alternatives provide for a greater degree of possible leasing than exists at present, with about 25% of the total Forest acreage available. Potential for production and resultant effects on rangeland vegetation is considered low for all alternatives.

Effects from Livestock Grazing and Big Game Use

Herbivory is a disturbance agent to the herbaceous and shrub cover on rangelands. Its exact effect on succession depends on a number of factors including the level of grazing, timing, frequency, kind of herbivore, and existing seral condition of the vegetation. Grazing and browsing by livestock, big game animals, and other wildlife has similar effects.

Properly managed by vegetative type and within habitat capacities, use by ungulates tends to utilize, and provide for, a mix of seral stages across broad landscapes – roughly 10-20% of the vegetation in early seral, 60-80% in mid seral, and 10-20% in late seral. Although variations exist depending upon various plant communities and

wildlife types (amphibians, mammals, birds, etc.), these percentages also tend to approximate the number of wildlife species that depend upon those ranges of seral stages for preferred/required habitat (i.e., roughly 70% of all wildlife species rely on mid seral vegetative conditions for their needed habitat, about 15% of the species require early seral habitat, and only about 15% of the species require late seral vegetation) (Morrison, Marcot et al. 1992). High intensity use, repeated use during times of rapid plant growth, frequent use of individual plants or plant communities, or longer periods of use tend to push more of the vegetation toward the early-to-mid portion of this "bell curve," while lighter, shorter, or less frequent use tends to result in a higher percentage of mid and late seral vegetation.

High historic levels of grazing use across the Forest a century ago were responsible for maintaining large acreages in early to mid seral condition and for over-utilization in many areas including riparian zones and wet meadows. That use also contributed to maintaining native meadows and parks, a mixture of shrubland conditions across the landscape, and more open natural ponderosa pine stands. Reductions of grazing use over the last several decades has helped to contribute to conifer encroachment in native meadows, less desirable habitat for big game on many shrubland winter ranges, and increases in fuels in the under-story of many ponderosa pine stands.

Browsing and grazing of young aspen shoots can be detrimental to successful reestablishment of replacement stands following fire or other treatment. Areas may need to be fenced – depending upon extent and location of burned or treated areas – or otherwise managed to control use by cattle until the young trees are big enough to avoid being detrimentally grazed – generally 6 feet tall.

Each alternative provides for livestock grazing to varying degrees. Alternatives A, B, C, D DEIS, D FEIS, and E call for continuing existing use levels. Alternative F calls for a corresponding reduction in the amount of livestock use by 25%. Implementation of each alternative, and its associated standards and guidelines, will result in approximately the above amount of permitted use, but this is only an estimate for alternative comparison purposes. Actual permitted grazing levels are an outcome of the standards and guidelines, objectives, and management area guidance, and are not an objective or goal in their own right.

Big game populations, however, are less manageable or predictable, but their effects on managing for desired seral stage are similar. Higher numbers of big game species will move or maintain more acres of rangeland vegetation to an early or mid seral condition (elk in the meadows and more open grassland types, deer and antelope in shrublands and grasslands and riparian areas, and moose in riparian/wetland habitats like willow stands); lower numbers allow more acres to move to a higher seral stage.

In addition, seasonal use such as big game moving up the mountain very early following greenup – each year – hits plants when they are most vulnerable and sets back succession and can damage wet soils. In the same way, seasonal and intense use on palatable shrubs such as mountain mahogany and antelope bitterbrush can retard succession and result in undesirable vegetative or soil conditions.

Currently, all big game populations are continuing a quarter-century trend of increasing in numbers, and elk, in particular, are well above the levels desired for the habitat. Some species – elk in particular – may be higher in numbers than ever before. There are areas, particularly on the Snowy Range, where heavy utilization by elk and moose on willows is preventing riparian areas from achieving desired vegetation condition. High populations of elk are creating over-utilization on some areas of winter range that in turn result in heavy use of winter range, riparian areas, and hay fields on deeded lands below the Forest. Elk use in some aspen stands, both on the Snowy and Sierra Madre Ranges, has resulted in "barking" of the trees and hedging or elimination of young trees.

Browsing and grazing of young aspen shoots can be detrimental to successful reestablishment of replacement stands following fire or other treatment. Depending upon the densities of new trees following the disturbance (which can be as low as perhaps 100 shoots per acre to as high as 30,000 shoots per acre), utilization by elk and other big game animals on the newly treated areas can negate efforts to reestablish aspen across its range.

Big game populations are probably independent of alternative (because the Forest provides summer range, which is seldom the limiting factor in population numbers).

Effects from Rangeland Vegetation Management

The effects from rangeland vegetation management were discussed for each rangeland component in the previous section.

Effects from Forest Vegetation Management

As timber is harvested, however, it may open areas in the canopy so that forage is grown underneath or it may create new acreages of rangeland vegetation in small harvest units. This is called transitory rangeland, and it only remains in this state until the forest stands once again close or the young trees get dense enough that rangeland vegetation no longer occupies the site (generally, this occurs within 15-25 years on the Forest). The order of alternatives with timber harvest activities, from most to least, are: B, followed by D DEIS, C, A, D FEIS, E, and F. The Biological Diversity Section of this Chapter discusses changes to forestlands and creation of early successional stages through management actions and by natural disturbance processes. These areas of transitory rangeland may provide rangeland vegetation connections between previously unconnected rangelands (e.g. mountain meadows) and result in more movement of animals into low-use areas. See the Biological Evaluation for grazing effects on sensitive plants that occur in some of this remote or rarely grazed areas. There are no other effects to existing rangeland vegetation from timber harvest.

Effects from Land Exchanges

There is no effect to rangelands and the seral stage of the vegetation unless the land exchange results in a large net change of acres.

Effects from Wildlife and Fisheries Management

None except for the big game effects discussed above.

Effects from Threatened/Endangered/Sensitive Species Management

In general, the habitat requirements in and around each known or discovered T/E/S location will be protected, restored, or enhanced to promote the continued existence of these species. These management actions generally restrict grazing by domestic livestock and sometime big game. Conservation plans for individual species may call for the manipulation of vegetation to provide habitat for existing or addition populations of T/E/S species. Since these actions would occur independently of alternatives, management of threatened, endangered, and sensitive (T/E/S) species will have a consistent effect on rangeland vegetation for all alternatives.

Effects from Soil and Watershed Management

Soil and watershed restoration or improvement projects are designed to improve condition of the land – in essence to move seral stage upward or at least to provide site stabilization and long term sustainability. Though not specific to rangelands, the greatest number of soil and water improvements is planned in Alternative B, followed by C, D DEIS, D FEIS, E, and A; F plans the least. Alternatives E and F plan the greatest amount of stream or riparian restoration, then D DEIS and D FEIS; A and C are next; and B plans the least.

Effects from Communities of Interest

The communities of interest and the culture of these communities provide a continued interest in the amount, distribution and condition of rangeland vegetation and the use of this rangeland vegetation by both domestic livestock and big game. Rangelands of the MBNF are connected to the rangelands of adjacent ranches and domestic livestock, big game and other wildlife use rangelands both on the MBNF and on the adjacent ranches. The amount, distribution and condition of rangeland vegetation on the ranches is often correlated with changes on the MBNF. Changes in land uses adjacent to the forest can result in changes in grazing patterns and intensity and increased introduction of noxious weeds. Changes in land uses can also influence fire suppression at the boundary between NFS lands and private lands. The result can be fewer natural disturbances influencing in these boundary areas (Christensen 2002).

Cumulative Effects

Alternative B will move about 5% of the vegetation from late to mid seral condition as a result of a 60% increase in the use of prescribed fire. It will retain a majority of the rangelands in mid to late seral condition, just a proportionally higher percentage in mid seral condition. Alternatives A and C would maintain rangeland vegetation very similar to the present.

Alternatives D DEIS and D FEIS, E, and F will increase the amount of late succession vegetation by 10%, 15%, and 24% respectively. Much of that will be achieved through reduced timber harvest. Use of fire for fuels treatment is about double the current levels in D DEIS, D FEIS, and E, but slightly less than at current in Alternative F.

More than half of the ranchers that hold Forest Service grazing permits also hold BLM grazing permits. Many of their private lands also contain small isolated tracts of BLM lands in the midst of their private holdings as well (Section 15 lease lands), adding to the complexity of management. A majority of these operators have all three types of land ownership (and may have leased State lands and/or other leased private land as well) intermingled in their year-round livestock operations. A change in land use, livestock management, seasons, or numbers on any ownership influences all the other lands and their resultant vegetation.

State hunting policies and current herd management objectives can be considered constant across all alternatives; however, population levels that may vary as a result of implementing the various alternatives have cumulative effects on both the Forest lands and the private lands below and adjacent to the Forest.

Some level of private land development in the six counties surrounding the Forest will occur regardless of management activities on the Forest. However, management decisions on the Forest that might result in increased levels of development or subdivision of the deeded lands adjacent to the MBNF may result in changes to rangeland vegetation amount, distribution or condition (see previous section on communities of interest for details).

Wildlife

Introduction: The Medicine Bow National Forest provides a wide diversity of habitats that support over 300 vertebrate species, including 75 mammals, 227 birds, 19 reptiles, and 6 amphibians (Von Ahlefeldt and Speas 1996). These species provide Forest users and visitors with a broad range of wildlife related recreation opportunities that include sport, commercial, and viewing activities.

Historical records reveal that some species once present on the Forest are believed to have been extirpated by the early 1900s. Examples are the wolverine, grizzly bear, gray wolf, and mountain bison. Other species' populations, especially those hunted or trapped, fell in the late 19th and early 20th centuries, but recovered after protective regulations were enacted (including deer elk, otter, bobcat, mountain lion, and black bear (Von Ahlefeldt and Speas 1996). The past status of lynx is uncertain, though the species is documented from the adjacent mountains in Colorado and are likely to have occupied suitable habitat on the Medicine Bow NF. Prior to 2003, there were a very few lynx records. In 2003, 4 radio-collared lynx from releases in Colorado were present intermittently on the Medicine Bow NF. The science Team studying the wolverine (based in Missoula MT) has not found any of the wolverine sightings in recent decades to be credible and believe that the species is currently extirpated in the Southern Rockies. However, there is a healthy population in NW Wyoming and natural dispersion to the Southern Rockies is not unlikely (McKelvey 2003, pers. comm.) Wolves released in Yellowstone have produced an expanding population and have spread into the Wind River Range and the Wyoming Range.

Currently deer and elk populations are at, or exceed, state of Wyoming objectives over much of the Forest. Smaller populations of black bear, bighorn sheep, antelope, and mountain lion are also yearlong or seasonal residents.

About 80% of the forest consists of forested cover, dominated by lodgepole pine (44%), spruce/fir (18%), ponderosa pine (9%), aspen (8%). Other species such as limber pine, Douglas fir and cottonwood are less than 2% of the forest. Non-forested cover types are dominated by shrubs on 12% of the forest and grasses on 7% of the forest.

Species of viability concern are addressed individually in FEIS Appendix I (the Biological Assessment for Threatened, Endangered, Proposed and Candidate species; the Biological Evaluation for species on the Region 2 sensitive species list; and the Evaluation of Species of Local Concern).

Changes between DEIS and FEIS

Discussions on snow compaction, spatial pattern, dead and downed wood and snags were edited to improve clarity. Sections on wilderness and roadless, ponderosa pine habitat and aspen habitat have been added.

Legal and Administrative Framework

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

The National Forest Management Act (1976) requires the Forest Service to consider all resources in the land management planning process.

The Forest Service is directed by 36 CFR 219.9 to maintain habitat for viable populations of existing native and desired nonnative vertebrate species. Viable populations are defined as those with the estimated numbers and distribution of reproductive individuals to ensure the continued existence and that they are well-distributed. In order 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 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)).

The Wyoming Game and Fish Department is directly responsible for managing wildlife populations, the Forest Service indirectly affects population numbers, diversity, and species viability through the management of habitat. The Forest Service and the Wyoming Game and Fish Department work in partnership to strike the best balance between wildlife population goals and habitat management on the forest.

Viability Determination – A Two-Part Approach

For more detailed descriptions of methods and assumptions, please refer to Appendix D- Biodiversity Report.

The approach adopted in this analysis has two components:

1. An ecological assessment comparing current habitats and processes to those that occurred in the last several centuries (under climate similar to today's) (Historic Range of Variability) to cover most species.
2. Single species assessment to cover species that are of public interest (like game animals and songbirds), and species that have been identified as reduced in number or range or are suspected to be of concern because of alterations in habitat or other factors.

Assumptions in the use of Historic Range of Variability (HRV)

This way of evaluating today's habitat conditions by comparing them to HRV involves making the following assumptions.

- The conditions created by natural processes provided habitat adequate to support viable populations of most native species
- We are able to correctly define the range of conditions, include all the relevant parameters, and incorporate this information into management in a way that creates an environment that provides adequate habitat for most of the native species.
- Identification of changes from HRV provides guidance for conservative management and yields valuable clues to potential problems for species that may rely on those features.
- Using HRV as a reference helps us compensate for our ignorance of the importance of habitat components and structure

For these reasons, using comparison to HRV by itself is never adequate, any more than the single species approach had been. Rather, the two parts are complementary and are only useful to protection of viability when they are integrated.

Species of viability concern are addressed individually in the Biological Assessment and Biological Evaluation in Appendix I. *Game species* are addressed individually in this chapter because of high public interest and *landbirds* are addressed as a group. Most of this chapter focuses on the "ecosystem assessment approach."

For more detail on these approaches and methods see Appendix D.

For more detailed description and analysis of the changes in habitat and natural processes compared to what was typical of forest shaped by natural processes, please refer to the Biodiversity section of this chapter and Appendix D-Biodiversity Report.

Key Indicators

Key indicators were selected that appear to have the most potential affect on wildlife communities, because of the intensity of effect or the extent of affected acres. Those indicators are:

1. Age/Structural Classes of forest (including old growth forest)
2. Spatial pattern on the landscape (fragmentation, connectivity)
3. Snags and dead, down wood (amount and quality)
4. Snow compaction
5. Security area/roads/human disturbance
6. Wilderness and roadless areas,

7. Recently burned forest,
8. Ponderosa pine forest, and
9. Aspen Habitat
10. Birds
11. Big Game
12. MIS
13. Effects from proposed management activities

AFFECTED ENVIRONMENT
SPATIAL PATTERN ON THE LANDSCAPE

Fragmentation of Spruce-Fir and Lodgepole Forest

On the Medicine Bow NF, the current spatial distribution of patches of forest of different age has been created primarily by timber harvest and roads. This pattern differs from patterns created by natural processes in many respects. Patch size is smaller and there is less interior forest. Patches are more uniform in size. (Dillon and Knight 2000). The amount of high-contrast edge is increased in high-elevation forest where roads and timber harvest have occurred (Reed, Johnson-Barnard et al. 1996), (Dillon and Knight 2000). In addition to alteration in vegetation pattern, some stands have been fragmented by roads, trails, and clearcuts. (Reed, Johnson-Barnard et al. 1996), (Baker and Knight 2000).

The early studies of fragmentation focused on remnant patches of forest in landscapes converted to non-forest vegetation. Over time, the term came to be applied to other situations in which a continuous forest was altered by creation of openings within it. The resulting pattern is openings scattered in a matrix of forest rather than a "fragmented" forest with islands of trees in a matrix of unforested land. This "perforated" pattern does not meet the definition above of "fragmentation." Forest animals can theoretically, move through the whole forested area by moving around the openings in the continuous forest matrix. In a true "fragment," an animal would have to cross unforested land to reach islands of forest.

The pattern on the Medicine Bow is both perforated and fragmented. The spatial pattern currently found on the MBNF has been created by three factors:

1. A patchy physical environment (elevation, aspect, soil type, temperature, moisture, snow pattern, etc. (Romme and Knight 1981), (Knight and Reiners 2000);

2. Superimposed on that pattern, effects of natural disturbances like fire, blowdown, and patches of tree mortality caused by insects and disease (Romme and Knight 1981),(Veblen 2000); and
3. Human activities that alter connectedness and patch characteristics like shape, size, and isolation.

Determining whether the current pattern of forest vegetation is significantly different from those created by natural processes is difficult because of the variation in the patterns that could be created by natural processes and by our lack if information on actual examples. Studies done using either unloggged areas or reconstructed landscapes concluded that current landscapes differ from those created by natural processes in at least the following ways: (1) decreased patch size; (2) increased patch density, total edge perimeter, and edge density; and (3) simplification of patch shape (into more rounded or square rather than irregular shapes); (Reed, Johnson-Barnard et al. 1996), (Reed, Johnson-Barnard et al. 1996), (Miller, Joyce et al. 1996); (Tinker, Resor et al. 1998) (Veblen 2000)). Both the Medicine Bow and Bighorn studies isolated the effects of logging from that of roads and concluded that roads contribute more to the observed differences than do harvested patches. These conclusions are also supported by the HRV Report on the Forest (Dillon et al 2003).

"Fragmentation" on the Medicine Bow NF is created by (1) a *"perforated"* pattern of *temporarily-altered* young patches and strips in a *connected matrix of forest* and (2) narrow persistent openings (roads). Animals that will cross roads can move through the landscape without leaving forest, but the cut-over areas also regain cover and eventually become permeable to these same species. Patches isolated by logged areas become reconnected over time as shrubs and trees grow in cut-over areas. Even along large strip cuts that may isolate small animals with limited mobility, the populations will be connected over time as the forest regenerates. The nature of the altered habitat remains within the historic habitat type.

Interior Forest

The pattern of past logging and the density of roads have reduced the amount of interior forest. Though no map of the pattern prior to logging is available, the original spatial arrangement can sometimes be deduced by the blocks that appears when a map or current mature/old (structural class 4 and 5) stands and a map of past harvest are combined (Kozlowski, pers. comm.) For animals that typically used large patches of mature/old forest, in "perforated" parts of the MBNF, resources and conditions associated with interior forest are less aggregated than in the past.

Recent re-assessments have found that the effect of habitat loss in many cases is much greater than the effect of fragmentation under most conditions

Which animals are likely to be affected by fragmentation in addition to effects of habitat loss? Ignoring for the moment possible effects of edge, patch size, and patch

shape, it seems to depend on the **relative scale** of the species home range and that of the new patches and remaining matrix.

- For animals with very small home ranges compared to the size and shape of the residual forest patches, each home range is either completely altered (logged) or untouched (except those along the edges of the logging). Therefore, (ignoring edge effects), the decline in numbers will be close to proportional to the loss of habitat. (Fine scale home range, coarse scale matrix)
- For animals with home ranges larger than the residual patches (say 10 times as big), the home range of each is partially logged. Unlike the previous cases with small home ranges, habitat quality within the home range is affected. A home range that provided adequate resources will no longer do so, and the home range must be expanded to adjust for the lower resource density. (Coarse scale home range, fine scale matrix.)

The pattern created by logging and roads is **not** similar to the pattern created by natural processes. Whether a particular species is affected depends on its home range size, the extent its daily movements, its dispersal distance, and its ability to move safely through forest gaps. To best cover the needs of all species, management should imitate patterns created by natural processes.

It is impossible to generalize the results of fragmentation on "wildlife." For some species there may be close to a linear relationship with amount of habitat (unaffected by the spatial pattern). For others spatial patterns may be critical to their use of habitat: these include:

1. Some small birds associated with old growth (Hermit Thrush, Brown Creeper, possibly Red-breasted Nuthatch (Keller and Anderson 1992), (Hejl and Paige 1994), (Ruefenacht and Knight 2000));
2. Those sensitive to edge effects (though expected edge effects were not found in vertebrates by Ratti and Reese 1988, Keller and Anderson 1992, Cotteril and Hannon 1999, or Lichstein et al 2002), and
3. Those with large home ranges (American marten, (Bissonette, Harrison et al. 1997), possibly Northern Goshawk (Reynolds, Graham et al. 1992).

Effects of Fragmentation on Wildlife- Roads

Roads differ from timber-harvested areas because they are long and narrow and because they are long-lived features (they are not regenerating to native vegetation). Roads also are sites of human disturbance, which will be addressed in the section on Security Areas. Effects on wildlife include alteration in the environmental conditions (temperature, light, moisture) in adjacent forest and along the verges, related changes in vegetation (and associated wildlife), and inhibition of free movement in formerly connected habitat.

- Gradients of environmental conditions from the road edge toward the center of the stand are steepest in wet, dark, dense forest, where the dry open conditions and light are radically different from forest interior that formerly extended for hundreds of miles with only small openings. Most of the literature in the edge effect of roads on adjacent forest was done in such settings, like the Pacific Northwest. In dry, more open forests (like ponderosa pine and much lodgepole) these effects are not as significant.
- Where verges are broad (especially along larger roads), there may be great alteration in the vegetation, with grass, forbs, and shrub species that would not occur in the forest canopy. Many of these species would occur along the edges following natural disturbance. Associated wildlife like butterflies and shrub nesting birds will move in and forest animals like deer and bears may selectively feed there. However, roads are also corridors for transport of weed seeds and many roadsides are highly altered communities composed of invasive noxious weeds. Though it has long been believed that predation rates on bird nests were increased (Wilcove 1985), it seems that this happens at forest edges associated with agricultural and human development (where predator numbers are related to those influences) but not in forests with timber management (Small and Hunter 1988, Haskell 1995).
- The barrier effect varies with species. Small animals usually remain in habitat with overhead cover to avoid detection by avian and other predators, and are less likely to cross openings of any kind than to remain under cover. Such animals often have small home ranges that are arranged on one side or the other of the road or, if there is a road in the home range, they cross it less than expected if they were as likely to cross the road as any other part of the territory e.g., (Meadows 2002). Larger animals may also cross roads less than expected (Mace, Waller et al. 1996), (Krebs and Lewis 1997), though this may be related more to avoiding disturbance than to the physical presence of the road.
- The barrier effect also varies with the size of the road and the level of traffic. Lynx crossed a major highway less than expected if movements were random but freely crossed forest roads (McKelvey, Aubry et al. 2000).

Overall, the physical effect of road corridors (in the absence of human use) has most adverse effect on wildlife when the road:

- Penetrates dense forest;
- Is wide (both the prism and cleared verges);
- Divides limited habitat essential to small animals (like riparian areas in habited by preble's meadow jumping mouse); or
- Separates resources needed within the annual home range (like boreal toad hibernation and breeding sites).

Additional effects of roads on large animals will be addressed in the section on Security Areas/Roads.

Connectivity

The Medicine Bow National Forest is not a contiguous land unit. It is made up of four discrete sections of land that are located at high elevations (up to 12,000 feet) and separated by valleys that are around 7000 feet. Forest Service management is concerned mostly with movement within each of these sections. Different species use "connecting" habitat in varied ways. Some will use quite narrow "corridors" as travel paths (frequently riparian areas). Others need "linkage areas," occupied by residents, for connections and gene flow to occur.

Connectivity is not always beneficial. Where connectivity of a particular habitat has been reduced from HRV, animals that were adapted to free movement through and area may be shut off from needed resources, face blocked migration pathways, or be unable to interbreed. However, increasing connectivity over HRV is just as bad- new predators and diseases may be introduced or locally-adapted populations may be "polluted" by genes from other populations.

Perforated landscapes (like much of the MBNF) may retain connectivity- apart from the long narrow stripcuts, most of the openings created by logging are relatively square and surrounded by intact forest. Though some leave-strips may be too narrow for travel (or occupation) by some species, it is generally possible to move long distances without leaving forest, even if this means zigzagging around clearcuts. The adverse effects of the perforated pattern on forest species appear to result from the low density of resources left after logging, rather than from a loss of "connectivity," strictly speaking. The added travel costs of a circuitous route through the forest may contribute to making the habitat unsuitable.

Connectivity is important not only for forest dwellers, but for open country animals. Bighorn sheep, for example, avoid entering forest. The development of a forested band may be enough to isolate a herd into two separate units that no longer interact. On the Medicine Bow NF, bighorns move between summer and winter range through unforested areas; as these have grown into forest, the Wyoming Department of Game and Fish has expressed concern about the effects of the loss of connectivity on bighorns. Most animals that use early successional forest patches (rather than adjacent grass- and shrublands) are adapted for moving around and finding isolated patches or habitat, as the distribution of fire-created patches was discontinuous.

Conclusions on Spatial Patterns

The Medicine Bow Range and the Sierra Madre are each composed of a matrix of mature/old forest perforated with patches that are open, grass/shrub/ or young forest.

The perforated pattern created by timber harvest and the linear pattern created by roads have little effect on animals with very small home ranges (relative to the size

of the blocks of remaining forest) independent of habitat loss. These animals can arrange their living spaces in the forested areas. Populations will decline linearly as the amount of the original habitat declines. Spatial pattern will not have a great separate effect.

Animals with large home ranges may increase the size of home range as habitat is lost within the home range. At a certain point, essential resources may become too dispersed to be used with a net energy gain, and the area may be abandoned.

Where habitat is bisected by a road, some small animals will not cross the openings; others will cross but will be exposed to predation and being hit by a vehicle while doing so. Larger animals may freely cross forest roads (like lynx (McKelvey, Aubry et al. 2000) in lynx book), show some avoidance but frequently cross (like martens (Robitaille and Aubry 2000), or show strong avoidance, especially during breeding season (like female wolverines (Krebs 1998) and grizzly bears (Mace, Waller et al. 1996)).

ENVIRONMENTAL CONSEQUENCES SPATIAL PATTERN ON THE LANDSCAPE

As with most parameters that measure characteristics of forest, there is no single "best" size of patch or arrangement on the landscape. Approximating the patterns created by all kinds of disturbance will provide for the best balance of patch size, shape and arrangement on the landscape and will best retain connectivity and useable patches for all species. All alternatives protect riparian zones, which serve as both movement corridors and inhabited linkage zones that provide connectivity between habitats and populations.

Consequences of alternatives are generalized, because effects depend on site-specific considerations of existing conditions, relation to natural movement pathways, and the specific animals under consideration.

Direct Effects

Activities under the Plan will create openings in forest by timber harvest and construction of roads and trails. As discussed above, each of these activities has different effects on different species.

Cumulative Effects

The non-NFS lands that separate the four sections of NFS lands are predominantly non-forested and privately owned. The predominant land use activities on the non-NFS lands are human settlements and grazing by domestic livestock and wildlife. Forest animals would only rarely have crossed these great expanses of prairie. Movement of mammals from one unit to another has been reduced by fences, spots of human development, and highways (often fenced).

Evaluation criteria for the alternatives are habitat restoration emphasis (including use of fire and timber harvest to connect openings), timber harvest amount and spatial design, road reduction objectives, retention of existing large blocks of old forest, and retention of forested habitat between lynx habitat (LAUs) in the Medicine Bow Range and the Sierra Madre to lynx habitat in Colorado. All alternatives propose reduction in roads, design of most new roads as short-term roads, under 10 miles of trail (some or all of which may be converted road), and require consideration of natural patterns and connectivity (Subgoal 1.b objectives and strategies).

The American marten is proposed as a Management Indicator Species for spatial pattern in all alternatives except F (where it is proposed as an indicator of spruce-fir habitat, which would suggest different monitoring designs).

Alternative F will result in few human-created patches; primarily natural processes will create young forest. These alternatives will allow the existing perforated pattern to "grow together" (as the contrast between patches declines) or to be burned over, gradually restoring a pattern more typical of the past. Alternative F will have highest estimated stand-replacing fire in the first 50 years (26,650 acres). If all stand-replacing disturbances including logging are included, this alternative has the fewest acres set back to early successional stages. In addition, the map for Alternative F connects "core" areas via "corridors" that will be harvested very little (though the mature/old forest there may be killed by natural processes). As a result, the forested cover could move toward a connected pattern that was typical of the pattern created by natural processes only in long cold, moist intervals. This will provide good habitat for species that use large expanses of older forest.

Alternatives A, B, and C are the most likely to retain today's pattern, finely fragmented by roads and perforated by small timber harvest units, with adverse effects on small animals (to which roads are barriers or sinks) and on wide-ranging forest-dependent animals (when habitat loss occurs in a pattern that create edge or makes the resources too dispersed for efficient use).

Alternatives D DEIS, D FEIS, and E have relatively more MA5.15 (compared to 5.13) than Alternatives A, B, and C. This MA promotes timber harvest designed to emulate natural patterns. Projects should be designed in part to alter the current perforated pattern and to avoid perforating or fragmenting large intact stands. Alternative E proposes more road closures, less timber allocation (5.13 and 5.15), and will reduce fragmentation slightly more than Alternative D DEIS.

The perforated pattern that now exists will recede over time as the logged areas grow to merge in structure with adjacent stands.. Alternative F will rely on natural recovery (allowing trees to age) and on removal of roads. Alternatives D DEIS, D FEIS, and E will also rely on natural recovery, while allowing more timber harvest (than Alternative F) located in a way that does not exacerbate the perforated pattern. These alternatives will close fewer roads than Alternative F. Alternatives B and (to a far lesser extent) A and C will perpetuate the methods of designing timber harvest

that create perforation on more of the land than the other alternatives (based on acre allocated to MA 5.13).

AFFECTED ENVIRONMENT
OLD GROWTH

In the past, the percentage of each age/structural class of forest varied greatly over time. In cool moist intervals, large fires and mortality from insects and disease would occur at a low rate and much of the forest would age into a late-successional or old growth stage. When conditions turned warm and dry, patches of early-succession, recently disturbed forest increased on the landscape. The wildlife community therefore varied over time. Mature/old forest animals increased during the cool moist periods and declined when the climate became hotter and drier. Species of early succcessional forest followed the opposite pattern.

Though past levels of old growth varied over space and time even within the same cover type, some research on historical ecology provides a range that can be used as an estimate of HRV levels. Estimates from three sources are given below.

Table 3-82. Historic range of variability estimates for various cover types on the Medicine Bow National Forest.

	Losenski 1994	Romme 2002	Roche 2003**
	% of landscape-range and average of sites*	% of landscape during "ordinary" climate conditions	% of landscape during "ordinary" climate conditions
Ponderosa pine	6% to 70%, average 62%	No data	No data
Lodgepole	1% to 46%, average 13.5%	High elevation***: 15% to 30%	High elevation***: 30% to 40%
Spruce-fir	13% to 73%, average 41%		
Method	Historical ecology		CES-HSS

* Estimated the percentage of old growth in 1900 for 24 ecological "sections" in the Columbia River Basin The ranges for each cover type and average values per section (but note that these are not true averages because they are not adjusted for the acres of the cover type in the section).

** See Biodiversity Section of this chapter.

*** Lodgepole and spruce-fir were combined in this analysis.

Losenski (1994) found that values were constantly high for ponderosa pine (only two sections had less than 53% old forest), but varied greatly for lodgepole and spruce-fir. In these forest types, the percentages are probably related to the frequency of stand-replacing fire. Old growth was near the high end of the range for areas with naturally infrequent fire (like Yellowstone NP), and low where fire was frequent (for example in the Bitterroot Valley, Blue Mountains, and on sites where fire could

spread from adjacent drier types). The fire frequency on the Medicine Bow is intermediate along this range. On the Medicine Bow, the interval is estimated at 200-300 years, and old growth was probably near the center of the sites described by Losenski.

Romme and Roche did not separate high elevation forest by cover type, so their results are not exactly comparable to Losenski's. (The studies also differed in their definitions of "old growth.") Very approximately, the range of common values (not found during extreme conditions) is 15% to 40%- with lodge pole stands at the low end of the range, and spruce-fir at the medium to high end of the range.

The pattern of disturbance characteristic of forests in the Medicine Bow NF under the current climate conditions would not produce huge expanses of very old forest like the continuous old forest typical of the Pacific Northwest. Most of the local animals that rely on old growth on the MBNF may use scattered features like small islands or riparian stringers of very old trees that are set in a matrix of mature (but not "old") forest as well as large blocks.

Animals associated with old growth include the American marten, red-backed vole, brown creeper, hermit thrush, and red-breasted nuthatch. In addition, lichen and fungus that form the base of the food chain are most abundant and productive in old growth, supporting a variety of herbivores and carnivores. Many animals use "old growth components," (often inherited from the previous stand that occupied the site, like large snags and downed wood) for dens, rest sites, feeding, and concealing young. These components may occur in younger stands, so species associated with them are not necessarily tied to stands of old forest.

As discussed in the Biodiversity section of Chapter 3 of the DEIS, the amount of forest reaching the Mehl (Mehl 1992) definitions for old growth in the Medicine Bow NF is uncertain. The database available does not contain enough of the variables in the Mehl definitions to categorize stands as "meeting" or "not meeting" the definition. Using combinations of available variables identified a "pool" of stands that probably contains most or all of the old growth on the forest, but also includes mature and late successional forest that would not be considered old growth.

There are two sources of possible concern about old growth on the MBNF. First, though the *sum of all acres* is large, much of this age class is in *stands that are fragmented* by past timber harvest and may not be high suitable for many of the animals needing old growth in larger patches. The research cited on changes in fragmentation on the MBNF (Reed, Johnson-Barnard et al. 1996) did not differentiate between fragmentation in stands of different ages. However, the map of the "pool" of late successional stands shows many patches that are perforated by past logging units or divided by roads. Second, in the long-term (after successive rotations) in timber emphasis MAs, areas (outside security areas and old growth left to meet the standard) could be cut repeatedly, as often as every 120 years in lodgepole (100 years in MA 5.15).and 110 years (partial cut) in spruce/fir. The expectation is that not all stands would be cut at the minimum rotation age, but in

areas of timber emphasis especially MA 5.13, it is possible. It is not known whether the provision of old growth islands in a matrix that was harvested so frequently would provide indefinitely for viable population of the animals most dependent on structure related to old forest (like the American marten).

ENVIRONMENTAL CONSEQUENCES
OLD GROWTH

All alternatives except A and F include an objective for a forestwide inventory of old growth. Old growth percentages for each cover type will be measured at the scale of the mountain range. Existing old growth may be cut, though the standards provide a minimum, not a target percentage of the landscape. Alternative F will retain all existing old growth.

Table 3-83. Percentage of the landscape in a cover type to be retained as old growth.

	Alts A, F*	Alts B, C, D DEIS, E**	Alt D FEIS**
Ponderosa pine	10%	25%	25%
Lodgepole	10%	10%	15%
Spruce-fir	10%	20%	25%
Aspen	10%	10%	20%

*measured for each watershed

** measured for each mountain range with guidelines for distribution across watersheds.

Alternative F will provide the most old growth over time as forests age with little active management (assuming that wildfire is limited). Alternative A will provide the least old growth. Alternatives B and C have a commodity emphasis (C also emphasizes motorized recreation) and are expected to reduce old growth over time to the minimum standards over time (but the standards will protect existing old growth. Alternatives D DEIS, D FEIS, and E are intermediate.

Alterntives B, C, D DEIS, and E contain a guideline for recruitment of future old growth not found in the other alternatives. Alternative D FEIS does not have this guideline, but relies on objectives and strategies for creation of conditions that will provide enough acres and a desired configuration of old growth in the future.

AFFECTED ENVIRONMENT
SNAGS AND DEAD DOWNED WOOD IN LODGEPOLE AND SPRUCE-FIR FOREST

Dead standing and downed wood provides essential habitat for many species and contributes to the attributes and functional features of most late- successional and old growth habitats.

Snags (standing dead trees, often with internal rot), are considered to be a unique habitat component. Snags provide habitat for nesting (in cavities or on branches), denning (in cavities along the trunk or at the base), rest sites, as lookout perches for visual foragers, as foraging sites (feeding on insects and microorganisms on or in the snag), and as the source of shelter and food for insects and other small organisms that live within the wood or bark of the dead tree. Often neglected is the key role of snags for communal roosting by small mammals (like flying squirrels) and small birds in winter. Cavities provide a somewhat insulated site for these small animals to gather and, tightly clustered, share heat and reduce heat loss to the environment.

The most valuable snags for wildlife are those that (1) are located in riparian areas, (2) are large, and (3) have developed from a tree infected with fungus prior to its death- the fungus rots the heartwood while it is nourished by the living tree. Because of the last two of these factors, it takes a long time to produce a high quality snag.

Snags are often removed from forests to reduce fire hazard, in the course of timber harvest, to remove a safety hazard, and for firewood. In areas where these activities have been extensive, snags may be less abundant and/or of lower quality than occurred with natural processes. The range of decay in retained snags may be inadequate, or the though retaining the largest snags for animals with more restrictive requirements, may reduce habitat effectiveness for the whole community of snag-dependent species.

Downed wood comes either from live trees that die when they blow over or from fallen snags. Many native species- from microorganisms to top carnivores- rely on downed wood for essential parts of their life cycle. Downed wood and the micro-environment it creates are essential to individual species and to ecological processes that affect regeneration of trees and energy transfers in food webs. Downed wood provides cover from predators; resting and denning sites; fungi and insects eaten by small mammals, birds, and bears; and a structure that intercepts snow and provides an insulated area beneath the snow in which several species of small animal live in winter. Larger animals like lynx and bears use large downed wood for dens and rest sites.

High elevation forest, especially spruce/fir historically provided a high percentage of snags and downed logs. Snags and coarse woody debris are normally created as a result of fire, insects and disease outbreaks, and blowdown, but can also be created through management practices such as girdling and timber harvest.

In harvested stands, the density of snags and coarse woody debris has been reduced from the norms expected in unharvested stands (Dillon and Knight 2000).

Under natural processes, the trees standing today would provide the next generation of downed wood. Removing the boles inevitably reduces the supply of future downed wood. Because the effects of this removal are long-lasting, acres that are missing a generation of downed wood will accumulate across the landscape. The effects on wildlife and on nutrients and productivity over repeated entries are uncertain.

ENVIRONMENTAL CONSEQUENCES REDUCTION IN SNAGS AND IN AMOUNT AND LONG-TERM RECRUITMENT OF DEAD DOWNED WOOD

All alternatives except Alternative A include increased standards for retention of amounts of downed wood (10-15 tons/acre in the most harvested forest types, lodgepole and spruce/fir).

In spruce-fir, Alternative D FEIS includes a guideline to protect the complex structure of downed wood retained after logging in spruce fir forest. However, in lodgepole, rollerchopping may continue. Rollerchopping is used to crush the downed wood and get it in contact with the soil where the smaller pieces remain moist and decay more rapidly. Benefits are better regeneration, reduced fire risk and improved visual quality. The cost to wildlife is that rollerchopping removes the structure that makes downed wood useful to wildlife (suspended, at angles to allow subnivian entry points, intact to provide a relatively stable microclimate inside). Alternatives B, C, D DEIS and E contain a guideline to avoid crushing dead downed wood in all cover types. Alternatives A and F do not include either of these guidelines.

All alternatives are expected to provide adequate snags and recruitment of downed wood for the life of this Plan (10 to 15 years). However, this predicted success for this short time depends upon the presence of large legacy trees from the previously uncut forest, especially in spruce-fir. If spruce-fir forest were really to be cut at the minimum rotation age, the size and the amount of downed wood (and its biological functions) would be lost as the current down wood decayed and as more of the forest was cut.

Conclusions for Snags.

Assuming that firewood collection would be relatively constant in all alternatives, the major differences are a result of (1) post-logging snag retention levels and (2) acres harvested. Though the modified standards are designed to provide adequate snags for the long term, the abundance, distribution, context, and qualities of the

snags that remain on the site will probably not replicate patterns left by natural processes. For example, snags in harvest units are often selected for felling based on risk to safety, rather than on traits beneficial to wildlife. Retaining a better current wildlife snag (but one that, being soft, was more dangerous to work around) would require a safety buffer in which unprotected people would not be permitted to work.

Alternatives A and F contain the snag retention standards of the 1985 plan. Alternatives B, C, D DEIS, D FEIS, and E contain modified snag retention standards based on an estimate of the average density of snags found in each of the forest cover types. The standards specify retention of more snags than the standards from the 1985 Plan, selection of larger snags, and retention of recruitment snags (live trees to grow and produce future large snags). All alternatives provide protection against firewood collection for snags in riparian areas (within 150 feet of water).

All alternatives will result in a loss of snags over time. Natural processes will be reduced (wildfire will be suppressed even in Alternative F to provide human safety). Timber harvest and associated road-building remove snags without creating any. Even with snag retention and recruitment standards, areas that are logged will, on average, end up with fewer snags. Any snags over the minimum standard are often felled for safety.

Alternatives F provides the best production of snags and protection of snags, since it allows the most natural processes and the fewest acres of planned harvest timber. Alternative F has a lower snag standard than all others (except A) but will treat the fewest acres and close the most roads, both of which result in more snags on the ground (ASQ is 3 MMBF).

In Alternative E, timber production will be much higher than in F (ASQ is 20.7 MMBF). Much of the timber harvest emphasis area is in MA 5.15, so consideration of snags should be a major factor in selection of the location for harvest and the design of the sale. However, because MA 5.15 is timber oriented, natural processes like fire and insect/disease outbreaks, will be limited in the large area (256,828 acres) allocated to this MA. MA 5.15 will retain standing trees in all units, even in regeneration cuts in lodgepole, that will provide clusters of downed wood in the future.

Alternatives D DEIS and D FEIS are intermediate in effects. The two have similar allocations of land to timber emphasis (MAs 5.13 and 5.15; 421,924 acres and 413,882 acres respectively), but D DEIS has more of this area in the less intensive MA 5.15 (72%) than Alternative D FEIS (68%). The ASQs for the two are similar (24.2 for D DEIS, 22.8 for D FEIS). Alternative A is expected to result in decline in snags over time on areas that are harvested, because of lower post-harvest retention, less of protection of riparian snags, and the large number of acres planned for harvest. Alternatives B and C also entail some risk of snag decline.

The alternative that will produce and retain snags at the highest level is Alternative F, followed by E, D FEIS, D DEIS, C, B, and A.

Conclusions for Dead Downed Wood

Several features mitigate these possible effects. First, in each geographic area only about 70% of the area is suitable for timber harvest, and some of that may be designated as old growth or security areas. The limitation on harvest to 25% of each watershed will slow the rate of harvest in some areas. In spruce/fir forests, harvest will be limited to group selection and individual tree section, so that large expanses that are low in downed wood are not created. Despite these limitations, there will be a net loss of downed wood over time in all alternatives except possibly F. The ecological significance of this change is not clear.

The evaluation criteria used to compare the consequences of the alternatives on creation of dead downed wood are the standards and guidelines in retention of downed wood after logging, the amount, the distribution of MAs that would manage for harvest on a 120-year rotation. Size, amount, and distribution of downed wood will decline most in alternatives with large amounts of MA 5.13. Impacts will be greatest when MA 5.13 occurs in large continuous areas (up to 20 miles by 5 miles in size). Alternatives D FEIS, D DEIS, and E have smaller blocks of 5.13, have more 5.15 (which is designed to emulate natural patterns and retains more standing material in clearcuts). Alternative F places the most emphasis on natural processes and the least emphasis on removal of timber and is expected to produce the largest amount of dead down wood.

AFFECTED ENVIRONMENT
SNOW COMPACTION

Snow is an integral component of habitat. Snow depth and characteristics affect animals' access to prey or vegetation, the ease of travel, and availability of insulated microsites. Modern human activities, particularly use of snowmobiles and skiing, have the potential to alter snow conditions.

Winter in the mountains of Wyoming poses challenges for warm-blooded animals. In addition to snow, extreme cold and wind make it difficult to maintain a positive energy balance, that is, to provide more calories (whether from stored fat, stored food, or by active foraging) than the animal must consume each day to maintain its body heat. Many native animals meet this challenge by leaving the area (migration) or by storing fat and reducing energy demand (hibernation). Most of the breeding birds migrate south for the winter. Some birds and mammals move to lower elevation where the weather is less extreme and snow is less deep. Black bears and many rodents hibernate.

However, even at high elevation, some animals are present and active all winter. Some animals have anatomical adaptations for locomotion on or through snow (like the large feet of snowshoe hare or the shoulder structure and long legs of the moose which allow it to move through deep snow and to spend the winter at higher

elevation than deer and elk (Marchand 1996). Animals that are active on the surface may change color to provide camouflage (like ptarmigan, weasels, snow buntings, and snowshoe hares). Insulation may be increased by the growth of a denser coat (shrew article) or deposition of subcutaneous fat. Many animals have seasonal physiological adaptations, like changes in metabolic rate, fat storage, or ability to mobilize energy in response to cold (e.g. Merritt 1984). Other species live in or beneath the snow.

Animals that live in snowy environments are adapted for survival with snow. They may rely on snow for creation of sheltered microsites or for competitive advantage over species lacking their adaptations. High mortality or reduced reproduction may occur in years with little snow (Formozov 1946), (Jannet Jr. 1984), (Merritt 1985), (Merritt, Lima et al. 2003). Alterations in snow compaction have implications both for animals that live above the snow ("supranivian") and for those that live on or below the ground surface, at the base of the snowpack ("subnivian").

Supranivian species at high elevation include the lynx and the snowshoe hare, both of which have large feet and long legs that support them on top of the snow when another animal of the same weight would sink and be unable to travel efficiently.

In an early assessment of the effects of snow compaction on animals, Bury (Bury 1978) concluded that the animals most affected were small mammals that live beneath the snow and are active during the winter. A review some of the features of the snowpack that affect subnivian wildlife habitat is given in the Wildlife Section of Appendix D – Biological Diversity. For a more thorough review, see (Pruitt Jr. 1960), (Halfpenny and Ozanne 1989), and (Marchand 1996). For an extensive review of the physical properties of snow and the ecology of snow-covered ecosystems, see (Jones, Pomero et al. 2001).

Alterations in Snow Compaction with Winter Recreation

Skiing, snowshoeing, and snowmobiling alter the formation of the snowpack. On the Medicine Bow NF, snowmobiling affects far more area than downhill skiing, cross-country skiing, and snowshoeing. In the first snows of the season, any of these uses will compress the snow hard against the ground (in the same way that snow freezes to a driveway under tire tracks). Unlike natural snow, this compacted snow is not likely to melt off (after an early snowfall followed by mild weather), terminating access to food earlier in the autumn. Compacted snow will also melt later in spring, again denying access to food supplies for animals that survived the winter. Finally, this compression onto the ground eliminates the basis of the formation of the subnivian space (the air space under the snow around grass and other clumps of low vegetation) replacing it with a dense layer that animals cannot burrow through.

These winter recreation activities also alter the density of the snowpack. The degree of natural compaction of snow is variable. In open windy settings, snow is blown and the "arms" of the flakes are broken, forming pellets that lie in a dense pack. However, even in the open areas in the Snowy Range, snowmobile and ski tracks are

clearly visible, indicating that compaction (at least in portions of the area) is increased compared to that created by natural forces. In more sheltered forested areas, the fluffy snow becomes denser over time because of changes in physical structure (metamorphosis as water molecules migrate in the snowpack), compression by overlying snow, and by alteration (even melting) at the surface. However, it generally remains far too soft to support a walking person, for example, unlike a track created by skiers or snowmobiles.

Studies in the Snowy Range at the Glacier Lakes Ecosystem Experimental Site found that the density of snow on snowmobile trails was 1.5 to 2 times as dense as snow off trails (Musselman 2002). These results are similar to those of Schmid (1971) in Minnesota. Compaction may occur in off-trail areas because about 75% of the compaction of fresh snow caused by snowmobiles can be attributed to the first pass compared to compaction after 5 sequential passes, (Keddy, Spavold et al. 1979).

ENVIRONMENTAL CONSEQUENCES FROM SNOW COMPACTION

There are five possible effects of snow compaction on wildlife.

1. Effects of increases in predators at high elevation.
2. Reduction of the insulation of the snowpack.
3. Reduction of the amount and connectivity of the subnivian space.
4. Reduction in the accessibility of food.
5. Alteration of ecological processes in the soil.

Variation in Snow Compaction and Subnivian Animals on the Medicine Bow NF

Downhill skiing is limited to the Snowy Range Ski Resort and telemarking on steep slopes, mostly on high stony mountains. Snowshoeing and cross-country skiing is concentrated along groomed trails that are limited in area: use is along linear trails. Few people ski extensive distances off-trail. Though large animals often react more to non-motorized than to motorized users, backcountry non-motorized is uncommon enough that it has little effect on wildlife populations.

The largest area of snow compaction is done by snowmobiles, which have a much greater daily range than non-motorized uses. Use and impacts vary with setting.

In densely forested settings, most snowmobile use on the Medicine Bow NF is on linear routes (roads) that lack woody debris and are not good habitat for small mammals. Compaction creates a barrier to subnivian movement, which is already impeded by the lack of vegetative and other structure on roads.

In open areas within forest, compaction of snow by snowmobiles may adversely affect the survival of shrews, voles, squirrels, and amphibians. These areas include open forest, meadows, riparian areas, wetlands, and, occasionally, past harvest units (either those with little structure or when snow cover is deep enough to cover the downed wood. Habitat quality may be reduced for the predators of these small mammals like Boreal Owls, goshawks, other forest owls and hawks, and marten.

Wetlands within the forest are of special concern for two reasons: first, wet meadows and wet lake edges may support relatively high densities of small mammals (including the sensitive pygmy shrew) and second, these areas are commonly used by snowmobiles as "play areas" and are heavily compacted if there is a reasonable route to them. Shrews build insulated nests under the snow and make foraging forays every few hours. An animal that could maintain its nest at a high enough temperature and could gather enough food to survive at a temperature near freezing could not necessarily do the same if the soil temperature fell to –15 degrees C.

Above treeline, snow characteristics are different from those in forested areas because of the effect of wind and topography. Wind-blown snowflakes are re-shaped as the delicate structure is broken and the "flakes" become pellets that pack tightly together when they settle. The snowpack is naturally more compacted that a forest snowpack. Snow collects in concave places (and sites downwind of a structure like a tree or boulder) and blows off convex sites (Pruitt Jr. 1984), (Hiemstra, Reiners et al. 2002). In places this is obvious (vegetation may show through wind-blown sites, and huge drifts may accumulate downwind of trees), but in other places it may be difficult to estimate snow depth from the surface. However, small mammals select hollows that are filled with deep snow, either for their subnivian qualities or because these areas have higher moisture (and productivity) in the snow-free season (Pruitt 1984).

Snowmobile use above treeline is heavy and continuous within a few hundred yards of main travel routes. Farther off-trail, large "play" areas of desirable terrain may be essentially continuously compacted, but overall use becomes less continuous. Much of the area is compacted when snow is still shallow; other areas are not affected until snow is several feet deep. Some uncompacted sites exist, but these are not correlated with areas of most value to subnivian mammals. The lack of surface evidence of concavities makes management of snowmobile use around specific sites infeasible. Only area closures of regions with a high density of concavities like wetlands, lakes, and hollows would protect samples of this habitat.

Sources of compaction of snow from winter recreation are snowmobiling (which affects the most area), snowshoeing, cross-country skiing (on trails and telemarking on slopes) and alpine ski areas (though ski areas are altered in other ways that reduce their value as small mammal habitat). Other sources of compaction include winter logging, plowed access to private property and concessionaires, and access for wildlife surveys, other research, and maintenance of oil and gas structures. These

non-recreation sources are reviewed for effects in NEPA analysis, are developed in cooperation with other agencies and are limited in area, or are legal mandates.

All alternatives provide for snowmobile, snowshoeing, and skiing use of the forest. Though all three activities compact snow, snowmobiles cover a much larger area of the forest. The alternatives differ in the amount of area designated for non-motorized use in winter (which would remain largely uncompacted) and in whether snowmobiles are restricted to designated routes.

Evaluation criteria for the effects of snow compaction on subnivian animals and their predators are the area in each alternative that is limited to non-motorized use in winter and whether snowmobiles are restricted to designated routes.

Table 3-84. Acres of semi-primitive non-motorized recreation class in winter and restriction of snowmobiles to designated routes by alternative.

	Base Year	A	B	C	D DEIS	D FEIS	E	F
Acres where Snowmobiling is Not Allowed*	185,139	185,139	180,125	192,909	316,322	345,216	483,411	940,119
Restricted to Roads and Trails	No	No	No	No	No	No	No	Yes

**These acres are based on the winter ROS class; many acres (in this category and in the areas where motorized use is permitted) are not suitable for snowmobiling because of forest, topography, lack of snow and other reason. These values omit Sheep Mountain (a National Wildlife Refuge), where snowmobiling is also prohibited (18,669 acres).*

Within forested habitat, snow compaction is mostly limited to linear routes. The sensitive features there are wetlands and meadows that are accessible and are used as play areas by snowmobiles, rather than within the forest. In open areas at high-elevation, where snow depth and compaction are patchy, a balance of uses would be provide a cautious approach until more information is available.

Alternatives A, B, and C will result in the most area of snow compaction, based on MA allocation. The area will be similar to the current area.

Alternatives E and D DEIS allow off-trail use but assign more acres to a semi-primitive non-motorized allocation. However, these alternatives do not stop snowmobile use in any area where it is now going on. Alternative F entails the least risk to subnivian animals and processes that are tied to snow compaction. Non-motorized use would still compact snow to the detriment of subnivian systems but the area affected would be far less than that used by motorized vehicles at present or under the other alternatives.

The limitation of snowmobiles to routes in Alternative F would benefit subnivian animals and their predators by eliminating off-trail use in wet meadow, wetlands and riparian areas and in concavities above treeline. However, most of the popular access roads from the various parts of the forest would probably remain open. These

routes, connecting lower to high elevation, are the conduits for coyotes and other predators that may compete with or kill lynx. Though some routes might be closed, unless access was restricted to a very limited number of routes, restriction of snowmobiles to routes would not be expected to alter the presence of other predators at higher elevation. There is currently no stable or reproducing population of lynx on the Medicine Bow NF, though from the Colorado releases have been wandering on and off the Forest in 2003.

Creation of routes of compacted snow that might allow more predators to get to high elevation is similar for all other alternatives.

AFFECTED ENVIRONMENT
SECURITY AREAS

Some animals avoid areas that are disturbed by human activities. Avoidance of roads has been demonstrated in many species, including elk, grizzly bears, marten, and wolverine (Rost and J. Bailey 1979), (Lyon 1987), (Hillis J. Michael, Michael J. Thompson et al. 1991), (Hurley and Sargeant 1991), (Christensen, Lyon L. Jack et al. 1993), (Rowland 2000). (Mace, Waller et al. 1996; Robitaille and Aubry 2000).

Secure areas, which provide cover and are free of human disturbance and motorized access, are important for many wildlife species, especially large animals, those sensitive to disturbance, and those that are hunted or trapped (e.g. (Hillis, Thompson et al. 1991), (Robitaille and Aubry 2000). The concept of "security areas" was developed to provide areas in which bull elk had a chance to survive the hunting season (Hillis, Thompson et al. 1991). These are patches of cover that are at least 250 acres in size and lie at least ½ mile from a road that is open to motorized use. This concept was developed in response to concerns about increasing bull survival over the hunting season, but is beneficial to other species than large ungulates.

Security areas are identified as patches of habitat structural stages 3B, 3C, 4B and 4C greater than 250 acres in size, with a boundary lying at least ½ mile from a road. The area contained in security areas was measured as a percentage of the forested land in each Geographic Area. These values ranged from 0 to over 70% (see table below), and averaged approximately 20% (not adjusted for acres in each GA).

Not surprisingly, given the high density of roads on the Forest, the level of security areas is relatively low. The objective recommended Hillis et al (1991) is 30% to 35% security area in each analysis area (approximately comparable to the Geographic Areas on the Medicine Bow).

The following table displays the percentage of security areas by Geographic Area and the percentage of each Geographic Area that is forested (and could potentially provide security cover) and the percentage that actually lies in security areas. Recruitment of more security areas can occur over time with growth of forests so that they provide cover (and produce larger patches of cover). Closing roads to

motorized use can accomplish short-term recruitment of security areas. (For reference, if all class 2 roads on the forest were closed, the area in security areas would increase to about 39% of all forested acres.)

Table 3-85. Percent of forested areas and security areas in each GA.

Geographic Area	Percent of GA that is Forested	Percent of the Forested Area in "Security" blocks with Class 2, 3, 4 and 5 roads buffered ½ mile
Barrett	74.75%	0.00%
Battle Creek	86.10%	31.17%
Bear Creek	89.88%	29.20%
Beaver Creek	76.99%	10.79%
Bow River	78.92%	13.66%
Box Elder	84.11%	43.18%
Brush Creek	88.90%	2.28%
Cottonwood Creek	94.33%	20.45%
Encampment River	87.40%	35.43%
French Creek	83.64%	5.10%
Horseshoe Creek	87.34%	38.46%
Labonte Creek	92.82%	17.19%
Lower Douglas Creek	80.95%	0.92%
Middle Fork	86.88%	14.47%
North Fork	75.67%	15.42%
North Savery	83.58%	24.12%
Northeast Sierra Madre	81.64%	10.80%
Palmer Canyon	85.63%	10.78%
Pass Creek	93.96%	4.44%
Pennock Mtn Cedar Creek	79.57%	15.46%
Platte River Savage	73.58%	37.98%
Pole Mountain	36.31%	3.54%
Sheep Mountain	61.13%	74.24%
Snowy Range Eastern Front	88.23%	30.69%
South Savery	58.77%	9.71%
Upper Douglas Creek	88.78%	1.50%
Upper Little Snake River	92.07%	37.27%
War Bonnett	83.67%	0.24%
Average	79.89%	19.65%

ENVIRONMENTAL CONSEQUENCES
SECURITY AREAS

Evaluation criteria are pattern and amount of timber harvest planned, retention of roadless quality in currently roadless areas, and expected reduction in road density.

All alternatives would have some level of timber harvest that could reduce security areas, although the quantity and objectives for harvesting those trees vary by alternative. Forestwide and management area standards and guidelines are designed to reduce adverse impacts to wildlife. Examples of management area direction designed to protect and enhance wildlife habitat includes the use of MA 5.15. This prescription includes guidelines to provide blocks of undisturbed habitat of all sizes, guided by patterns created by natural processes.

Because security areas depend on large blocks of undisturbed habitat, the acres of current roadless areas that would be open to logging (by road) for each alternative will also impact the amount of security areas on the forest. Potential adverse impacts to security areas from loss or roadless character in existing roadless areas, based on harvest levels (from most to least adverse) are from alternative are

In addition, all alternatives provide some level of road decommissioning identified in the Supplemental Tables of Chapter 2 of the EIS, which will improve the security areas Forest-wide. The actual levels of road closures will be identified during Phase II of the Travel Management Analysis, which is being completed over the next 5 years. The desired condition for road eradication for the alternatives is shown in the following table.

Table 3-86. Desired miles per year of roads decommissioned, and expected level given experienced budgets.

Roads decommissioned, System and Non-system (miles)	Alternatives A, B, C, and D DEIS, D FEIS	E	F
Desired Condition	27	112	181
Based on experienced budgets	18	75	121

Evaluation criteria are harvest levels, retention of roadless character, and reduction of existing roads. In comparing alternatives, it is assumed that land allocated to MA 5.15 will have more clustered units and correspondingly fewer miles of road in the desired condition than lands allocated to MA 5.13. Alternative F would retain the most acres of current security and (through road eradication) would recruit the most acres. Alternatives D FEIS, D DEIS, and E are intermediate. Alternatives A, B, and C, with relatively high timber harvest and lower retention of roadless character are

expected to result in fewer acres in security areas and less connectivity between security blocks.

OTHER ISSUES

Wilderness and Roadless Areas

No wildlife species needs designated "Wilderness." However, some species may benefit from the larger unfragmented areas, the reduced human disturbance, and the higher level of natural process that are typically found in current inventoried roadless areas wilderness. For other species, the limitations on habitat manipulation in Wilderness may be detrimental in some contexts. For example, in low elevation big game winter range, burning to create big game forage maintains the natural vertical structure and mixture of shrubs and grass. Prescribed fire is permitted in wilderness, but not for the purpose of enhancing wildlife habitat. Exclusion of fire from these area would reduce habitat quality for animals whose habitat depends on frequent fire.

Species that benefit from wilderness include the following:

1. Species that benefit from fire, including woodpeckers, secondary cavity nesters (like songbirds and owls), fire-dependent insects and plants, small mammals and insects that use downed wood, and predators on those species.
2. Species that are negatively affected by the pattern of forest fragmentation created by timber harvest.
3. Species that are hunted or trapped. (This is not always true: wilderness areas can be the focus of horse packing trips that convey a large number of hunters into unroaded areas.)
4. Species that use snags or dead downed wood for nesting, roosting, or feeding.
5. Species vulnerable to predation when crossing roads.
6. Species that use old growth, especially in large patches (like martens and boreal owls).
7. Species that need solitude. Species sensitive to disturbance may do better in Roadless than in Wilderness areas. Wilderness designation may increase in recreation and human disturbance

Many of the benefits to animals listed above are enhanced by increased size of the wilderness area or roadless area.

Evaluation Criteria for determining roadless areas where retaining roadless character would contribute the most to wildlife.

The following criteria were considered for analyzing which roadless areas might contribute the most to wildlife.

1. Roadless areas that contain the **headwaters** of watersheds flowing into existing Wilderness
2. Roadless areas that would **increase size and/or connectivity** of existing wilderness. Roadless areas that would increase the size of existing wilderness are East Fork Encampment, Encampment River Addition, Huston Park Addition, Illinois Creek, Little Snake River, Platte River Additions, and Savage Run Additions.
3. Roadless areas containing **ecological "hotspots**" identified by the WYNDD that represent habitats that do not need active management.
4. Roadless areas that contain **ecological types underrepresented** both on the Forest and in the Region as a whole; areas meeting these criteria would be prioritized by size (or addition to an existing Wilderness).

The Inventoried Roadless Areas were evaluated based on their contribution to each of these factors and given a score between 0 (meets fewest criteria)and 5 (meets most criteria). This was conducted to determine high priority areas that benefit wildlife.

Table 3-87. Roadless areas where retaining roadless character would contribute most to wildlife based on the criteria above.

Score	Roadless Area
5	Illinois Creek, Platte River Additions, and Savage Run Additions
4	Encampment River Addition, East Fork Encampment, Huston Park Addition, and Little Snake
3	Battle Creek, Big Sandstone, Laramie Peak, Battle Mountain, Battle Mountain (public proposed) and Vedauwoo (public proposed)

For more detail on methods and results, please refer to the wildlife Specialist's Report.

Table 3-88. Acres of designated, recommended wilderness areas by alternative.

	A	B	C	D DEIS	D FEIS	E	F
Designated / Recommended Wilderness Areas (acres)	78,850	78,850	78,850	139,709	106,881	83,403	350,207

For the roadless areas that were assessed to *contribute the most to wildlife habitat*, (those adding acreage to existing wilderness and adding headwaters of streams

entering wilderness, a score of 4 or 5 in the table above), roadless character was retained most in Alternatives F. Alternative D FEIS retains roadless character around the Huston Park and Encampment River Wildernesses and in Illinois Creek Alternative D DEIS retains roadless character around the Huston Park and Encampment River Wildernesses and along the southeast border of the Platte River Wilderness (the latter is MA 1.33, and allows off-road motorized use in winter). Platte River or Savage Run Wildernesses. Alternative E, which allocates most of these areas to MA 3.5 (wildlife emphasis) will receive limited commodity use, and winter recreation will be limited to roads and trails. Alternative C retains more roadless character than Alternatives D DEIS and D FEIS but allows motorized use in winter in these areas (MA 1.33). Alternatives A and B do not retain any roadless character in roadless areas that score highest in the criteria listed above.

Recently Burned Forest Habitat

In boreal forests, two habitats are consistently reduced from historic levels; old forest and recently burned forest (Murphy and Lehnhausen 1998), (Schmiegelow and M 2002). Burned forest has typically been treated as a destroyed forest, and only recently been recognized as a unique, recurring habitat that is part of the evoltionary history of native species.

Fire has not been especially frequent on the Medicine Bow, with an estimated 50-500 acres of forest burning in the average year. However, fire suppression has reduced fire frequency and size. The historic range of variation was very broad in the non-equilibrium forest type (lodgepole and spruce-fir) and these forests are not outside of HRV (Dillon, Knight et al. 2003). Recently burned forests may be salvage logged.

Some insects specialize in attacking trees that have been killed or weakened by fire, gathering to breed and lay eggs while the fire is still smoking. The resulting larvae produce a flush of food for woodpeckers and other birds. Recently burned forest is habitat for a unique community of birds (Hutto 1995), including the insect foragers and species that need open habitat for feeding (like flycatchers and ground or trunk gleaners).

The dynamics of species that use this habitat are not well known. Some do well in another habitat, but exploit the abundance resources in burned areas. Others may "hang on" in other habitats with relatively low reproduction and rely on intermittent access to burns to boost populations. It is not clear whether loss of recently burned forest below some threshold would threaten the persistence of any species. Sensitive species that rely heavily on this habitat include the olive-sided flycatcher, the American three-toed woodpecker, and the black-backed woodpecker.

Stand-replacing fire reduces potential timber value and is seldom permitted in timber-suitable land. Even in unsuitable land, fires are generally suppressed to avoid their spread to adjacent forest, threatening private land, commodity value, recreational use, or residences. When stands of sawlog-sized trees burn, salvage

sales are often proposed to remove the residual timber. This destroys habitat that is either the only breeding habitat (for black-backed woodpeckers in the West) or primary habitat (the Lewis's and three-toed woodpeckers) for some R2 sensitive birds.

The allocation of land to MAs that allow natural processes (including fire), and those that emphasize commodities is shown in the following table. Burned forest habitat will increase most rapidly in alternatives with high emphasis on natural processes and fewer acres in a commodity emphasis. (Acres in "special designations," "recreation," and "biological conservation overlap those in the "natural processes" category and are omitted from the table.)

Table 3-89. Percentage of the MBNF allocated to MAs that allow more natural processes and to MAs that emphasize commodities and estimated wildfire for each alternative.

Alternative	A	B	C	D DEIS	D FEIS	E	F
Natural Processes predominate (% of MBNF)	20	28	37	48	45	48	74
Renewable resource (commodity emphasis) (% of MBNF)	55	63	53	45	44	39	25
Estimated acres of wildfire in first 50 years (Acres)	13,065	18,135	23,855	31,070	29,250	31,005	48,035

Alternative F will provide the fastest recovery of this habitat by allowing the most fire to burn and conducting least salvage. Alternatives A, B, and C have the strongest commodities emphasis and will allow the least fire and salvage the most burned forest. Alternatives D DEIS, D FEIS, and E are intermediate.

Ponderosa Pine Forest

This habitat type is limited in extent on the MBNF, occurring mostly on the Laramie Peak Unit. Ponderosa pine is also present in scattered stands on Pole Mountain and in the southwestern corner of the Sierra Madre. Fire regime and structure are discussed in the Biodiversity section of this chapter. Only the low elevation stands experienced frequent fire and had open structure, and animals associated with that open structure, in the past.

There is little difference in the effects of the alternatives on ponderosa pine and its associates. Beetle attacks and fire have removed much of the old forest. Much of the LPU portion is unroaded and inaccessible and restoration is unlikely in any of the alternatives.

In Alternative D FEIS, there is no scheduled timber harvest in the Laramie Peak Unit. The ponderosa pine in the SW Sierra Madre has been logged in the past.

All alternatives except F have an objective of restoring fire-dependent ecosystems. Except for fuel reduction projects near the Forest boundary (to reduce fire hazard to adjacent private land) it is not likely that restoration efforts will be great enough in extent to affect conditions at a large scale. There are no predictable measurable differences among the alternatives.

For more detailed description and discussion, please refer to the Biodiversity section of this chapter and the Wildlife Specialists Report.

Aspen Habitat

In much of the west, aspen may cover less of the landscape because of fire suppression. However, Dillon and Knight (2000) believe that existing evidence is not adequate to support this conclusion on the Medicine Bow NF.

Aspen disturbance patterns, stand structures and location on the landscape have been extremely variable in the Southern Rockies (Romme, Floyd-Hanna et al. 2001). In years of extensive fire, clones were regenerated and coniferous forest that was burned releases suppressed aspen or allowed seeding. Aspen regeneration thus occurred in pulses, one of which took place near the turn of the twentieth century, when extensive fires during the tie hacking era created large areas in which aspen was all about the same age.

The widespread initiation of new stands at that time and the reduced extent of fire since then have resulted in the relatively old, uniform age of current aspen stands. Unlike many forest cover types, in which old forest is reduced from historic levels, in aspen the age class structure on the MBNF has shifted toward old forest. About half the aspen on the MBNF is climax and stands will remain, replacing themselves, for long periods of time. The other half will convert to coniferous species if not disturbed (killed by fire or regeneration).

The subsequent period of fire suppression has resulted in the retention of these large stands and little regeneration of the aging clones. Past overgrazing contributed to the reduction of fire by removal of continuous fuel. Livestock and game animals ate much of the regeneration that sprouted after clones were burned.

As a result, aspen stands are older than was typical of the past. Currently, 45% of the aspen on the forest is classified as mature/old (structural classes 4A, 4B, 4C, and 5). Only 6% is in the two youngest stages (structural classes 1 and 2). More conifers have invaded stands (across the whole landscape) than was typical in the past; in montane stands, aspen has been crowded out by conifers (Cerovski et al 2001).

Aspen of any stand age is a major center of biological diversity- for birds, butterflies, and vascular plants (Chong, Simonson et al. 2001; Rumble, Mills et al. 2001). Single-species concerns about aspen are usually focused on the need for older trees

and snags as nest sites for many birds (purple marten, red-naped sapsuckers, and northern goshawk) and many secondary cavity nesters. However, retention of all the existing old aspen for cavity nesters would ignore the benefits of creating a pulse of younger stands to provide habitat for early seral species and to provide the first step in creation of future old aspen.

Many birds nest in aspen but forage in adjacent coniferous forest (e.g., northern goshawk and three-toed woodpecker). If old aspen is retained when adjacent conifers are cut, by the time the coniferous forest is old enough to provide feeding habitat, the aspen will be over 200 years old and will be falling down.

Active restoration by slashing and by burning is desired, while considering the effects on species that use the older trees. This restoration could logically be directed at the peripheral aspen (stands in a sagebrush matrix) and at stands that are being converted to conifers, rather than at aspen-dominated landscapes (Bartos 2001). Patches surrounded by coniferous forest would normally burn with the whole area and should be regenerated as part of timber harvest projects in nearby coniferous forest.

All alternatives include and objective for restoration of aspen. All alternatives will have similar effects on aspen. All alternatives have an old growth retention standard of 10% except Alternative D FEIS, in which the standard is 20%. For more detail, please refer to the Biodiversity section of this chapter and to the Wildlife Specialist's Report.

AFFECTED ENVIRONMENT

Species and Groups Addressed Individually

Birds

Many bird species breed in the planning area and then migrate out of the area to return the following year. Species such as ravens and boreal owl are year-long residents. Management for these species needs to take into account year-long habitat needs.

The Forest Service has prepared "The Land Bird Strategic Plan." This document lays out a course of action for conserving habitats on the national forests and grasslands for sustainable resident and migratory land bird populations. Rocky Mountain Regional as well as Forest Plan goals and objectives provide for implementation of the strategic plan on the MBNF planning area. In January 2001, an Executive Order was issued emphasizing the importance of conservation of migratory birds by federal agencies.

In July 2001, the Wyoming Bird Conservation Plan (Version 1.0) (WBCP) was prepared consulted to help guide implementation of management direction in the Revised Plan for the MBNF planning area. The WBCP concentrates on those birds that will be most positively influenced by management, as well as those species with the greatest immediate threat of extirpation (Cerovski, Gorges et al. 2001).

The MBNF provides important seasonal (breeding as well as year-long) habitats for many bird species—songbirds, raptors, shorebirds, woodpecker and others. Migratory birds are of high public interest and recent cooperative conservation initiatives demonstrate this. Partners in Flight (PIF) is an international coalition of government agencies, conservation groups, academic institutions, private businesses, and citizens. The PIF program focuses attention on the need to conserve migratory birds and their habitats across national borders. While the PIF program initially focused on migratory birds, it has since expanded to include all breeding, wintering and resident birds (Cerovski, Gorges et al. 2001). The Forest Service is a signatory to PIF (among other conservation programs) and is committed to conservation of these species on NFS lands.

Many of the bird species identified as "priority species" (Level I) by Partners in Flight, Wyoming Bird Conservation Plan, have been identified and are discussed in the Biological Assessment or Evaluation (mountain plover, sage grouse, ferruginous hawk, Brewer's sparrow, northern goshawk, peregrine falcon, bald eagle, whooping crane).

Species having been identified in the Wyoming Bird Conservation Plan as Level II (Monitoring) have also been discussed in this chapter or in the BA/BE (FEIS, Appendix I) (Lewis' woodpecker, black-backed woodpecker, three-toed woodpecker, pygmy nuthatch, boreal owl, loggerhead shrike, brown creeper,). In addition, the common loon, golden-crowned kinglet, and merlin were discussed in Appendix I of the DEIS, but have since been dropped from the R2 Sensitive Species list and are not addressed in the FEIS. No breeding loons occur on the Forest. Golden-crowned Kinglet is addressed as a Management Indicator Species.

The brown-capped rosyfinch is identified as a species of local concern on the Forest (or Level III – Local Interest) and is addressed in the FEIS Appendix D – Biodiversity Report.

ENVIRONMENTAL CONSEQUENCES

Habitat management that enhances habitat suitability for one bird species may occur at the expense of other species. Habitat specific to those birds listed as conservation priority species follows.

Direct and Indirect Effects

Alpine meadow areas are potentially affected by mining, recreation, and grazing by native animals like bighorn sheep and elk. The white-tailed ptarmigan has not been recorded on the Snowy Range since the late 1970s and early 1980s, Alternative F would encourage re-introduction of the species. One factor that may affect the current suitability of this area for ptarmigan is off-trail snowmobiling, which creates disturbance in winter and compacts snow where normally it would be soft enough for the birds to fly into for insulated roosting sites. The white-tailed ptarmigan is discussed in the BE (Appendix I). The alpine brown-capped rosyfinch is considered a Species of Local Concern and is assessed in the FEIS Appendix D – Biodiversity Report.

As is true in much of the west, there is concern about the effects of livestock grazing on riparian areas. The recent arrival of the moose on the forest may also affect riparian willow communities (Berger 2001). Lincoln's sparrow and Wilson's warblers will serve as Management Indicator Species for long-term effects of grazing on birds of riparian habitat.

Mountain shrub habitat can also be affected by livestock grazing (reduced perennial grasses, increased shrub coverage, increased bare ground and increasing invasion of non-native grasses and forbs). Livestock management standards and guidelines apply to all MAs that permit livestock grazing, so impacts to bird species that rely on this habitat will generally be the same under all alternatives with the exception of Alternative F, which has a 30 percent utilization standard. These lower utilization standards would result in higher levels of late seral grass and forbs.

Improving conditions for flammulated owl and other species closely tied to ponderosa pine habitat will require intensive forest management, to include harvest of other species and regular low-intensity fire to maintain ponderosa pine dominance. Much of this habitat has been burned recently or is inaccessible, so that the number of acres treated is likely to be modest. Alternatives E and F are the two most likely to benefit the flammulated owl. See the discussion related to this species in the BA/BE (Appendix I).

Maintaining snags will provide for many cavity-nesting birds. All alternatives except A and F include standards and guidelines to maintain higher levels of snags and coarse woody debris than in the past. Alternative F provides for snags because there will be less of the anthropogenic sources of snag loss; snags will be retained because of the lack of timber harvest and the protection of more forest from firewood collection (related to reduction in roads). See the discussions regarding "snags" and "dead downed wood" earlier in this section.

Some birds rely on recently burned forest, at least exploiting these areas as they available. This habitat is at the low level of HRV, due to fire suppression and salvage of burned areas. See section on Burned Forest habitat.

In managing for multiple species that reside in a dynamic ecosystem, the soundest approach is management based on mimicking frequency and pattern of natural disturbance. This is the primary way that the Revised Plan provides for birds. However, this approach is not perfect, because substitution of human activities for natural processes does not create the original outcome. Logging may imitate the pattern and shape of burned areas, but the heat, chemical changes, and residual burned trees are missing. In addition, the level of human disturbance and associated roads will never be within HRV. The Revised Plan includes protection for raptors that are known to be sensitive to human disturbance (by providing buffers around nests), for species with limited perennial nest sites and that are listed as threatened, endangered, or sensitive.

Cumulative Effects

Many of the birds on the MBNF are migratory and changes in population may be effects of mortality or habitat loss during migration or winter. Many raptor populations were depressed by accumulations of DDT and other pesticides that reduced reproductive success. Migratory birds that winter outside the United States may still exposed to these substances.

In the late 19th and early 20th century, the Forest was grazed by unregulated numbers of livestock, especially sheep. At high elevation, these flocks reduced forage for native animals and may have affected species like the white-tailed ptarmigan and the pika.

West Nile virus reached Wyoming in 2002, and deaths of birds are increasing. The long-term effect of this disease on local bird populations is unpredictable.

Conclusion

Since different species use different habitats and structures, no alternative is best for all birds.

- Alternatives A, B, and C, favor birds that use early successional forest.
- Alternatives D and E balance the needs of birds of early and those of late successional forest. They retain high levels of snags and allow some more natural process like insects and fire that provide forage for some birds.
- Alternative F favors cavity-nesters and birds of late successional forest and species that use burned forest (like woodpeckers, mountain bluebirds, and Olive-sided Flycatchers).

Cavity nesting birds will benefit from the increase in number of snags retained following timber harvest in Alternatives B, C, D DEIS, D FEIS, and E. Alternative F has less timber harvest so the rate of associated snag loss will be low.

Alternatives B, C, D DEIS, D FEIS, and E include standards for protection of habitat for goshawk nests and post fledging areas.

All alternatives except A and F contain direction for management toward natural patterns of patch size, shape, and connectivity and the use of HRV in assessing effects. Though HRV is not a target, this approach should lead to increases in reduced habitats like burned forest. Alternative F maps a network of existing cores of unfragmented forest with connecting designated corridors that would be managed to retain forested connectivity.

Alternative F would provide the most habitat for cavity nesters and birds that exploit recently burned forest.

Monitoring of bird populations by the Rocky Mountain Bird Observatory was begun in 2002 and is expected to continue. Birds designated as Management Indicator Species are northern goshawk, three-toed woodpecker, golden-crowned kinglet, Wilson's warbler, and Lincoln's sparrow.

AFFECTED ENVIRONMENT

Game Species

The following "affected environment" section for game species was prepared by the Wyoming Dept. of Game and Fish, submitted by Bill Wichers5/15/02.

Elk occur throughout the forest in a variety of ranges including spring, summer, fall, winter year-long and transitional. Four Herd Units are managed by the Wyoming Game and Fish Department. In general, current populations meet or exceed Herd Management Objectives set by the Wyoming Game and Fish Department.

Table 3-90. Elk numbers and herd management objectives from 1980 to 2000.

Herd Unit	Herd Numbers		Herd Mgmt Objectives	
	1980	2000	1980	2000
Sierra Madre	3,905	6,800	4,200	4,200
Snowy Range	4,700	7,865	4,000	6,000
Iron Mountain	325	2,000	100	1,800
Laramie Peak/Muddy Mountain	2,595	3,800	2,300	5,000

Mule deer are found throughout the forest in a variety of ranges including spring, summer, fall, and winter year-long ranges. Seven Herd Units are managed by the Wyoming Game and Fish Department. In general, current populations are near Herd Management Objectives set by the Wyoming Game and Fish Department.

Table 3-91. Mule deer numbers and herd management objectives from 1980 to 2000.

Herd Unit	Herd Numbers		Herd Mgmt Objectives	
	1980	2000	1980	2000
Baggs	11,850	9,150	9,350	18,700
Platte Valley	24,400	17,200	15,000	20,000
Sheep Mountain[1]	10,300	13,650	10,000	15,000
Iron Mountain	5,800	9,200	5,800	7,500
Laramie Peak[2]	19,600	15,200	14,000	14,000
South Converse[3]	8,000	16,530	8,000	16,000
Bates Hole/Hat Six[4]	5,800	8,500	6,200	12,000

[1] Population high in the 1990s was 16,575.
[2] Population high in the 1990s was 19,600.
[3] Population high in the 1990s was 18,100.
[4] Population high in the 1990s was 11,800.

Bighorn sheep are considered in detail in Appendix I under "Species of Possible Viability Concern."

Black bear: Population estimates of black bears are difficult to obtain, and typically are assumed to be imprecise, with large margins of error. The Wyoming Game and Fish Department does not use estimates of population size in their management efforts, but rather an estimate of trend. The population management focus for black bears is to maintain a viable population, while maintaining hunting opportunity as the major management tool.

- **Laramie Peak Black Bear Management Unit**: The population currently appears to be stable and at a low density. Both spring and fall hunting opportunities exist, though harvest is very minimal. The majority of bear harvest occurs on Forest lands or on adjacent private land.

  The Forest habitat is important to the relatively small numbers of bears present. Black bears occupy Forest lands year-long. Riparian, aspen, and wet meadow sites are the preferred habitat for black bears during the spring, summer, and fall period due to the lush vegetative growth. Maintaining these habitats from excessive forage use is a concern. Road density in the Albany Peak area (some of which are not Forest roads) likely has some impact on bear use of available habitat, and human disturbance, particularly ORV use, is a concern. In addition, the effects of improper food storage by campers, recreationists, and cabin owners is a concern, and will need to be addressed more thoroughly as recreational opportunities increase and expand on the Forest.

- **Snowy Range Black Bear Management Unit:** The population appears to be stable to increasing. The Forest provides very important habitat for these bears, and almost all habitats occupied by bears occurs on Forest lands. Some spring and summer use is located just off forest near developed sites.

  Improved management of garbage, food storage, and developed and dispersed camping to minimize bear-human conflicts is a management issue.

- **Sierra Madre Black Bear Management Unit:** The population appears to be stable. The Forest provides very important habitat for these bears, and almost all habitats occupied by bears occur on Forest lands. Some spring and summer use is located just off the Forest near developed sites.

  Riparian management is a primary management concern. Upland scrub oak management, for fall food, is a concern in the Battle Mountain, Cottonwood Rim, the Sandstone Canyons, and Battle Creek areas. Road density is an issue, as is management of garbage, food storage, and developed and dispersed camping to minimize bear-human conflicts.

Mountain lion (forestwide): Population estimates of mountain lions are difficult to obtain, and typically are assumed to be imprecise, with large margins of error. The Wyoming Game and Fish Department does not use estimates of population size in our management efforts, but rather an estimate of trend. The population management focus for lions is to maintain a viable lion population, while providing ample hunting opportunity as the primary management tool. Lion populations appear to be currently stable on the Medicine Bow Forest.

The Forest provides very important year-long habitat and hunting access for mountain lions. Forest lands, along with BLM and private lands immediately adjacent to the Forest, provide almost all the seasonal habitat for this species. Since the main prey base for mountain lions is mule deer, they will typically occupy similar habitats year-round. Hunting access and opportunity are usually dependent on snow conditions.

The trend in habitat quality for prey species (mainly deer, some elk) is the biggest influence on lion populations. For all lion areas that include the Forest, maintenance of healthy shrub communities, aspen stands, and riparian vegetation are key to mule deer production and consequently to lion populations.

Wild turkey:

- **Laramie Range:** There is no population objective for wild turkeys in the Laramie Range. The numbers of wild turkeys have remained fairly stable in recent years, dependent mainly on annual weather patterns. Wild turkeys often use private lands adjacent to the Forest during winter. The majority of these turkeys migrate back on the Forest during the spring period and spend summer and fall there.

  The Laramie Range provides important spring, summer, and fall habitat for wild turkeys, including breeding, nesting, and brood rearing habitats. In addition, the Forest also provides hunting opportunities during both the fall and spring hunting seasons. These turkeys are usually associated with ponderosa pine stands adjacent to open parks, mountain shrub stands, and riparian areas. It appears small scale thinning cuts have helped increase herbaceous cover and shrub growth, which the turkeys utilize as feeding areas.

  Turkeys are typically most affecte when herbaceous understory habitat or small openings in forested habitats are altered. These areas provide important insect production necessary for developing poults and provide essential loafing and escape cover. Early livestock release dates into forested herbaceous areas can reduce herbaceous cover below that adequate for turkeys, especially during drought years. Herbaceous stands associated with more productive areas (riparian, seeps, etc.) typically receive relatively heavy use by livestock, reducing their value to turkeys.

- **Rest of Forest:** Recent transplants near Pole Mountain have resulted in turkeys using Forest lands in the area. Transplants near Centennial may result in limited use on Forest land upstream on the Laramie and Little Laramie Rivers. Ponderosa pine stands adjacent to open parks, mountain shrub stands, and riparian areas will be habitat considerations for these populations.

Blue grouse (forest-wide): The Forest supports a stable to decreasing population of grouse. Numbers vary by area due to habitat presence and quality.

The Forest provides most of the occupied blue grouse habitat in the Laramie Peak area and nearly all habitat in the Snowy Range and Sierra Madres. Aspen, riparian, and open grass meadows are used as breeding, nesting, and brood rearing habitat and are needed to sustain blue grouse populations.

Blue grouse are typically most impacted when forested areas having a good herbaceous understory or small openings in forested habitats are changed. These areas provide important insect production necessary for young chicks and provide essential loafing and escape cover. Early livestock release dates into forested herbaceous areas can reduce herbaceous cover below that adequate for upland birds,

especially during drought years. In particular, herbaceous stands associated with more productive areas (riparian, seeps, etc.) typically receive relatively heavy use by livestock, reducing their value to blue grouse. Increasing encroachment of conifers into the limited acreage of aspen will reduce the suitability of blue grouse habitat.

Sage grouse: No leks are located on National Forest lands, though nesting, rearing young, and winter habitat may occur. Standards provide protection from disturbance during breeding season within 2 miles of lek sites (for leks on or off Forest land). For more detail, see the analysis for the species in the Biological Evaluation.

Columbian sharp-tailed grouse: The Forest provides important habitat for this species. Key areas are on Cottonwood Rim, east and northeast of Battle Mountain, below the Stock Drive, and in the lower portions of Big and Little Sandstone Canyons. There may be additional undiscovered leks near the northern boundary near Tullis and near Dexter Peak.

Maintaining adequate serviceberry and other shrub habitat for winter survival, and adequate shrubs with understory vegetation for nesting hens is important for this species.

Fur bearers (beaver, marten, bobcat, muskrat, weasel, mink, river otter): Most of these species depend heavily or exclusively on Forest habitats.

Most, if not all, marten habitat in southeast Wyoming is found on Forest lands in the Sierra Madre and Snowy Ranges. Large, healthy, old growth spruce-fir stands with corridors provided by mature spruce-fir or lodgepole pine are the major habitat needs for marten. Trapping seasons were shortened in the Snowy Range in part due to high vulnerability resulting from increased motorized accessibility and habitat fragmentation.

Forest lands provide important riparian habitats for beavers throughout the Forest. Beaver utilize willow riparian areas and adjacent aspen stands, if available. Many beaver-dependent fisheries have been developed through the establishment of ponds by beavers. Besides the obvious benefits of storing water and creating wetland habitats, beaver ponds also provide important waterfowl and amphibian habitat.

In general, for these remaining species, habitat issues will focus on riparian and wetland habitat health and diversity (muskrat, mink, river otter), downed logs for dens and undergrowth for prey species (weasel and bobcat).

ENVIRONMENTAL CONSEQUENCES

Elk

Direct and Indirect Effects

Bull elk prefer mature and old forest as cover, and would benefit from the higher retention of old growth and the provision for old growth recruitment blocks found in Alternatives B, C, D, and E. The reduction of timber harvest in Alternative F (and to a lower degree in Alternative E) will provide for abundant mature and old forest. Logged and burned areas provide forage in the late spring through mid-fall. Logged acres would be highest in Alternatives B and C, but these alternatives would provide the fewest acres of burned forest. Alternative F would create little recently-logged habitat, but the most burned acres. Alternatives D and E combine some tolerance of natural processes (fire) with an intermediate amount of logging.

All alternatives will reduce roads and create security areas that will benefit elk. This is likely to occur most quickly in Alternatives E and F and most slowly in Alternatives A, B, and C. Alternative D DEIS is intermediate. An objective of reduction of 150 miles of road in the 10 to 15 year life of the Revised Plan was added to Alternative D FEIS. Winter disturbance has adverse effects on elk's ability to survive the winter and for cows to carry successful pregnancies. Mapping of winter range based on the latest maps of elk locations in winter was used to map crucial winter range in alternatives B, C, D DEIS and D FEIS, and E. Alternatives A and F are based on older information.

Motorized use in crucial winter range is forbidden off roads or trails except on travelways designated by the Forest Supervisor in Alternatives B, C, D, and E. Alternative F closes winter range (MA5.41) to all human activity, including passing through the area to reach higher elevation land. Alternative A allows use on all roads and trails in winter range and provides the least protection to wintering elk.

Cumulative Effects

Potential development of adjacent agricultural land into residential use would decrease the winter range available to the elk herds that use the MBNF.

Within the life of the Revised Plan, it is possible that wolves will disperse onto the MBNF from the Yellowstone population, with consequent reduction in the size of elk herds and change in the behavior of the animals.

Chronic Wasting Disease has spread into Wyoming from Colorado and is present at low frequency in elk in Wyoming (about 1%, Williams, pers. comm 2003). The effects on CWD on big game populations is uncertain. Hunting pressure may decrease on elk as some people may be less interested in hunting in areas with the

disease, though transmission to humans from consuming meat from infected animals has not been demonstrated. Hunting pressure may increase on herds that are relatively free of CWD. Either trend would alter efforts by Wyoming Game and Fish to manage the size of specific herds. It is also possible that the disease will become common enough that the herd size will decrease over time as animal are less resistant to other stressors like extreme winter cold and average lifespan shortens.

Conclusions for Elk

Big game management was not a major revision topic because the 1985 Plan was considered to provide adequate conditions of game species. Some alternatives emphasize protection from disturbance in winter, others emphasize increases in summer forage or old/mature forest cover. All alternatives provide for burning to improve winter forage. All alternatives are expected to provide habitat for abundant elk, at or above the State's objectives.

Mule Deer

Mule deer are affected by many of the same factors addressed in the elk analysis above. In herds that use the Laramie Peak Unit and Pole Mountain, the disease is endemic (an infection rate of about 10%). The disease is rare in the Medicine Bow Range and the Sierra Madre but has been reported as far west as Baggs (west of the Forest). Alternatives providing summer forage (following logging or fire), security areas, reduction of disturbance along roads, and protection from disturbance in winter benefit mule deer. Direct, indirect, and cumulative effects are similar to those for elk, described above. All alternatives are expected to provide habitat for mule deer, at or above the State's objectives.

Bighorn Sheep

Environmental consequences on bighorn sheep are considered in Appendix I under "Species of Possible Viability Concern."

Black Bear

Maintaining key riparian, aspen and wet meadow habitat is key to minimizing impacts to black bear. All of the alternatives incorporate Forestwide standards, guidelines, and objectives to protect and improve these habitats.

Black bears may abandon winter den sites, even abandoning cubs, in response to disturbance during the winter. Alternatives that limit the extent of disturbance in winter reduce this risk. Alternative F is the only alternative that limits motorized winter recreation to designated roads and trails. Population size is controlled primarily by state hunting policy, though an occasional black bear may be removed in predator control near livestock (see Effects of Predator Control on Wildlife at the end of the Wildlife section).

Mountain Lion (forestwide)

Mountain lions benefit from abundance of prey (especially mule deer) and security areas. All alternatives are expected to provide habitat for mule deer at or above the State's objectives. More road eradication and less removal of cover will occur in the alternatives with less emphasis on timber production (E and F), providing more opportunity for increasing security areas.

Wild Turkey

Because of the limited habitat range, no adverse effects are anticipated for wild turkey. The effects of all alternatives on wild turkey are expected to be the same.

Blue Grouse (forestwide)

There is no clear difference among the alternatives in the treatment of aspen that would create different effects on blue grouse. All alternative share an objective for restoration of aspen.

Sage Grouse

Sage grouse are addressed in Appendix I as a sensitive species. Very little habitat for sage grouse is found on the MBNF. Some nesting, brood rearing, or wintering may occur, but no leks currently occur.

Columbian Sharp-tailed Grouse

Columbian sharp-tailed grouse are addressed in Appendix I as a sensitive species.

Fur Bearers (beaver, marten, bobcat, muskrat, weasel, mink, river otter)

See analysis for northern river otter and American marten in the Biological Evaluation (Appendix I).

Direct and Indirect Effects

Loss of large downed wood and snags (for denning habitat and travel cover) following logging is detrimental to marten, bobcat, and weasels. Alternatives F, and E call for the least logging and will provide the most of these resources. These alternatives will also provide the greatest recruitment of snags and downed wood created by natural processes (fire, insects and disease, etc) and the greatest retention of these elements because of the reduced likelihood that such material would be salvaged in commercial timber sales. Weasels, marten, and bobcat eat many species of small mammal that live in clearings, along riparian areas, and in wet meadows. It is not clear whether off-trail snowmobiling in these areas is reducing the populations of these animals. If so, the restriction of snowmobiles to roads in Alternative F

would benefit furbearers. The Revised Plan includes and objective to cooperate with others in addressing effects of snowmobiles on subnivian prey species.

Cumulative Effects

All these species suffer mortality related to trapping. However, trapping pressure has been low over the past 2 decades, and current populations have experienced only local effects. At this writing (2003), fur prices are rising from the depressed value of the recent past , and trapping may increase in importance as a factor. The marten and northern river otter are Sensitive species, and the beaver is still recovering. These factors will be considered by the state in setting limits on trapping.

Beaver are trapped both for their pelts and for removal as a "nuisance" when their dams flood roads or structures. Introductions by the state initiated restoration of the population, which had been lost due to earlier trapping.

Conclusion for furbearers. All alternatives are expected to provide adequate habitat for bobcats, weasel, mink, and muskrat at current levels. Beavers and otters are expected to continue increasing to desired levels. For effects on the American marten, see Appendix I. Furbearer populations do not appear to be in decline related to trapping.

Population size will be maintained by state regulation on trapping. Only if fur prices continue to increase and trapping pressure greatly increases will Forest Service habitat management be expected to affect populations of these species. Alternatives that restrict motorized access in winter may reduce access by trappers and provide refugia, either by providing blocks of non-motorized land (Alternative F and E provide over 500,000 acres; Alternative D provides 343, 092, and the remaining alternatives less than 212,000 acres) or by restricting use of snow machines to designated routes (Alternative F).

Conclusions on Game and Trapped Species

All alternatives will provide adequate habitat for big game, game birds, and aquatic mammals. Alternative A will retain less downed wood and fewer snags than the other alternatives. Effects of Alternative F are least predictable; early successional stages of forested habitat (forage for big game) may decline is there is little wildfire; mature forest cover may decline if wildfire is extensive. Bears and mountain lions might benefit from the retention of security areas, but their populations probably are determined more by hunting regulations than by habitat.

Management Indicator Species (MIS)

36 CFR 219.19(a) directs each forest to select "Management Indicator Species," a sample of the species on the forest on which population data should be collected so that trends can be evaluated. They serve as surrogates for all species in two functions: during development and revision of the Plan to shape and analyze Forest

Plan alternatives, and during implementation of the Plan by tracking MIS population trends and determining relationships to habitat changes.

An objective of all of the alternatives is to provide for adequate habitat amount and quality to maintain a viable population of native and desired non-native species. However, it is not feasible to monitor the numbers of individuals of every species. In addition to data on species of viability concern (threatened, endangered, sensitive, and species of local concern) and game, the adequacy of management direction is also tested by monitoring populations of selected Management Indicator Species.

Management Indicator Species (MIS) are intended to test Plan assumptions and achieve Plan objectives. Therefore, management is not designed to meet the needs of these species. Rather, we use monitoring of these species to test whether Forest Plan assumptions are having unexpected effects. For example, if our snag protection standards are adequate, we would not expect to see forestwide declines in cavity-nesters. If our standards for protection of riparian shrubs are adequate, populations of songbirds nesting in this habitat should not decline.

The desired outcome of the effects analysis for MIS species depends on the species and the purpose for which it is being used. For a TES species, the species may be used to test whether our actions are improving habitat; in that case, an increase may be desired. If the species is used to test the assumption that our management will not cause a decline, then a stable trend is desired; a decline would trigger further investigation of the causes. Increases are not always desired. An increase in an MIS may occur at the expense of declines in other species. For example, if the MIS prefers dense habitat, it may decline with thinning, but another species may increase.

Species Selected as MIS

For a full discussion of method and rationale, see Appendix H.

The management indicator species selected are:

1. Northern goshawk
2. American marten
3. Snowshoe hare
4. Golden-crowned kinglet
5. Three-toed woodpecker
6. Common trout (brook, brown, and rainbow)
7. Lincoln's sparrow
8. Wilson's warbler

These species were selected because there is basic knowledge of their habitat requirements (including habitat components and need for security), but there is some uncertainty about management effects on their habitat. The emphasis on each will

depend on the extent of specific management activities and habitats affected by the alternative selected. Alternatives with relatively more emphasis on timber harvest, for example, would result in more monitoring emphasis on MIS that were selected to detect forestwide response to logging.

See Appendix H of the Revised Plan for more detailed information on the evaluation of MIS.

ENVIRONMENTAL CONSEQUENCES FOR MIS

American marten are primarily animals of dense, old forest with a complex structure of understory and downed wood. Late-successional multi-storied stands of spruce-fir forest are preferred, though multistoried lodgepole (usually with invading subalpine fir) and other forest types with downed wood are also used. Martens are found in dense forest with canopy cover of at least 30%. A complex arrangement of downed wood (large logs, tangles of smaller material, root wads, downed trees with branches, and sloping logs and branches) provides habitat for prey, cover from predators, dens, resting sites, and entry to subnivian habitat (Thompson and Harestad 1994). Squirrel middens, hollow logs, cavities in snags, and rock piles are used for dens (Ruggiero 1998). Partially arboreal, marten hunt and rest in trees, in cavities and on mistletoe brooms (Bull, Parks et al. 1997).

Martens appear to respond to fragmentation (including perforated patterns) at the scale at which logging typically occurs on Forest Service land. Marten populations declined to near zero when 25% to 30% of a watershed was logged (Bissonette, Harrison et al. 1997), a decline that would not be expected until 60% of the mature forest was logged if the animals were responding to habitat loss alone. Where forest is fragmented by regeneration timber harvest, a marten must occupy a larger area to include adequate forest habitat in its home range.

Activities on Forest Service land that may adversely affect the American marten, directly or indirectly, include logging of old forest (removal or reduction of dense canopy, reduction of snags, reduction of large downed dead wood, and fragmentation of old/mature forest, especially in spruce/fir), access for trapping, snow compaction over resting sites, and snow compaction that adversely affects prey density, and snow compaction along linear routes that increases other predators.

Alternative A is least beneficial to martens. It has the lowest retention of key habitat features (old growth, snags and downed wood) and retention of only 10% old growth is not likely to provide adequate connectivity. Alternatives B, C, D-DEIS, and E will retain 20% and Alternative D-FEIS 25% of old growth. The more old growth is retained, the better the chance of retaining large patches, and patches that are close enough together to maintain connectivity. Alternative F is most beneficial, followed by Alternative E. Alternative D-DEIS and D-FEIS are intermediate and are similar-D-DEIS has less MA 5.13, but D-FEIS has higher old growth and retention of complex structure of downed wood.

Northern goshawks nest in ponderosa pine, lodgepole, and aspen. On the Medicine Bow, most nests are in mature aspen trees that lie in or adjacent to mature or old lodgepole that provides good foraging habitat. Many of the bird's prey species are most abundant in areas with downed wood (squirrels) and snags (woodpeckers and other cavity nesting birds and mammals). Alternatives that result in retention of mature aspen and lodgepole pine in a spatial configuration that permits access to foraging habitat result in beneficial effect. Mature aspen and lodgepole are described by habitat structural stages 4 and 5. There are currently 258,359 acres of mature aspen and mature lodgepole pine.

All alternatives except A are expected to maintain a viable population of Northern Goshawks, because of the protection of habitat nest sites and post-fledging areas, protection of active nests from disturbance, and increased old growth. Alternative F (followed by E) will alter the least goshawk habitat and has the highest confidence in providing a stable or increasing population. The other alternatives will alter more goshawk habitat, and entail more risk of a decline in numbers, though not to a point that is likely to threaten viability because of protective standards.

Snowshoe hare are the primary prey species for Canada lynx, and are important prey for northern goshawks, bobcats, and American marten. Hares use foraging habitat that range from young, dense lodgepole pine to forest with a dense understory. Measures to conserve lynx by providing habitat for snowshoe hare are incorporated into the standards and guidelines for all alternatives except Alternative A. Alternative A promotes and plans thinning in young lodgepole stands. This reduces canopy density and created conditions unsuitable for hares. Active management to create young, dense foraging habitat is a major component of the conservation plan.

All alternatives are believed to provide for the continued presence of the hare on the Forest. Alternative A would not provide management direction for conserving lynx (which includes management that favors snowshoe hare habitat), and is least favorable to the snowshoe hare. All other alternatives contain standards for management for snowshoe hare habitat and creation of young lodgepole stands (either by logging or by fire). Alternative F (followed by E) would retain the most old forest with understory, another important habitat for hares.

Golden-crowned kinglets prefer the upper crowns of large spruce trees. There are 192,000 acres of spruce-fir across the Forest. Over the long term, alternatives with the fewest planned entries into spruce-fir would be create the most habitat for golden-crowned kinglet.

Alternative A retains the least old growth in spruce-fir and is least beneficial for the Golden-crowned Kinglet. The conversion of existing old forest to young forest by timber harvest is greatest in alternatives B, C, and A (in order), followed by a somewhat lower expected conversion in Alternative D DEIS and D FEIS, and forestwide populations of golden-crowned kinglets may decline in these alternatives.

Less timber harvest will occur in Alternatives E and F; however, the effect of wildfire in this habitat is not predictable. All action alternatives are expected to retain enough late successional forest to provide adequate habitat for a viable population of golden-crowned kinglets.

The American three-toed woodpecker prefers sites of insect outbreaks (often in recently burned forest) or mature/old, unbroken stands of spruce/fir and lodgepole pine. The species nests in conifers (usually snags). The species uses two different habitats: recently burned forest provides a short-term (4-8 year) high quality habitat with a high density of food; old forest provides a long-term steady supply of food. Alternatives that promote increased fire on the land, reduced salvage, and retention of old, coniferous forest result in beneficial effects.

Compared to Alternative A, old growth retention standards in spruce-fir have been raised from 10% to 20% (Alternatives B, C, D DEIS, and E) or 25% (Alternative D FEIS). In Alternative F, the low level of timber harvest will provide de facto protection of old growth. Alternative F also allows the most natural disturbance (fire) to provide the preferred habitat for this species. Alternative A is least beneficial because it has the low old growth retention and an expected timber harvest similar to Alternatives B and C.

All alternatives are expected to retain enough late successional forest to provide adequate habitat for a viable population of American three-toed woodpeckers. Under Alternatives A, B, C, the population may remain stable or decline. Under Alternatives D DEIS, D FEIS, and E, the population is expected to remain stable: declines are possible (with loss of old forest), but so are increases (if burned forest increase). Under Alternative F, three-toed woodpeckers would be expected to be stable or increase over time.

Lincoln's sparrows and **Wilson's warblers** are sensitive to grazing in riparian areas. There are 69,000 acres of forested and non-forested riparian and wetland acres on the Forest. Both domestic livestock and ungulates such as moose, elk and deer graze on the same lands, including the riparian areas. Moose are not native to the area (having dispersed from introduced populations in Colorado). Standards and guidelines along with frequent on-site monitoring of domestic livestock grazing on the Forest result in protection of riparian resources. High populations of big game (deer, elk, and moose) may create detrimental effects.

All alternatives are expected to provide adequate riparian habitat for Lincoln's sparrow and Wilson's warblers. If declines are noted, riparian structure will be assessed and source of change will be evaluated.

Common trout are sensitive to sedimentation, water quality, amount of structure and shade. Alternatives with little or no development or ground disturbance in and near water are the most beneficial to trout. However, when development or ground disturbance is permitted, implementing standards and guidelines to protect water or water related resources ensure that water dependent species such as fish are

protected. Therefore, all alternatives are expected to create adequate habitat for common trout.

Effects of Proposed Management Activities

Effects from Oil and Gas Leasing

Oil, gas, and minerals development can impact wildlife primarily through alteration or destruction of habitat and disturbance (noise and human activity). Disturbance and activity can cause displacement abandonment, increased mortality and reduced reproductive success of some wildlife species (Joslin and Youmans 1999). Effects are mitigated through land reclamation and through standard lease terms, stipulations on oil and gas development (Appendix E in the Revised Plan), and standards and guidelines in the revised plan.

Oil and gas development on the Forest is expected to be low with only 2 wells developed over the planning period. Alternative A has no oil and gas leasing. Alternative B utilizes standard stipulations only. All other alternatives include further standards (and stipulations) for protection of sites where animals are especially vulnerable to disturbance, like bighorn lambing areas and raptor nests. Potential negative impacts from most to least would be Alternatives B; E, C, D DEIS, D FEIS; F and A.

Effects from Locatable Minerals

Potential effects from locatable minerals development are similar to oil and gas leasing. Effects are mitigated through land reclamation and standards and guidelines in the Forest Plan. Locatable minerals are available for exploration throughout the forest, except where specifically withdrawn from mineral entry. Locatable minerals would be withdrawn from MAs 1.13, 1,2, 1.31, 1.41, 1.5, 2.2 and 8.21. By Alternative, the most potential for locatable minerals exploration would occur under alternative A followed by B through F.

Effects from Fisheries and Riparian Management

Managing fish and riparian habitat includes many techniques, including in-stream structures, riparian plantings, exclosure fences, and bank stabilization. Usually these management tools also result in higher quality habitat conditions for terrestrial wildlife, especially riparian-associated species. Planned activities (based on the first decade) include restoration of streams or riparian areas and restoration or enhancement of lakes and wetlands. The outcomes range from 2 miles and 4 acres in Alternative A to 6 miles and 8 acres in Alternative F. While the stream, riparian and lake restorations and improvements may have site-specific positive impacts on riparian associated terrestrial species, there would not be a measurable forest-wide change in the first decade.

Effects from Lynx Amendment Standards and Guidelines

The Forest Service is in the process of amending Land and Resource Management Plans (LRMPs) for seven National Forests in Colorado and Wyoming to provide for conservation and recovery of the Canada lynx.

This management direction, which is incorporated into Alternatives B-H, will have beneficial effects for lynx habitat in these alternatives. Since the habitat standards are tied to HRV, there should not be adverse effects on other species.

Effects from Predator Control (Animal Damage Control)

FSM 2650 provides direction concerning animal damage management on National Forest System lands. This direction defines the cooperative approach and responsibilities of the Forest Service, APHIS, local and state agencies, and other federal agencies. The Forest Service meets annually as a cooperating agency as part of the NEPA analysis carried out by the Wildlife Services division of APHIS (Animal and Plant Health Inspection Service).

Verified losses of domestic sheep to predators on the MBNF from 1997 to 2002 are shown in the following table. An additional 126 lambs and 20 ewes dwere lost, but the kills were not verified by Wildlife Services.

Table 3-92. Verified domestic sheep losses on the MBNF, 1997-2002.

	Coyotes	Black Bear	Mountain Lion
Lambs	49	28	4
Ewes	1	37	

Source: Bob Mountain summary of Wildlife Services annual reports.

Removal of animals classified as "game" (black bear and mountain lion) done only following predation on livestock, and are targeted at the species (if possible, the individual) involved in the attack. In the six years from 1997 to 2002, Wildlife Services removed one black bear and no mountain lions.

Removal or animals classifed as "predators" (coyotes and red fox) may be either preventative (removal of adults and young in dens prior to introduction of sheep to an area) or responsive (following predation attributed to the species). In the six years from 1997 to 2002, Wildlife Services removed 48 coyotes and 2 red foxes.

At this rate of removal, predator control does not threaten the viability of predator species on the MBNF.

Effects from Fire and Fuels Management

Fire and fuels management can have a variety of both beneficial and adverse effects on wildlife habitats. Fire influences the composition, structure, and pattern of vegetation that provides wildlife habitat. (Changes in these features compared to HRV and difference in fire regime in different vegetative communities is covered the

Biodiversity section of this chapter.) Activities under the Revised Plan that affect habitat included fire suppression, prescribed fire, salvage sales, and fuel reduction (thinning and associated removal of downed wood)

Past fire suppression has altered habitat in ponderosa pine and in grass-shrub communities. Prescribed burning partly mitigates this loss of fire, though ponderosa pine forests may already have a dense understory that has to be mechanically removed prior to burning.

The lodgepole and spruce fir forests have a longer natural interval between fires, and the vertical structure of these forests is consistent with HRV. However, These high elevation forests would have had a number of small fires in most years, providing a supply of recently burned habitat. With fire suppression and subsequent salvage, the amount of this habitat on the land has been reduced.

Fuel reduction will focus first on areas near structures, private land, and sites where fire poses a risk to safety (near campgrounds). In these areas, downed wood standards will be waived, so habitat quality will be reduced for species relying on the structure it provides. Thinning may be done, which will create a structure that is not typical of the past and will result in loss of useable habitat for species that require a connected canopy. The area altered in these fuel reduction treatments is not expected to be large enough to affect population viability of any species.

Further thinning may also be done to reduce insect outbreaks in areas allocated to MA 5.13 or MA 5.15 (timber emphasis) to protect timber resources. The risk of fire is reduced by avoiding an insect epidemic that would kill trees, creating fuel for future wildfire.

The estimated fuels treatments (which includes prescribed fire and mechanical treatments) range in the first decade from 2,200 acres in Alternative F to 4,000 acres in Alternatives D DEIS, D FEIS and E. While the lands restored, improved, or maintained by prescribed fire may have site-specific beneficial or adverse impacts on terrestrial species habitat, there would not be a Forest-wide measurable difference on terrestrial wildlife populations between alternatives.

Predicted acres of wildfire wildfires from most to least are Alternatives F, C, D DEIS, D FEIS, E, B, and A. However, in a warm, dry interval, very large, intense fires are impossible to control and, under those conditions, fires are almost equally likely in all the alternatives.

Restoration of insect and birds typical of habitat created by stand-replacing fire would be greatest in the alternatives that incorporate natural processes (Alternatives F; D DEIS and D FEIS; C and E; B; and A.)

Effects from Insects and Disease Management

Forest insects and diseases have always been a natural component of the forest. Along with fire, they are among the most important disturbance agents that have created the current composition, structures, and pattern of wildlife habitats. The

primary insect species are mountain pine beetles, followed by the spruce beetle and wood-boring insects. Primary coniferous and deciduous tree diseases include lodgepole pine dwarf mistletoe, Douglas-fir dwarf mistletoe, Armillaria root disease, and several decays and cankers of aspen. (See Biodiversity section of this chapter).

Insect and disease create wildlife habitat directly (for example by serving as prey or by changing other texture of the heartwood in a tree that subsequently becomes a snag). Many species of wildlife (such as the lynx, marten, and three-toed woodpecker) depend on snag and downed woody dependent species and may benefit most from periods of increased insect and disease activity. Other effect are indirect; epidemics that killed trees in large patches providing fuel for large stand-replacing fires created age diversity and the spatial pattern used by native species. For example, the variable pattern created by wildfire is important to bird diversity (Hejl 1992).

The infrequent epidemic outbreaks can also have negative impacts on other wildlife species. Some examples include reduction of species associated with late-successional and old growth habitats and loss of cover and security habitat for big game species.

All alternatives may implement management actions to control, to varying levels, insect and disease infestations, mainly through timber harvesting and thinning. Based on predicted acres of insect and disease, Alternatives F, D DEIS, E and D FEIS (in descending order) provide the most area where insects and disease will be tolerated. Alternatives A, B, and C provide the most area where spread of insects and disease will be halted to the extent possible and trees threatened by these processes will be harvested.

Effects from Livestock Grazing

Activities related to domestic livestock grazing can have beneficial or adverse effects on wildlife and wildlife habitats, depending on the species. Livestock grazing is more likely to be beneficial to native animals and plants in areas that were grazing by bison herds. Livestock may consume dense vegetation, stimulating new growth that increases forage nutrient content and availability, and improving habitat for species that select more open habitats. Adverse impacts occur when shrub or grassland communities are grazed to a level that decreases habitat quality for species associated with dense vegetation, including many ground-nesting birds.

Competition for forage, space, and water can occur between wildlife and livestock. Forage reduction can be significant in times of drought when productivity is low. Timing and distribution of livestock can effectively reduce or eliminate the majority of these conflicts.

Domestic sheep can infect bighorn sheep with disease, most significantly with *pasturell*a-caused pneumonia. Guidelines for Geographic Areas in the Medicine Bow Range and on the Laramie Peak Unit will help protect bighorns from contact

with domestic sheep. See Biological Evaluation (Species of Local Concern) for full discussion.

Trampling by domestic livestock may alter the form of stream banks, eliminating nest sites for birds like the Cordilleran Flycatcher. Degradation of water quality by increased sediment and by deposits of fecal material may adversely effect aquatic animals like the sensitive amphibians and Hudsonian emerald.

Domestic livestock grazing would continue to be permitted under all of the alternatives. Livestock management standards and guidelines apply to all MAs that permit livestock grazing, so impacts to wildlife generally will be the same under all alternatives except F, which has a 30% utilization standard.

Effects from Noxious Weeds

Controlling noxious weeds in infested areas will help maintain habitat for some species of wildlife. Noxious weeds can adversely impact herbaceous cover and forage for some species, including elk, some ground-nesting birds, and small mammals like Preble's meadow jumping mice. The Revised Forest Plan provides general direction to control noxious weed infestations and to implement the Forest-wide noxious weed plan. It is not expected that any of the alternatives will provide control adequate to halt or reverse the spread of noxious weeds on the forest, although rate of spread over the long-term should be reduced.

Effects from Recreation Management

Some types of recreational activities can result in direct loss of wildlife habitat, disturbance, and temporary or permanent displacement of species. Effects on wildlife would primarily be associated with increased disturbance from people. Any expansion or construction of new facilities would include an analysis of site-specific effects on wildlife. Increases in the trail system the alternatives (see following Table) are modest. Effects will depend on the location and cannot be generalized.

Table 3-93 Expected increase in trail system for each alternative for the desired condition.

Trails constructed (miles/yr) per alternative	A	B	C	D DEIS	D FEIS	E	F
Desired level	8.0	5.0	10.0	10.0	10.0	5.0	4.0
Based on experienced budget level- in 1st decade	3.0	1.5	5.0	5.0	6.0	1.5	0.5

* Note: These values are based on the level of funding that has been available recently for the first decade of implementation of the Revised Plan.

Dispersed recreation, whether motorized or nonmotorized, has the potential to disturb and displace some wildlife species. Human activity can increase predation on passerine nests, either by attracting predators to the site or because disturbed birds flush and disclose the nest location (Gutzwiller, Riffell et al. 2002). Some nesting birds, including open country raptors and eagles, may abandon nests if disturbance is great (especially at the time of nest initiation) or the nest may fail if disturbance

interferes with foraging and feeding the young. The effects of motorized use and road density on wildlife have been covered in the discussion on security areas in this chapter.

Snowmobiles compact the snowpack. Possible effects are dealt with in the Snow Compaction section of this Wildlife report. In addition to compaction effects, research has shown that disturbance related to snowmobile use has the potential to displace wildlife, can result in habitat loss, and can sometimes lead to mortality (Bury 1978; Boyle and Samson 1985). Behavioral responses can be of both short and long duration (Knight and Gutzwiller 1995). No comparable studies are available on the effects of the quieter machines now under production.

Snowmobile use would be allowed to occur under all alternatives, but the amounts and types of use would vary. Snowmobile use would be allowed to occur in Alternative A (79% of the forest acres), B (79%), C (78%), D DEIS (67%), D FEIS (64%), E (51%), F (9%). Area in which snowmobile use can occur but is restricted to roads and trails is Alternative A (0%), B (3%), C (4%), D DEIS (11%), D FEIS (10%), E (22%), F (9%).

In lower elevation areas, particularly in crucial big game winter range, (MA 3.58), winter motorized recreation is prohibited (except on routes designated by the Forest Supervisor) between November 15 and April 30 to minimize disturbance to wintering big game.

Most studies of recreational disturbance have focused on overt behavioral responses, rather than habitat avoidance, physiological effects, or deferred effects like increase future mortality risk. Minimal information or research exists that addresses possible impacts at the population or community level. Forest Plan standards will reduce impacts from recreational activities for some wildlife species (e.g., elk calving and winter range areas, bighorn sheep lambing areas, caves, and protection of known raptor nests). Research and monitoring (Revised Plan, Chapter 4) will determine whether any site-specific changes are necessary in management of snowmobile use.

Effects from Travel Management

Roads and trails can impact wildlife species by direct removal of habitat during construction and reconstruction or indirect loss of habitat associated with increased human use and disturbance. Some animals are sensitive to human disturbance and will abandon habitat that is otherwise suitable in response to human use. This effect is greatly reduced when roads are closed or decommissioned. Generally those alternatives proposing the fewest miles of road construction and the most miles of decommissioning pose the least risk to sensitive species and their habitat. Based on this, adverse effects to wildlife from travel management from most to least are B, A, C, D DEIS, D FEIS, E, and F. In summer, motorized travel occurring off designated routes is prohibited in all alternatives.

Effects from Timber Management

The direct effects of vegetative management, especially timber harvest, would be an immediate change to the structure and often the composition of the treated areas. Timber management can result in both beneficial and adverse effects on wildlife. Many of these effects have been discussed in earlier sections of section of this Wildlife discussion (Spatial Pattern, Old Growth, Dead Downed Wood, and Snags, and Burned Forest) and in the BA and BE in Appendix I.

In place of the decreased levels of historical disturbance agents such as fire, insects and diseases, timber management can help retain the diversity of habitats and vegetative composition, structure, and pattern. Timber management and related roading can also result in loss of habitat effectiveness and can increase wildlife disturbance and displacement. Cutting of dead trees and snags for firewood following logging can reduce the availability of cavities for nesting and security for snag dependent species.

All alternatives would have some level of timber harvest, although the quantity and objectives for harvesting those trees vary by alternative. Forestwide and Management Area standards and guidelines are designed to reduce adverse impacts to wildlife. Examples of forestwide direction includes maintaining minimum levels of old growth habitat, snags, and coarse woody debris. Examples of Management Area direction designed to protect and enhance wildlife habitat includes the use of MA 5.15. This prescription includes guidelines to provide large blocks of undisturbed habitat, emulating natural patterns on the landscape and maintaining islands of un-harvested trees within clearcuts to simulate natural unburned patches and provide future downed wood. The relative benefit of each alternative differs from one species to another. Based on harvest levels (and associated activities) and ecological emphasis potential adverse impacts to specialist species and overall diversity are greatest in Alternatives B, A, C, D DEIS, D FEIS, and E. The harvest level in Alternative F is expected to be less than 1/3 of the next closest alternative; if wildfire is not widespread (for example if suppression is necessary to meet safety needs), overall diversity could decline over time.

Uses and Designations of the Forest

Lands

Introduction – This section addresses those aspects of Forest Service management relating to land ownership, special uses (e.g., electronic sites, utility corridors), and rights-of-way.

Legal and Administrative Framework

Act of 1866 General Mining Law authorizes rights-of-way across public lands for ditches and roads.

An Act to Repeal Timber-Culture Laws, 1891 authorizes ditch easements across public lands and Forest Reserves.

Organic Act of 1897 provides for rules to regulate occupancy and use of the Forest Reserves.

Transfer Act of 1905 transferred Forest Reserves to the Department of Agriculture.

General Exchange Act of 1922 authorizes land adjustments within forest boundaries.

Federal Land Policy and Management Act of 1976 updated authority for management of National Forest lands, provided general authority for use and occupancy of forest lands, required fair market value for uses on the Forest, and repealed sections of many previous acts.

Ditch Bill of 1986 amended FLMPA to authorize permanent easements for agricultural water systems.

Key Indicators

- Land exchange cases, pipeline, and acres.
- Number of rights-of-way.
- Number of special use permits.
- Utility corridors.

AFFECTED ENVIRONMENT

Land Ownership

Acreages under administration by the Medicine Bow National Forest are shown in the following table.

Table 3-94. Land ownership on the Medicine Bow National Forest.

Land Ownership	Acres
National Forest System (NFS)	1,084,614
Other non-NFS	307,230
Total	1,391,844

Land Ownership Adjustments

Most of the opportunities for land ownership adjustments are located on the Laramie Peak unit of the Forest, primarily due to the fragmented ownership patterns. Most of the mineral and homesteading inholdings located on the Laramie and Brush Creek/Hayden Districts have been subdivided, which limits the exchange opportunities. Over the past 10 years, the Forest has used purchases, tripartite and fee exchanges, donations, and Small Tract Act sales to improve land ownership patterns.

Most funding for purchases comes from the Land and Water Conservation Fund. This is a competitive national fund and is not a reliable source of funding for land purchases on the Forest. In the future, most adjustments will be done with land exchanges.

Special Uses

Special use permits are used to authorized occupancy and use of NFS lands by federal, state, and local agencies and private industry and individuals. Several different public laws regulate activities under special use authorizations. The Organic Act of 1897 and the Federal Land and Policy Management Act (FLPMA) of 1976 authorize the majority of the uses.

The major law passes since the 1985 Plan is the 1986 amendment to FLPMA known as the Ditch Bill. This law provides for permanent easement for agricultural water systems in use before 1976. Water users had 10 years from passage of the bill to apply for existing structures located on NFS lands. Currently, 27 easements have been issued under this law with an estimated 11 additional applications being processed.

Special land use applications are increasing as more people make use of national forest lands. The following table lists the number of permits by type as of September 2001.

Table 3-95. Number of special use permits on the Forest.

Use	Number of Permits
Powerlines	29
Road permits	72
Ditches	38
Communication permits	32
Dams and reservoirs	11
Recreation residences	106
Resorts	5
Oil and gas pipelines	2
Sanitary system	4
Ski area	1
Telephone	14
Pastures	2
Water pipelines <12”	12
Water pipelines >12”	2
Wells of spring developments	42
Stream gauging stations	6
Research/education	23
Outfitters and guides	48
Recreation events	11
Organization camps	2
Fences	14
Other Improvements/permits	39
Totals	448

Source: SUDS (Special Use Data System)

Recreation Residence Permits

There are 9 summer home groups with a total of 100 cabins located on the Forest and 6 isolated cabin tracts. In many areas, this use has existed since 1925. Permits for the recreation residences are issued for 20 years. The purpose was to encourage use of the National Forests by allowing individuals to build cabins and occupy them for a portion of the year. The program was successful, and several thousand permits were issued nationwide. The current national policy is not to issue any additional permits, but continue to acknowledge the recreational values associated with the existing Recreation Residences and to reissue those correctly issued existing permits when the current permit tenure expires. It is the intent of the Medicine Bow National Forest to conduct the proper environmental analysis and reissue those correctly issued Recreation Residence permits when the current permit tenure expires.

Access

Lack of public access to the Forest is a growing problem as the demands to use the Forest increase. Private landowners adjacent to Forest boundaries often enjoy nearly exclusive use of the Forest through control of the access by denying public access through their property. In many cases, this is the reason they purchase the land. These landowners are reluctant to negotiate to grant public access.

The Forest has gained access to 79 roads and trails since 1990, many achieved through the landownership adjustment program. We have identified 101,955 acres of National Forest System lands on the Medicine Bow National Forest with inadequate access. The majority of this is in the Laramie Peak District (62,500 acres). Some of the access issues may be remedied through land exchange or public road determination. Others, if pursued, may require condemnation.

Utility Corridors

Presently, there are only 3 designated corridors on the Forest. They are Cheyenne Stage 1 and 2 municipal water transmission lines on Brush Creek/Hayden and Laramie Districts, WYCOLO Railroad, and a power transmission line on the Laramie Peak unit, Douglas District (see map on following page). The areas designated as utility corridors (MA 8.3) are also found on the management area prescription maps for each alternative and they do not change by alternative. Corridor management complies with the objectives of adjacent management areas. The Forest would not approve expansion and other activities and actions that would not meet these requirements. The width of the corridors is specified in the special use permit. The Forest only designates corridors for transmission lines over 69 kilovolts and for pipelines more than 10 inches in diameter. Local distribution lines and smaller pipelines have not been identified as corridors and are normally run in conjunction with the existing road system or other previously disturbed areas in order to minimize environmental impacts.

Western Utility Group (WUG) has identified two priority utility corridors in their latest update that have the potential of effecting Medicine Bow National Forest lands. One identified route is through the north end of Pole Mountain, and the other is through the northeast corner of Laramie Peak District. No site-specific information has been provided, and analysis will occur when that information has been received.

Map 3-5. Location of utility corridors on the Medicine Bow National Forest.

Map 3-6. Location of electronic sites on the Medicine Bow National Forest.

Electronic Sites

Electronic sites are identified in the previous map and the following table. Any additional sites for commercial or Forest Service use will require approval of a site plan. The site plan specifications must comply with visual quality and other resource management objectives. The number of electronic sites does not change by alternative.

Table-3-96. Electronic sites on the Forest.

Site	Used by Forest Service	Other Users
Hill 8821	Yes	38
Beacon Hill	No	12
Crow Creek	No	7
Gilmore Ridge	No	1
Laramie Peak	Yes	9
Spruce Mountain	Yes	0
Little Brooklyn Lake	Yes	1
Kennaday Peak	Yes	0
Bridger Peak	Yes	0
Rock Mountain	No	1

Source: SUDS. Note: Other users are not the same as number of leases.

Rights-of-way

Since 1990, the Forest has acquired 79 rights-of-way (ROWs). The ROW inventory identified 101,955 acres with inadequate access. Additional ROWs are necessary to provide basic public access to the Forest. Many exist, and it is a matter of finishing legal documentation.

ENVIRONMENTAL CONSEQUENCES

General Effects

Land Adjustments

There are approximately 307,000 acres of non-Forest System lands located within the jurisdictional boundary of the Medicine Bow National Forest. Of this, approximately 70,000 acres would be suitable for acquisition under the guidelines established for the land adjustment analysis. This number is low due to the large number of non-federal acres located within the jurisdictional boundary of Laramie Peak District that are not suitable. Consolidation of federal lands is the primary objective for future land exchanges.

Land adjustments are based on a willing seller concept. The landowner must be willing to exchange lands at the appraised values. The Forest has identified parcels

that meet the criteria to be exchanged out of Federal ownership. Other parcels not presently identified will be evaluated under the merits of each proposal. Exchanges are evaluated based on the guidelines shown in Appendix F of the Revised Plan.

The Forest has established a "pipeline" of potential exchanges which accounts for 22,000 acres to be acquired, with a similar number of acres being exchanged out of federal ownership. Funding levels established during the annual budget process can affect the number of exchanges processed. The number of exchanges processed should not vary by alternative. The Forest is currently involved in the proposal stage of a large land exchange with the State of Wyoming Land Board including all state property located in the Laramie and Brush Creek/Hayden Districts. The potential exchange includes approximately 16,200 acres on each side. The projected timeline for completing the exchange is June 2006. This will be a concurrent NEPA process to the Plan Revision, with the plan decision coming first and the exchange decision expected later. The site-specific NEPA for the proposed land exchange will address Management Area Prescriptions for the acquired federal lands.

The Forest does utilize the Small Tracts Act (Pub 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 on, road rights-of-ways, and mineral survey fractions. All applications must qualify under the guidelines of the Small Tracts Act. The amount of land exchanges is not expected to vary by alternative.

Recreation Residences

At the current time, no other uses have been identified for the areas occupied under permit for recreation residences. Future use determination would be to continue to permit recreation residences in all alternatives until such time as conditions change. Each permit would then be evaluated. Land exchanges have occurred with the Albany, Morgan, and Ryan Park Recreation Residence Tracts. These were successful due to the proximity of the tracts to existing private property. Additional exchanges with recreation residences are not anticipated in the future due to the locations of the existing tracts.

Utility Corridors

The areas designated as utility corridors are also found on the management area prescription maps for each alternative, and do not change by alternative. Corridor management shall comply with adjacent management objectives. Expansion and other activities and actions that would not comply with these requirements would not be approved. The corridors are set in width as identified by the Special Use Permit issued.

Electronic sites

Electronic sites are identified in the previous table. Any additional sites for commercial and Forest use will require the approval of a Site Development Plan.

The Site Development Plan must demonstrate compliance with visual quality and other resource management objectives. The number of electronic sites does not change by alternative.

Rights-of-way

The ROW inventory identified 46 more that need to be acquired. The readily obtainable ROWs have been acquired. The remaining ROWs needed are more complex. An estimated 35 ROWs may be reasonably available for all alternatives.

Cumulative Effects

School Section Land Exchange:

The Forest is currently involved in the proposal stage of a large land exchange with the State of Wyoming Land Board including all State property located in the Laramie and Brush Creek/Hayden Districts. The potential exchange includes approximately 16,200 acres on each side. The projected timeline for completing the exchange is June 2006. This will be a concurrent NEPA process to the Plan Revision, with the plan decision coming first, and the exchange decision expected later. The site specific NEPA for the proposed land exchange will address Management Area Prescriptions for the acquired Federal lands.

Prior to NEPA, the Forest Service conducts an internal review of the project called Feasibility Analysis. The purpose of this analysis is to do a cursory review of the project by all resource specialists, ensure that the project meets statutory requirements, meets policy and regulation, and that identified environmental concerns appear to be mitigatable. This analysis must be reviewed and concurred by the Regional Office, and a project of this magnitude must also receive review and concurrence by the Washington Office.

Western Utility Group Proposed Utility Corridors:

Western Utility Group (WUG) has identified two priority utility corridors in their latest update that have the potential of effecting Medicine Bow National Forest lands. One identified route is through the north end of Pole Mountain, and the other is through the northeast corner of Laramie Peak District. No site-specific information has been provided, and analysis will occur when that information has been received.

Two Elks Power Plant:

The proposed Two Elks Power Plant would be located approximately 84 miles north-northeast of the Northeast corner of Laramie Peak District. Cumulative effects are anticipated to be recreational in nature, due to population increases in Douglas and other communities as a result of the employment base of the power plant.

Recreation

Introduction: The Medicine Bow National Forest is the only National Forest in Southeast Wyoming. It is the first mountain range travelers encounter going west on Interstate 80. Interstate 25 and Highways 287, 130, 70, and 230 also channel traffic around and through the Forest.

There are nearly a half million people within 50 miles of what is commonly referred to as the "main Bow" and over three and a half million within 150 miles. Forty four percent of the state population of Wyoming lives in counties around the Forest, which include Albany, Carbon, Converse, Laramie, Natrona, and Platte. The local market area (a commonly used concept in tourism market research) is considered to be located within 100 miles of the Forest, secondary (overnight and weekend) markets are between 100 and 250 miles, and overnight or tourist use are considered to be outside the 250 mile radius.

Recreation participation has grown, and continues to grow with the expanding population. Survey results from the National Survey on Recreation and the Environment (NSRE) show that "94.5 percent of Americans 16 years of age or older participated in at least one of the surveyed forms of outdoor recreation in the 12 months prior to being interviewed …almost 19 out of 20" (Cordell 1997). Most recreation participation occurs between the ages of 24 and 54 (ibid). In Wyoming, 43 percent of the total population is in this age group, except for Albany County; where 38 percent is between 24 and 54. Thirty five percent of Albany County is less than 24 years of age. .

Changes between Draft and Final

- The Key Indicators and Legal and Administrative Framework sections were missing from the Draft Plan for this section. They have been re-inserted.
- Visitor use numbers have been edited based on the newly released Forest Service report on use on the Medicine Bow National Forest (National Visitor Use Monitoring – NVUM) results. These numbers are also the baseline for the economic analysis (*Communities Section).*
- Potential changes to winter use levels were estimated, based on user input.
- The Summer (Adopted) ROS and Winter (Adopted) ROS for Alternative D FEIS maps were added to the published map package for this Plan.

Legal and Administrative Framework

The **Multiple-Use Sustained-Yield Act** (1960) supplements the purposes for which national forests were established and administered to include outdoor recreation, range, timber, watershed, wildlife, and fish.

The **Wilderness Act** (1964) established a National Wilderness Preservation System (NWPS) consisting of public lands designated by Congress for that purpose.

The **Land and Water Conservation Fund Act** (1964) "assists in preserving, developing and assuring accessibility to all citizens of the United States of America …. such quality and quantity of outdoor recreation resources as may be available and are necessary and desirable . . . by . . . providing funds for the federal acquisition and development of certain lands and other areas." The law also provides for the collection of daily recreation use fees for each federal agency that develops, administers, provides or furnishes, at federal expense, specialized outdoor recreation sites, facilities, equipment, or services.

The **Architectural Barriers Act** (1968) 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.

The **National Trails System Act** (1968) states that "to provide for the ever-increasing outdoor recreation needs of an expanding population ... trails should be established."

The **Forest and Rangeland Renewable Resource Act** (1974) directs the Secretary of Agriculture to periodically assess the forest and rangeland resources of the nation and to submit to Congress, at regular intervals, recommendations for long-range Forest Service programs essential to meet future resource needs.

The **Americans with Disabilities Act** (1990) establishes additional requirements to ensure that buildings, facilities, rail passenger cars, and vehicles are accessible to individuals with disabilities.

Key Indicators

- The range of opportunities based on the Recreation Opportunity Spectrum (ROS) in acres.
- Determination of changes in opportunities offered, given alternative themes.

Resource Protection Measures

Mitigation measures to reduce or prevent significant effects of developed and dispersed recreation on the resource are outlined in the standards and guidelines in Chapter 1 of the Plan.

AFFECTED ENVIRONMENT

Supply, Demand, Trends, Issues and Opportunities

Forest Service Recreation Agenda

Recreation management in the Forest Service has typically been more reactive than proactive. As people move into areas to recreate, or as other development projects

increase access, recreation use and development follows. Recreation use is expected to grow at least as fast as the population over the next 50 years, and with that growth comes an increased need to manage use.

According to a report outlining the Forest Service Chief's priorities in 2003, recreation management is one of the four main issues facing the Forest Service today.

> "Increased pressure from growing numbers of people, coupled with advances in recreation technology are challenging land management agencies to address needs and conflicting expectations of users on national forest lands while protecting the health and integrity of the land. Increases in recreation use has resulted in the destruction of fragile soils and vegetation, and while the Forest Service welcomes all Americans to use their national forests and grasslands in multiple ways, rising use has triggered the need for more intense management to protect natural resources (USDA-Forest Service 2003)."

In response to the growing importance of the National Forests for recreation, the Forest Service, in the spring of 2001, finalized a Recreation Agenda meant to direct management on Forests into the Agency's second millennium (USDA Forest Service 2000a). As stated in the Agenda, "National Forests have a unique niche of nature-based, dispersed recreation to offer, including undeveloped settings, built environments reinforcing the natural character, and wildland settings that complement enjoyment of these special places."

Further, "Both our deteriorating infrastructure and our recreation visitors are demanding more attention. The agenda focuses on meeting as much of this demand as possible within ecological and social limits…" including "impacts on the resource, impacts on experiences of other visitors, and limits on the recreation infrastructure… The realities of diverse interests, finite budgets, and environmental considerations will each influence the choices to be made in the management of forest and grassland resources." The Agenda goes on to direct Forest managers to:

- Maintain the integrity of the landscape setting by providing quality habitat for wildlife, which enhances hunting and fishing opportunities, and through well designed and maintained structures and signing.
- Protect and restore natural character through skillful application of recreation and ecological planning, cultural resource protection, scenery management, and social research.
- Invest in some facilities to meet health, sanitation, and accessibility standards, and at the same time, remove those that no longer meet our needs, are out of tune with the natural setting, present significant health and safety problems, and are too expensive to maintain.
- Manage OHV use to assure high quality motorized opportunities and quality experiences, while maintaining acceptable and balanced environmental

impacts on trails, and understanding that some settings are inappropriate for this use.

- Showcase nationally designated areas, and capitalize on unique offerings of each special designation, including innovative funding options for these areas.
- Provide access to recreation opportunities, including securing rights-of-way, and incorporating universal design in our facilities.
- Use marketing research and social science to manage and protect resources, and shape the services we provide for people.
- Establish professionally managed partnerships and intergovernmental cooperative efforts.

Universal Access

The Forest has an Accessibility Transition Plan, which outlines feasible projects for improving universally accessible facilities for the five years ending 2004. This plan will be updated to reflect accomplishments and changes in need. In addition, there are only a few Forest trails that provide universal access; most are narrow, with varying elevations and few opportunities for independence.

These accomplishments are dependent on funding, and for larger projects, the Forest capital improvement programs (CIP). The CIP is part of a Regional priority capital improvement program. Projects are scheduled according to this priority system, and some have 10-year-old plans. Regardless of when the funds become available, every project takes universal access into consideration during the planning and design phase. Some levels of accessibility are higher than others, depending on the funding sources (appropriations or CIP), and the environment in which they take place.

Other Recreation Opportunities Provided by Public Agencies

Wyoming is 49 percent federally owned; public land management agencies include the National Park Service, the BLM, the Bureau of Reclamation, and the Forest Service. Wyoming is home to three firsts: the Nation's first National Forest, the first National Park, and the first National Monument. The Bureau of Reclamation owns the reservoirs in the state, and the Wyoming Division of State Parks and Historic Sites manage the areas around the reservoirs as State Parks, while the Wyoming Game and Fish manages the surface water.

The State Parks in Wyoming are the premier providers of flat-water recreation. These facilities provide opportunities not available in the higher altitudes of the Forest. The Wyoming State Parks also manages the State's Historic Sites, an activity for which few residents said they used the Forest.

BLM lands provide opportunities similar to those found on the Forest, but in a desert environment. Hunting, fishing, hiking, walking, camping, bicycling, and motorized opportunities occur on BLM lands.

Wyoming Game and Fish manages all surface waters in the State of Wyoming, and provides public access areas for fishing and wildlife management, and viewing areas, also similar to the Forest Service.

Recreation Opportunity Spectrum

The Recreation Opportunity Spectrum (ROS) is the framework for integrating recreation values into National Forest plans, beginning with an inventory of the existing ROS settings, activities and setting consistencies.

The ROS is a planning and management tool to delineate, define, and integrate outdoor recreation settings and opportunities in land and resource management planning. ROS provides common definitions and criteria to assure consistent consideration of recreation settings and opportunities at all planning levels. An ROS inventory is required for every Forest Plan revision.

Recreation settings follow a continuum from highly developed urban parks to backcountry areas without developed trails. The recreation setting is a combination of the physical and biological conditions, managerial or regimentation levels, and social opportunities (opportunities to encounter other user groups). By combining these qualities and conditions, management can provide a variety of opportunities for recreationists (USDA-Forest Service 1986).

Six factors describe the range along the spectrum of available opportunities. The range of conditions that a factor can have represents relative limits of what is acceptable and appropriate along the opportunity spectrum.

- Access
- Other non-recreational resource uses
- Onsite management
- Social interaction
- Acceptability of visitor impacts
- Acceptable level of regimentation

The ROS System helps ensure that outdoor recreation opportunities are diverse. The Forest Plan describes the desired future conditions of the Forest, including the range of recreation settings to be provided. Each management prescription provides for one or more recreational settings that accommodate different types and styles of recreational use. Limitations are built in to some ROS classes – such as the size and user density criteria for the semi-primitive classes. User density, remoteness, and size of the area contribute to experiences along the spectrum. The ROS Classes on the Medicine Bow National Forest include Rural, Roaded Natural (RN), Roaded Modified (RM), Semi-primitive Motorized (SPM), and Semi-primitive Nonmotorized (SPNM). The classes and their setting criteria are important components of the ROS, and are defined below, according to the definition in the ROS book (USDA Forest Service 1981).

The **Rural (R)** classification is used to classify highly developed opportunities, specifically the area adjacent to the Snowy Range Scenic Byway (State Hwy 130). This classification is only used on the Snowy Range and on Pole Mountain (see previous table). In a Rural ROS class, use levels are high, development of facilities provides for greater numbers of visitors than other areas on the Forest, management is more obvious, and visitors' can expect opportunities to interact with others. Less than 4 percent of the Forest is considered to be Rural during the summer, snow-off season (summer ROS), and 2 percent is Rural in the winter, snow-on season (winter ROS).

The **Roaded Modified (RM)** classification wasn't used in the last planning cycle, but it better describes areas where the setting is predominantly influenced by human management activities, such as road building and clearcutting. Most of the acres currently inventoried as RM were previously inventoried as Roaded Natural (RN). These areas were managed for timber production and studies have found that many recreationists enjoy these highly modified settings because they provide opportunities for dispersed recreation without any formal structure. RM areas weren't designed for users amenity preferences; interaction with other users can be expected to be lower than in the Roaded Natural areas. Roaded Modified ROS areas account for 26 percent of total forest acreage in the summer season. None of the Forest is considered RM during the winter.

Roaded Natural (RN) areas are found around developed sites (campgrounds, picnic grounds, lakes, and roads) where the forested environment is managed to meet the needs of the visitor. These areas provide scenic driving opportunities, trailheads, dispersed campsites, and wildlife viewing, fishing, and hunting areas. Twenty six percent (26 percent) of the Forest is considered to be in a RN class in the summer, and less than one percent (.4) in winter.

Semi-Primitive Motorized (SPM) areas are natural appearing with 2-track roads, and/or motorized trail. They provide for a more solitary experience, in a setting where good survival skills are helpful. This classification has the same size criteria as SPNM, but application has been a combination of both, linear (along a motorized trail, with a buffer for noise absorption), or area-wide. These areas provide a challenging experience for the motorized trail user. Twenty five (25) percent of the Forest is considered to be in a SPM class in the summer, and 78.8 percent is in this ROS class in winter.

The **Semi-Primitive Nonmotorized (SPNM)** classification offers solitude, no motors on trails in an unaltered environment, and requires a high level of survival skill development because there's a lower probability of interaction among users. Unlike the SPM classification, the SPNM class should cover at least 2,500 acres. This classification was used for the four designated Wilderness Areas on the Forest, which were not considered to be Primitive because of their small size. There are currently 135,078 acres SPNM outside Wilderness. Twenty percent (20 percent) of the Forest is classified in a SPNM class in the summer ROS, and 17.1 percent is in this ROS class in the winter ROS.

Primitive (P) areas are large (at least 5,000 acres), and provide for solitude, with a very low likelihood of encountering other users. Backcountry survival skills are required in primitive areas. These areas are at least three miles from roads with traffic. There's currently no Primitive ROS on the Medicine Bow National Forest, primarily because of the road density being too high, although the opportunity could be provided in the Rock Creek roadless area, because of its size, lack of development, and low use outside the main trail corridor. There are four Wilderness Areas on the Medicine Bow, but it was determined in the 1985 plan they lack other characteristics of primitive areas, largely due to their accessibility for use (see the description in *Wilderness* in this chapter).

Supply

The following table compares the most recent inventory (2000) with the 1981 inventory. Most of the changes occurred in the addition of the Roaded Modified (RM) ROS class, and in the decrease in Rural ROS class. The RM class is a sub-class, not used in the 1985 plan, but appropriate as a consequence of roading and timber management (see the discussion below for Roaded Modified and Roaded Natural). The overall differences in ROS class acres, including Rural ROS, are a reflection of new technologies in mapping, and in the recreation specialists' familiarity with the ROS concept. The ROS was first used by the Forest Service in the early 1980's.

The information for a winter ROS inventory was developed using a Geographic Information Systems (GIS) program (see Appendix B). The following table is an estimate of ROS acres based on Management Area guidelines. This inventory is used to compare all alternatives. These categories aren't necessarily 'useable' acres, as there is no established definition of winter 'useable' areas. Some individuals will ski or snowmobile in areas others wouldn't consider using, so this classification is extremely subjective, but provides an adequate method for comparing alternatives. The acres used in this inventory and analysis are consistent with management area guidelines.

The nonuse category was used to map the Sheep Mountain National Wildlife Preserve. The Wyoming Game and Fish has an established area closure from the middle of November through the middle of June in this Wildlife Preserve. The GIS model used to develop the winter inventory was used to compare alternatives.

Table 3-97. Inventoried summer and winter Recreation Opportunity Spectrum Class acreages 1981 and Alternative A.

ROS Class	Inventoried 1981	Summer ROS Acres - Alternative A	Winter ROS Acres - Alternative A
Rural	101,091	36,445	22,193
Roaded Modified	0	289,051	0
Roaded Natural	665,617	277,662	4,454
Semi-Primitive Motorized	140,345	264,089	854,159
Semi-Primitive Non-motorized	175,661	213,928	185,139
Nonuse	0	0	18,669

Demand

An adequate supply of any ROS class is a function of where on the landscape opportunities are located, relative to one another. The Forest Service is committed to providing a full array of opportunities. The National Visitor Use Monitoring study conducted in 2002 (USDA Forest Service 2002) asked exiting visitors their level of satisfaction in various elements of their stay on the Forest. Scenery was consistently labeled as both the most satisfying and the most important element of satisfaction.

Residents in the County Land Management (CLM) study, conducted in 1998 indicated a need for more semi-primitive opportunities, including motorized areas, non-motorized areas (outside wilderness), and for additional wilderness (University of Wyoming, 1998).

Statewide respondents to the 1995 Statewide Comprehensive Outdoor Recreation Plan (SCORP) survey indicated a preference for primitive or natural settings (State of Wyoming Department of Commerce 1995).

Visitor Use

Over the years, there have been different studies done to determine visitor use, and user preferences. Typical visitor use studies are based on users' recollections of previous visits ("during the last year, did you…?"). Prior to the mid-1990's, the Forest Service used its Recreation Information Management (RIM) system to store and analyze recreation use information that was converted to 12-hour equivalents (Recreation Visitor Days - RVDs). Managers often found they lacked resources to simultaneously manage the recreation facilities and monitor visitor use, following the established protocols.

The Forest Service developed a statistically valid process to estimate total use, and user preferences from random samples (days, sites, and interviews), and traffic counts to augment the interviews. The National Visitor Use Monitoring (NVUM)

data is collected on the forest, as visitors are leaving. . The complete report is included in *Appendix B* of this document. Following is a brief synopsis of different visitor use studies done that are used in this analysis, and their applicability.

The Statewide Comprehensive Outdoor Recreation Plan (SCORP) (State of Wyoming Department of Commerce 1990), (State of Wyoming Department of Commerce 1995), and (2000) sample Wyoming residents (statewide) for their preferred outdoor recreation activity in order to plan future use of Land and Water Conservation Funds (LWCF). This Plan is a requirement for these funds, and because it's a resident (only) study, none of the out-of-state user preferences are represented.

The 1998 County Land Management Study (CLM) (University of Wyoming 1998) is another resident use study, with residents from Albany, Carbon, Converse, and Platte Counties. This study used the same process for determining recent recreation use that was used in the 1990 SCORP. There are also a variety of questions relative to the Medicine Bow National Forest. Those responses are referenced in this analysis.

The National Survey on Recreation and the Environment (NSRE) (USDA Forest Service 1997) is a national study by the USDA Forest Service Southern Research Station. It's used to describe participation by Americans, their opinions concerning management of both public and private forests and grasslands, the importance and value of our natural environment, uses and values of wildlife and wilderness, people's lifestyles, and recreational trips people take away from home. The researchers have estimated future use from these data, which include demographic changes. Their projections are used in this analysis.

The 2000-2001 Statewide Snowmobile Study (McManus, Coupal et al. 2001) was done in response to the impending threat of closing Yellowstone to their use. This study was an interview process where both residents and non-residents responded. The results indicate users' preferences for trails, areas, their expenditures, and changes they would make in their participation if the planned closure were to occur. These data are used in this section and in the economic analysis for this EIS.

The 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation-Wyoming (Fish and Wildlife Service (FWS) 2001) is part of a nationwide study by the US Department of Interior, Fish and Wildlife Service to estimate trends in wildlife recreation, and expenditures by this user group. These data are used in this section and in the economic analysis for this EIS.

The 2002 National Visitor Use Monitoring (NVUM) (USDA-Forest Service 2003) survey for the National Forest System is the most localized information we have on visitor use on the Forest. This information is also the only information gathered on-site, and represents visitor use by a sample of current visitors on the Forest. The report that was provided to the Forest is included in *Appendix B* of this document.

Demand

Visitor use in the NVUM is represented by the following terms: trips, forest visits, and site visits. A Recreation trip is the duration of time beginning when the visitor left their home and ending when they got back to their home. Forest visits are defined as the entry of one person upon a national forest to participate in recreation activities for an unspecified period of time. A national forest visit can be composed of multiple site visits which are the entry of one person onto a national forest site or area to participate in recreation activities for an unspecified period of time. There are four different site types identified in this survey – overnight developed, day use developed, wilderness, and general forest area.

The average total length of time that recreation visitors to the Medicine Bow National Forest reportedly spent away from home on their recreation trip was 72.8 hours, and during the 12 months prior to the interview, the typical visitor had come to the Forest 4.2 times. They had participated an average 2.7 times in what they had identified as their main activity. Eighty seven percent said the Medicine Bow National Forest was their primary trip destination. A high percentage of visitors (79 percent) had gone only to the site at which they were interviewed, during this visit.

There was an average of 1.8 people per vehicle with an average of 2.3 axles per vehicle. This information, in conjunction with traffic counts was used to expand observations from individual interviews to the full forest population of recreation visitors, and may be useful to forest engineers and others who use vehicle counters to conduct traffic studies.

The following table illustrates the variety of recreation activities individuals reportedly participated in during 2002. As is the case in all studies, there are limitations to these data. For example, rafting wasn't represented in any of the 2002 interviews. This may be a function of the sampling schedule, the limited season, and/or of the low water levels and low use.

Visitors at the Forest's overnight, developed sites expressed satisfaction in nearly all aspects of their visit. Scenery, helpfulness of employees, and condition of the environment rated the highest; scenery is also the most important aspect, as defined by visitors (USDA Forest Service 2002). Forest road condition received the lowest satisfactory score of all items. Interpretive displays, signs, and exhibits were only rated as average or good (See *Appendix B* for the full report).

The NVUM information indicates that most activities are participated in, in with other activities (primary activities). All winter activities and big game hunting were generally reported as the only reason for the visit. Across the board, sightseeing and camping appear to be a typical part of most visits to the Forest.

Table 3-98. Recreation participation as indicated by the National Visitor Use Monitoring study.

Activity	Percent Participation	
	*2003 NVUM (all participation)	**2003 NVUM (primary activity)
Viewing WL	44.0	5.3
Day Hiking	39.3	15.0
General Relaxing	33.1	10.5
Fishing	17.8	7.6
Camping (primitive)	14.7	3.1
Sightseeing/Driving for Pleasure	13.7	4.1
Elk Hunt	13.5	13.4
Deer Hunt	13.5	13.4
Camping (RV)	13.2	3.5
Camping (tent)	13.2	3.1
Snowmobile Travel	9.1	9.4
4-wheeling	7.8	2.7
Picnicking	6.9	1.6
Downhill Ski	6.5	6.4
Cross Country Ski	5.9	5.9
Nature Study	5.5	0.8
Backpacking (in an unroaded area)	4.7	1.4
Historic Site Visit	3.6	0.1
Bicycle riding	3.3	1.6
Rafting/Canoe	0	0

* NVUM Percent Participation represents every activity participated in during the most recent visit to the Forest. One visit may include more than one site visit or activity.

**NVUM - Percent of activities identified as the interviewee's primary activity. These data have been prorated from a total 106 percent, and should add up to 100 percent.

According to the NVUM, the average length of stay on the forest was 27.3 hours, most of which was spent at their primary destination (average site visit was 25.1 hours). Just over 34 percent of visits involved an overnight stay on the Forest. Dispersed users in the general forest area had the longest visits (29.5 hours), followed by overnight users (20.3 hours) in developed sites, Wilderness users (11.3 hours), and developed day users (4 hours).

Basic descriptors of forest visitors were developed based on those visitors interviewed, then expanded to the national forest visitor population; 72.4 percent were male, and a high percentage were between 21 and 60 years of age. Visitors categorized themselves into one of seven race/ethnicity categories, 97 percent were white, 1.8 percent Spanish, Hispanic or Latino, and 1.3 percent were Asian (see the full results in *Appendix B* of this document).

Most of the visitors were from Wyoming communities around the Forest, including Laramie, Rawlins, and Cheyenne. Ft. Collins, Steamboat Springs, and Loveland Colorado, and Casper Wyoming were well represented, and less than one (.1) percent of forest visitors were from another country. The full array of zip codes (as shown in *Appendix B*) is used in the economic analysis to determine percentages of tourist visitors.

Developed Recreation

Proximity and availability of opportunities are a strong determinant as to what degree individuals recreate. In the NVUM, 25 percent of the interviews included a question about the type of constructed facilities and special designated areas they had used during their visit. The four most used facilities/areas were hiking, biking, or horseback trails, forest roads, the scenic byway, and developed campgrounds (see full results in *Appendix B* of this document).

Developed facilities are a large investment for the American public, requiring regular maintenance and labor-intensive upkeep, especially when they're snow covered an average half the year. Deferred maintenance costs increase at an increasing rate as facilities age. In 2000, deferred maintenance was estimated at $627,501. This estimate takes into account annual maintenance requirements, as well as accessibility upgrades. Deferred maintenance is a concern, Forest Service system wide, and is not expected to change in the near future. Use in campgrounds is low, but the expense of maintaining these facilities is high, compared to other developed facility types. This is an example of the need to consider the long-term effects of paying for a service the public seldom uses, which takes money from other areas of the Forest recreation program, such as trail development and maintenance.

Campgrounds

There are 693 developed campsites on the Forest, in 38 different campgrounds. Most of the facilities are on the Snowy Range. Camping in developed sites accounted for 13.2 percent of total visits on the Forest in 2002 (USDA-Forest Service 2003). Use of the Forest's developed campgrounds is low, with the exception of sites along the Snowy Range Scenic Byway (USDA Forest Service 2002). Pole Mountain campgrounds receive less use than other campgrounds on the Forest, but use in dispersed sites is high A facility's location dictates the likelihood of use; Sugarloaf Campground has a tremendous view of Medicine Bow Peak and is nearly full for the 65 days it's open. The other facilities along the Scenic Byway are

popular, due in part to the access from the highway, and the other amenities near the campground.

Generally, camping participation declines with age, with the exception of RV camping, for which there is no distinction. Camping demand is expected to increase less than one percent per year over the next 20 years (Bowker, et al 1999). Projections (adjusted for demographic changes) indicate the trend away from multiple-week vacations is continuing. People living within a day's drive will want convenient access to recreation sites. High visibility sites will also be more in demand with this trend.

Seventy five percent of the sites on the Forest were designed and built in the 1960s before long campers were common. The National Recreation Agenda states that we should close under-used facilities, primarily because they're expensive to maintain, and people are using the general forest area. Any decision to close facilities is an implementation item, subject to public participation, and not a forest plan decision.

Picnic Grounds

There are 234 picnic sites on the Forest. Picnicking is a traditional forest activity, not necessarily dependent on facilities. Annual occupancy rates in developed picnic areas average between 16 percent and 20 percent. Residents around the Forest report 39 percent less participation than regional users (USDA Forest Service 1997; University of Wyoming 1998). Similar to developed camping, use in picnic grounds is dependent on other amenities nearby. The Snowy Range and Vedauwoo picnic ground provide viewing opportunities without having to leave the picnic table.

Picnicking accounted for 6.9 percent of total visits in 2002 (USDA-Forest Service 2003). Picnicking tends to be favored by families with young children (USDA Forest Service 1997). Participation is expected to increase by at least 1percent per year by 2020, a total 62 percent over the next 50 years (Bowker, et al 1999). Participation increases with education and income levels, up to $100,000.

Two picnic grounds on the Forest have a low reported occupancy rate, Fir and Lakeview. Between the two, there's an average 2 percent occupancy rate.

Ski Areas

The Snowy Range Ski Area is operated under a special use permit. The ski area is located along the Snowy Range National Scenic Byway (Hwy 130), west of Centennial Wyoming. They have a total lift capacity for approximately 50,000 skier days. The Area provides beginner and intermediate skiing, with few expert runs. The 1985 Forest Plan allocated land for expansions to the ski area. In 1986, a Master Plan was approved for the three-part expansion, however only one part of the expansion could go forth; the other two parts were approved, contingent on further study. The Corner Mountain expansion was completed in 1990.

Downhill skiing on the Forest has remained stable over the years. According to the owners, use is evenly distributed among residents of western Nebraska, and northern Colorado. Wyoming residents account for nearly 27,000 visitor days.

According to the NVUM, 6.5 percent of Forest visitors in 2002 had gone downhill skiing. Regionally, 11.6 percent of total use is downhill skiing, which includes visitors to the world-class ski areas in Colorado. Residents in nearby counties reported 9.6 percent participation; however not all their use occurred on the Medicine Bow National Forest.

Nationally, participation is expected to increase 84 percent by 2050, and activity days can be expected to increase by 67 percent in that same time period, or 1.34 percent per year. In most cases, the rates of increase in participation, days, and primary-purpose trips will exceed population increases (Bowker, et al. 1999).

The owners of the ski area would like to continue with planned expansions into nearby terrain, in which they hope to add variety and black diamond (expert) runs. The Forest Plan is the appropriate place to determine the extent of Forest to be considered for allocation to the ski area. Approval of the expansion plans would be determined in a site-specific analysis if the expansion is proposed.

Other Developed Facilities

Other types of developed recreation facilities managed by the Medicine Bow National Forest include boating sites, cabin rentals, visitor information centers, and observation sites. Cabin rentals receive high use on a consistent basis. The cabins were Forest Service administrative facilities that have been updated to accommodate the general public. Some cabins are rented year-round, with little time in between rentals.

Boating on the Forest is primarily for fishing and relaxing. The water is cold enough that only the bravest souls would swim, water ski, windsurf, or jet-ski. Lakes in the State Parks system are very popular for those types of water sports, as are the "plains lakes" located just off the Forest on the east side of the Snowy Range.

By renovating and opening old administrative facilities, fire lookouts, and cabins for public use, the Forest Service has increased the opportunities available for another part of the public. One of the problems facing the recreation program is the question of providing universal access to these facilities. Updating them to facilitate use with a wheelchair can be expensive when cupboards need to have major adjustments.

Summer Trails and Trailheads

The Forest Service provides a range of non-motorized trail opportunities from backcountry wilderness to urban interface. Trail use is generally higher closer to trailheads, with fewer users per mile as the trail becomes longer. This coincides with

the semi-primitive non-motorized ROS class. These opportunities connect with one another internally to provide access to and within the National Forests.

Summer trail use includes hiking, backpacking, bicycling, horseback riding, ORV riding, and motorcycle riding. There are few (70) miles of motorized trail on the Forest. Due to increasing use levels, there will be increasing use pressure, especially outside the developed trail system. Half the motorized trails are on the Sierra Madre (32 miles), 28 are on the Laramie Peak unit, and 10 miles have been designated for this use on the Snowy Range.

There are 376 miles of non-motorized trails (inside and outside Wilderness); 178 miles are located on the Snowy Range and 114 miles are on the Sierra Madre. There are 35 miles on Pole Mountain, and 49 miles on the Laramie Peak unit. Trails around Medicine Bow Peak are the most popular, along with daily use trails on Pole Mountain. These trail systems are versatile, and have easy access.

The most heavily used trail system on the Forest is alongside the Scenic Byway. Increasing use levels on these trails is causing some crowded conditions where users would expect a remote, backcountry experience. Access to these trails is convenient however parking is inadequate. Non-motorized trail uses are expected to increase at least as fast as the population over the next 50 years. In order to provide experiential satisfaction for these additional users, the forest would need to build additional trails.

Day hiking was the highest primary use (15 percent) activity reported on the Forest, according to the NVUM (USDA-Forest Service 2003). Only 18.6 percent of resident backpacking use occurs on the Medicine Bow National Forest, which may be a function of supply (University of Wyoming 1998). There aren't many long-distance trails on the Forest. Non-motorized use is expected to increase 65 percent over 2000 levels, by 2050 (Bowker, et al. 1999). Day hiking is expected to increase 60 percent by 2050 (ibid), slightly more than expected population increases.

Bicycling has become more commonplace with the advent of the "fat tire" and other improvements that made bicycles useable on forestlands. Age is one of the determining factors for participation; as age increases, participation decreases. Bicycling is a mechanized use not allowed in designated Wilderness.

Horseback riding groups report that trails for riding horses are becoming increasingly scarce. Horseback riding on trails is most popular among the 25-39 year-olds, and unlike most activities, is not male dominated. Use is expected to increase by 60 percent by 2050 (Bowker, et al. 1999).

Summer motorized trail uses include riding off-road vehicles, 4-wheelers, and motorbikes on trails and 2-track roads. Motorized trail use accounted for 7.8 percent of total forest recreation use in the NVUM survey, 2.7 percent said this was their primary activity on this visit. Use is higher with a younger population and lower income levels. Resident motorized trail participation rates increased from 9 percent in 1989 to 13.4 percent in 1998, however, only 18 percent of their participation reportedly occurred on the forest, which is most likely a function of supply (State of

Wyoming Department of Commerce 1990; University of Wyoming 1998). This user group took an average 7 trips per year in 1997, down from 10 in 1989. Days off-road driving are expected to increase 54 percent from 2000 levels, by 2050, while percent of participants will increase 37 percent (Bowker, et al. 1999) in that same timeframe.

Motorized trails are needed to provide for the growing number of ORV and trail-bike users, especially since the 2000 Travel Management decision was made that limits motorized use to roads and trails. Although the 2000 decision was to do further studies to determine which roads should remain open to public use, these corridors don't necessarily provide trail experiences.

Two Executive Orders (EO) were signed by Presidents Nixon and Carter in the 1970's and subsequent direction was posted in Forest Service regulations (36CFR 295.2). *Executive Order 11644* established policies and provided for procedures that would ensure that the use of off-road vehicles on public lands be controlled and directed so as to protect the resources of the lands, to promote the safety of all users of the lands, and to minimize conflicts among the various uses of those lands. *Executive Order 11989* amended EO 11644 clarifying agency authority to define zones of use by off-road vehicles on public lands.

Non-Motorized Trails

The location, design, and use of trails play a critical role in determining whether the physical, social, and managerial settings of a given ROS class can be maintained as intended in the prescription. The configuration, quality, sequencing of environmental settings, and the landscape attractions are the basic attributes of a trail setting and user experience. Some management area guidelines include a full array of ROS classes, which indicates a trail's setting changes from start to finish, depending on its length. As discussed earlier, trail users should expect to encounter a higher number of users at the trailhead than further down the trail.

The Continental Divide National Scenic Trail (CDNST) runs for a total of 44 miles through the Sierra Madre mountain range. The trail elevations range from 8,441 feet at the northern edge to 11,004 feet at Bridger Peak. The vision for the CDT is to create a primitive and challenging backcountry trail on or near the Continental Divide to provide people with the opportunity to experience the unique and incredibly scenic qualities of the area. For many of the same reasons National Parks are established, National Scenic Trails are created to conserve the nationally significant scenic, historic, natural, and cultural qualities of the area. In addition, National Scenic Trails are designed for recreation and the enjoyment of these very special places. Most of the route is lightly used and visitors can expect considerable solitude.

Because there are segments of the trail located on existing roads, motorized use may be permitted where such use will not substantially interfere with the nature and

purpose of the trail. According to a July 3 1997 memo by the Deputy Chief of the Forest Service

> "it is the intent of the Forest Service that the CDNST will be for non-motorized recreation. As new trail segments of the CDNST are constructed to link existing non-motorized trail segments together, and to reroute the CDNST off of primitive roads or other routes where motorized travel is allowed, motorized use should not be allowed nor considered. Allowing such use would substantially interfere with the nature and purpose of the CDNST. If any newly constructed trail segments of the CDNST are currently allowing motorized use, that motorized use should be stopped as soon as practicable, but not later than January 1, 2000."

The motorized portion of this trail on the Medicine Bow National Forest is an established primitive road, and will be relocated as funds and staff time become available

Winter Trails and Trailheads

Some trails are used year-round, but during the winter, there's a premium on available access to the Forest from plowed state highways. Highway 130 is closed beyond four miles into the Forest, and Highway 70 is entirely closed to vehicular traffic. Parking is only available at the plowed ends.

The following table shows the different capacities and trailheads provided by the Forest Service for each type of use, by mountain range. Trailheads are assigned to a non-motorized, motorized, or mixed use, depending on trail opportunities from the trailhead.

Table 3-99. Publicly provided winter trailhead capacity by trail use type.

Site Name	Trail Use Type	Number of [Designed] Parking Spaces	Capacity (PAOT)*	Seasonal Capacity**
Green Rock	Mixed Use	40	120	18,000
Sierra Madre Winter	Snowmobile	20	60	9,000
Hog Park Winter	Snowmobile	15	45	6,750
Baggs Hwy 70	Snowmobile	15	45	6,750
Ryan Park	Snowmobile	35	105	6,300
Mountain Home	Snowmobile	20	60	9,000
Albany	Snowmobile	15	45	6,750
W. Chain's End	Snowmobile	40	120	18,000
Total		*160*	*480*	*62,550*
Tie City	X-C Ski	30	90	13,500
Happy Jack	X-C Ski	20	60	9,000
Bottle Creek Ski	X-C Ski	40	120	18,000

Site Name	Trail Use Type	Number of [Designed] Parking Spaces	Capacity (PAOT)*	Seasonal Capacity**
Green Rock Picnic ground	X-C Ski	10	30	6,750
Corner Mtn	X-C Ski	14	42	6,300
Little Laramie	X-C Ski	24	72	10,800
Chimney Park	X-C Ski	10	30	4,500
Brush Creek	X-C Ski	18	54	8,100
Total		*166*	*498*	*76,950*

* PAOT assumes 3 persons at one time per site

** Season Capacity is the season length in days multiplied by PAOT.

Winter trails are provided through partnerships with the state and with the Medicine Bow Nordic Association; snowmobile trail marking and grooming is a service provided by the State Trails program, and cross-country ski trail grooming is a shared effort between the Forest Service, and the Medicine Bow Nordic Association (see following table).

Table 3-100. Maintained winter trails by type and mountain range.

Trail Location	Miles of Trail by Trail Type as of 2003		
Mountain Range	Ungroomed Snowmobile	Groomed Snowmobile	X-Country Skiing, and Snowshoeing
Snowy Range	121	194	49
Sierra Madre	96	50	8.52
Pole Mountain	0	0	29.51
Laramie Peak	3	0	0
Total	220	244	38.03

Compared to regional participation rates, resident use is higher for snowmobile riding (6.9 percent participation vs. 5.1) and cross-country skiing (12.6 percent participation vs. 3.5 percent) than the regional average (University of Wyoming 1998). Statewide, however, snowmobile use studies indicate a 9.5 percent average increase, which was used to estimate future use growth. Area residents take more trips snowmobile riding and cross-country skiing than the rest of the region, and they rely on the Forest for most of their winter recreation.

According to the CLM study, area snowmobile riders use this Forest 54 percent of the time, and skiers use this Forest 72 percent of the time (University of Wyoming 1998). These users also travel to other parts of the State, and into northern Colorado for their recreation.

Cross-country skiing participation is becoming a winter fitness activity, as well as providing opportunities to get out and enjoy the winter. Residents from Laramie use the trails after work, since Laramie's only five miles from a groomed trail system. On weekends, residents from Cheyenne and Ft. Collins CO add to the use levels. Backcountry skiing is an activity for which users don't seek out a trail system, rather quiet and solitude, powder and challenge. Some backcountry skiers use snowmobiles to get further into the backcountry.

In 2001, 33.7 percent of Wyoming resident snowmobile riders listed the Snowy Range area as their preferred snowmobile [trail] system (McManus, Coupal et al. 2001). Most of the respondents said they were satisfied, or extremely satisfied (92.1 percent) with the miles of groomed trails. 'Snow conditions' (63.8 percent ranked this in their top three characteristics) was their most important natural feature when choosing a trail system, followed by off-trail powder (59.6 percent), and scenic views (45.3 percent). Snowmobile riders in Wyoming said they want the freedom to ride off trail.

Winter is becoming a tourism season in Carbon and Albany Counties with both tourism boards spending a good deal of their advertising budget on one activity - snowmobiling. Nationwide, the Snowy Range consistently ranks in the top 10-13 areas to ride. Between 1999-2003, resident registrations around the Forest accounted for an average 15 percent of the statewide total. Non-resident registrations accounted for a high of 32 percent in 2000-2001 (from Wyoming State Trails program).

Overall, the two major outdoor winter recreation pursuits discussed in this section; cross-country skiing, and snowmobile riding are projected to see increased participants and increased participation intensities (more frequently) over the next 50 years (Bowker, et al. 1999). Cross-country skiing participation is expected to increase 26 percent by 2010 (Bowker, et al. 1999), and 36 percent more frequently. Snowmobile riding can expect to increase nearly ten percent (9.8 percent) over the eight years, 2002-2010.

Snowmobiling is negatively related to age; riding historically tapers off as we age, but increases as our incomes increase (Bowker, et al. 1999). Compared to national numbers, users in the Rocky Mountain region are younger, (regionally, 72 percent are in the 15-39 year age groups), and have a slightly higher income than average (77 percent have an income higher than $25,000). Sampling information from Wyoming, indicated 79.5 percent of all resident snowmobile riders are over the age of 35 (McManus, Coupal et al. 2001).

The State Trails Program managers believe snowmobile riding on the Snowy Range is the heaviest in the state. To some individuals, this means too many people are using the area for snowmobile riding. Others insist there's plenty of room on top – it's just the parking that's a problem (lack of space, causing crowding). Individual

comments cited safety concerns and environmental effects (see discussions in this Chapter under *Wildlife, Air, Aquatics, Soils).*

The Forest Service relies on the State Snowmobile Association, the State Trails Program, and individuals to help with education and information for this user group. There is snowmobile riding in closed areas, and while this is an illegal action, the nature of the activity makes these rules difficult to enforce.

Weekend use levels from the Greenrock trailhead parking lot are typically higher than parking capacities allow (which is 40 cars or trucks, not necessarily semi-trailers or long trailers with multiple snowmobiles). On one weekend day in 2002, there were 278 vehicles counted parked in this small parking lot, and along the highway. This area attracts both skiers and snowmobile riders, with most skiers going one direction, and snowmobile riders going the other.

In 2001, the Forest asked the University of Wyoming (Institute for the Environment and Natural Resources) to convene a winter use group to help address conflicts between different user groups. All members agreed that most conflicts are occurring at the parking lot (at Greenrock). Among the recommendations by this group was better parking for up to 250 vehicles. This would essentially provide space for an additional 112,500 users, season-long. The Laramie District is currently in planning additional parking near the Greenrock Picnicground.

The Medicine Bow National Forest is also part of the Southern Rockies Lynx Amendment process; forests are preparing an amendment to all Forest Plans that address the needs of the Lynx, an endangered species. Proposed standards and guidelines are included in the Plan, Chapter 1. Among the guidelines is the limitation on additions to the designated or groomed trail system within Lynx Analysis Units.

Dispersed Recreation

Dispersed recreation includes activities that are participated in, forestwide, but for which there are few facilities. Some dispersed activities include hiking, hunting, fishing, camping, picnicking, rock climbing, driving for pleasure, and viewing scenery and wildlife. The Snowy Range National Scenic Byway provides travelers across the Snowy Range with easy access to a number of developed sites, and a close-up view of Medicine Bow Peak.

In addition to the Scenic Byway, the Battle Highway is also heavily traveled for the scenic qualities offered. This highway has not been nominated as a National Scenic Byway, primarily because of the implications for such a designation; local citizens and businesses in adjacent communities are most affected by creating a tourism draw. Subsequently, the Forest Service has made the decision to step back and allow these local interests take the lead on the nomination.

The Carbon County Land Use Plan has also identified the opportunity for interpretation and additional amenities that could be provided along the Hog Park

road. Developing more of an interpretive program, along with the roadside clearing and parking would be a site-specific decision.

Dispersed recreation is facilitated by roads and occurs in less developed areas. Many dispersed campsites are multi-use sites; they are also used for the day, and just to park off the road to hike, hunt, or fish.

Table 3-101. Dispersed campsites by mountain range.

Mountain	Numbers of Dispersed Camp Sites
Snowy Range	1,165
Sierra Madre	1,610
Pole Mountain	193
Laramie Peak	308
Total	3,276

Dispersed camping, as the number of sites (see preceding table) implies, is very popular on the Medicine Bow National Forest. Campers in high use areas (typically along streams) are very protective of their campsites, some of which are used regularly, by the same individuals. Weekends and hunting season are the highest use time for dispersed camping. The CLM study didn't ask residents about primitive or dispersed camping participation, specifically.

Nearly 30 percent of residents said they had gone sightseeing on the Forest in 1997 (University of Wyoming 1998), and 13.7 percent of users in 2002 were "driving for pleasure on roads" (USDA-Forest Service 2003). Scenery was rated as Very Good by interviewees in the 2002 NVUM study, and was also rated as the most important. Also rated as important was the condition of the natural environment, which rated slightly lower than. Condition of Forest roads were rated as important, but received a slightly lower rating. This confirms the findings in the Forest Roads Analysis that identified a need for additional road maintenance.

Rock climbing at Vedauwoo on Pole Mountain is popular, especially with the student and Air Force populations in Laramie and Cheyenne. These world-class climbing routes are within walking distance of parking. The highest use age group for this activity is 25-39; it is also popular among the 15-25 year olds.

Thirty four percent of the CLM respondents had sought spiritual and mental renewal on the Forest, an average of 10 times in 1997. This confirms the importance of the forest environment for psychological benefits.

The NSRE indicates that participation in sightseeing activities can be expected to increase 74 percent over the next 50 years (Bowker, et al. 1999). Age has a positive relationship to sightseeing participation; the older we get, the more we prefer a comfortable sightseeing trip, or visiting points of interest or historic sites.

Fourteen percent of area residents went backpacking in 1997, with 32 percent of their trips occurring on the Forest. This number is expected to increase by 26 percent by 2050 (ibid). Race and income are important factors for participation.

Dispersed camping is one of the main uses of the Forest by repeat visitors. As more baby boomers retire to recreational vehicles (RVs), rather than one residence, they'll continue to seek out campsites for their campers. Until the Forest improves the condition of the developed campsites, they'll be looking toward the general forest area for space to park and use as a base camp. This increase in RV use may have the effect of creating a crowded atmosphere, which will drive more campers to create even more campsites that the Forest Service will have to clean.

The NVUM found that visitors rated the general dispersed forest, outside Wilderness, as relatively uncrowded (see *Appendix B* in this document for a full report). These users often look for uncrowded camping opportunities. Dispersed camping occurs forest-wide along roads and trails. For this reason, the 2,161 miles of developed roads on the Forest are highly valued.

Wildlife-related Recreation

According to Bowker, large numbers of Americans will continue to enjoy wildlife-related recreation into the future (Bowker, et al 1999). Of the 3 types, fishing, hunting, and non-consumptive uses, non-consumptive uses will experience the greatest relative growth in participation over the next 50 years.

Big Game Hunting

Big game hunting on the Forest accounts for 13.4 percent of total visits, and although use will increase in the next 20 years, hunting will account for a lower percent of total use. Factors most closely related to hunting participation are gender, race, and population density; this is a male dominated activity, attractive to rural Caucasians. Hunting is a way of life in Wyoming, and many residents depend on game meat to fill their freezer. Big game hunting participation is higher among Wyoming residents (17 percent) than the regional average (10.3 percent) (U.S. Fish and Wildlife Service 2003).

Hunting is part of a total recreation experience, which includes camping, hiking, being with friends, getting away from it all, relaxing, viewing wildlife, ORV riding, and horseback riding. Regionally, hunting days should remain stable over the next half-century in spite of the decline in participants.

Fishing

There are 3,465 miles of stream in Forest Service ownership on the Medicine Bow (see next table).

Table 3-102. Miles of stream under NFS ownership and percent of angler days by mountain range.

Stream Location	Intermittent	Perennial	Total	Percent of Total Use
Snowy Range	651	956	1607	73%
Sierra Madre	673	433	1106	5%
Pole Mountain	149	72	221	11%
Laramie Peak	374	157	531	11%
Total	1847	1618	3465	100%

Source: Wyoming Game and Fish Department, 2000

Forty six percent of surveyed residents (University of Wyoming 1998) said they fished at least once during 1997, and 23 percent of their total use occurs on the Forest (ibid). Resident fishing participation is nearly identical to regional participation (32 and 31 percent, respectively) (University of Wyoming 1998; USDA Forest Service 2000). Fishing accounts for eight percent of total visits on the Forest (USDA-Forest Service 2003). A high proportion of use occurs on the Snowy Range, mostly shore fishing on lakes. See the *Aquatics* section of this document for a discussion on high-value water recreation.

Fishing participation decreases with age, but is still popular with those in the over 60 category. There's a higher participation rate for people in rural areas with a greater than $25,000 income. As population densities increase, use will decrease. Primary-purpose trips (trips taken specifically to fish) will not increase as fast as the population, but days of fishing should increase in the Rocky Mountain region, and especially in Wyoming by about 59 percent by 2050 (Bowker, et al. 1999).

Non-Consumptive Wildlife Use

Viewing wildlife is just as important to recreationists as hunting or fishing. Residents responding to the CLM survey indicated that observing wildlife was a key factor in the satisfaction of their most recent outing. Fishing and viewing wildlife were popular activities in the NVUM and the USFWS study, which supports the notion that wildlife is an important component of a recreation experience.

Wyoming residents participate in wildlife viewing more than regional residents (46 percent vs. 37 percent), although both are relatively high participation rates. Forty four percent of respondents to the NVUM on-site survey said they'd been viewing wildlife. Participation will grow an average one percent per year over the next twenty years.

Twenty eight percent of residents said they had gone to the Forest specifically to view wildlife a third of the time, on an average six trips. By 2050, non-consumptive wildlife use will increase by 94 percent in the Rocky Mountain Region. The largest

contributing factor to the increased popularity of non-consumptive uses will be the aging of the population.

Wilderness Recreation

There are 4 designated wilderness areas on the Forest: Platte River (22,749 acres), Encampment River (10,400 acres), Huston Park (30,725 acres), and Savage Run (14,940 acres). The size and geography of the Medicine Bow National Forest Wilderness Areas are unique in the Rocky Mountain Forest Service Region. Although recreation is not the objective of wilderness, recreation is one of the primary uses of these areas, and all of them have easy access.

Unlike the 14,000-foot peaks in Colorado and the Wind River Mountains, these Wilderness Areas are primarily river valleys, and high mountain parks. It's possible to access a Wilderness Area and hike across it in one day (average length of stay is 11.3 hours). This makes weekend excursions to the wilderness possible for users within 250 miles.

The Encampment and Platte River Wilderness Areas provide outstanding water corridor opportunities, including class 4 and 5 whitewater rafting, and a blue ribbon trout stream on both rivers, however the Platte is more conducive to this type of recreation. The Huston Park Wilderness is a high mountain plateau ideal for wildlife viewing, as well as providing the backbone of the Continental Divide National Scenic Trails. The Savage Run was the first Wilderness Area to be designated on the Forest. All Wilderness Areas on the Forest provide easy access for trail uses, and wildlife viewing and hunting opportunities.

Whitewater rafters are limited to a short window of opportunity when runoff water levels are high. Use on the North Platte River is high at that time of year, but as water levels recede, so do use levels. Some rafters report early starts so they can get an average three runs in by the end of the day. This stretch of river is short, and driving time is brief, so the likelihood of accomplishing this during heavy runoff is high.

Wilderness recreation demand includes existence demand, as well as actual use. The *Wilderness* section of this Chapter provides information on this type of demand. Several questions on the NVUM survey dealt directly with use of designated Wilderness (see *Appendix B* for the full report). Wilderness was sampled twenty-one days on the Forest, and forty interviews were obtained.

The Wilderness visitors were from a wide variety of zip codes. The distribution of Wilderness visitor zip codes is shown in the report in *Appendix B*. There were 22 different zip codes reported. The average length of stay in Wilderness on the forest was 11.3 hours. In addition, all visitors were asked on how many different days they entered into designated Wilderness during their national forest visit even if we interviewed them at a developed recreation site or general forest area. Of those visitors who did enter designated Wilderness, they entered 1.4 different days. None

of those interviewed in Wilderness said they used the services of a commercial guide.

Wilderness visitors on the average rated their visit as uncrowded (1.4 on a scale of 1 to 10). Wilderness visitors expressed a high satisfaction level from their visit on the Medicine Bow. The least satisfying aspect of their visit was the parking (available and condition of…), availability of information, signage, and helpfulness of employees.

Projections of use indicate that backpacking, primitive camping, hiking, and horseback riding will all increase over 1 percent per year over the next 50 years (1999). The largest recreational uses in wilderness areas on the Forest are whitewater rafting, horseback riding, fishing, and hunting. Whitewater rafting participation has increased dramatically over the last few years, but is expected to increase slower than population growth over the next 50 years (ibid).

The Roadless Areas Appendix (C) has a full discussion on selection criteria for areas recommended for wilderness.

Special Use Administration

The recreation special use program is an area where the Forest is assured that private recreation providers are partners with the Forest Service. Special use permittees are communicators for the Forest Service, with a broad spectrum of the general public, providing valuable environmental education programs. Permittees like outfitters and guides, and lodge owners provide the equipment and expertise to introduce visitors to new activities, and to help provide a meaningful wildland experience. This Plan does not change administration of any of these permits.

The Medicine Bow National Forest presently permits 107 recreation residences. These are cabins on Forest Service system lands that have been permitted for years. These summer homes are located in designed, lotted groups. This is considered an acceptable, viable use of forestlands, and their authorized use under Special Use Authority is expected to continue in the future. No new construction or expansion of existing facilities will be allowed in any alternatives.

Their owners use them for weekend getaways, and although they're on Forest Service System lands, permittees have a sense of ownership in this property. The Forest Service monitors structural improvements, and charges a fee commensurate with market value for taxes on the property. The program has limited funding for monitoring and permit administration.

Most of the outfitter and guide permits are for incidental use, not overnight use. A number are actually hunting on their own or somebody else's private land, but they have permitted use for access, or to track wildlife moving on and off the Forest.

Hunting isn't the only outfitted business on the Forest. Floating the North Platte River is extremely popular for approximately 30 days at peak runoff times. In

addition, the National Outdoor Leadership School (NOLS) and Colorado's Outward Bound (COB) also have permits for rock climbing around Vedauwoo.

Table 3-103. 2001 recreation special use permits and amount collected.

Activity	Number of Permits	Fees Collected
Club	1	$0.00
Organizational Camp	1	$1,636.60
Isolated Cabin	1	$153.00
Recreation Residence	107	$56,272.20
Resort	3	$2,122.00
Rec. Lodging	161	$18,450.00
Recreation Event	9	$1,606.50
Outfitter/Guide	69	$16,625.74
Vendor, Peddler	3	$284.40
Ski Area	1	$22,000.00
Total	356	$119,150.44

ENVIRONMENTAL CONSEQUENCES

General Effects

Recreation management provides a range of recreation opportunities to meet the needs of users and local communities in balance with protection of forest resources. In all alternatives, recreation use on the Forest will continue to increase, however supply will affect the amount of the increase in Alternative F where movement through the Forest will be more restricted, especially in the winter. The quantity, quality, and distribution of opportunities is planned for as a mix of ROS classes available (see following ROS tables) and the theme of each alternative.

Funding varies according to alternative theme as discussed in Chapter 2. Budget priorities were developed for each alternative, depending on the theme, and according to the most recent three-year average. Budget comparisons are, therefore, specific to this analysis, and may or may not reflect future funding. The Congress of the United States will make that determination, annually.

Range of Opportunities Based on Recreation Opportunity Spectrum (ROS) Classes

An Adopted ROS Class map is included in the Plan documentation for this discussion. The ROS is a systematic approach to determining the range of opportunities based on access, setting, number of people (density) in one area, and the degree of management an area receives. The adopted ROS class indicates the maximum level of change an area should experience in terms of ROS criteria over the life of the Plan.

The ROS analysis used the GIS derived acres for all Alternatives (see *Appendix B)*. The ROS inventory was done by individuals familiar with the Forest, and who are also familiar with the ROS criteria. The ROS class mixes for all action alternatives are potential during 15 years of plan implementation. For definitions of the ROS classes, see the previous Affected Environment section.

Alternatives with a dominant ROS class include F with more semi-primitive (SNPM) ROS and Alternative B with more roaded modified (RM) ROS. This Plan only used one ROS class for Wilderness. The primitive class was not used, due to the small size and location of the trails (through the middle) of the existing Wilderness Areas, however the proposed Rock Creek Wilderness Area could potentially be classified primitive, depending on a future management plan for the area.

The following table illustrates the mix of Summer ROS classes for all alternatives, and the change from Alternative A.

Table 3-104. Summer ROS Class mixes – acres by alternative.

ROS Class	A	B	C	D DEIS	D FEIS	E	F
SPNM	213,928	181,932	239,463	316,919	286,266	265,054	433,331
Change from Alternative A		*-31,996*	*25,535*	*102,991*	*72,338*	*51,126*	*219,403*
SPM	264,188	210,322	216,268	199,855	223,056	254,595	302,892
Change from Alternative A		*-53,866*	*-47,920*	*-64,333*	*-41,132*	*-9,593*	*38,704*
RN	277,661	272,074	250,461	244,707	257,205	249,466	171,865
Change from Alternative A		*-5,587*	*-27,200*	*-32,954*	*-20,456*	*-28,195*	*-105,796*
RM	292,491	371,934	331,590	278,166	274,388	269,853	134,397
Change from Alternative A		*79,443*	*39,099*	*-14,325*	*-18,103*	*-22,638*	*-158,094*
RL	36,445	48,351	46,832	44,967	43,475	45,647	42,129
Change from Alternative A		*11,906*	*10,387*	*8,522*	*7,030*	*9,202*	*5,684*

The SPNM would increase most in Alternative F, followed by D DEIS, D FEIS, E, C, and A. Alternative B decreases SPNM acres. The SPM acres increase most in Alternative F, and A, but would decrease from A in all other Alternatives, beginning

with D DEIS, B, C, D FEIS, and E. The RN acres are highest in A, followed by B, D FEIS, C, E, D DEIS, and F. This represents a decrease in all alternatives over A. The RM acres are highest in B and C followed by A, D DEIS, D FEIS, E and F. Rural (RL) acres would increase slightly in all Alternatives, the highest amount being in Alternative B, followed by E, C, D DEIS, D FEIS, and F.

Respondents to the CLM asked for additional non-motorized areas, outside wilderness (University of Wyoming 1998). The following table illustrates how Alternative F provides the most SPNM of any of the alternatives; however most of these acres are inside areas recommended for Wilderness designation. Alternatives E and D FEIS provide the most additional SPNM acres outside Wilderness, followed by D DEIS, C, A, and B. Alternatives F and B provide fewer SPNM acres outside Wilderness. Alternative F increases SPM most.

Table 3-105. Semi-primitive non-motorized acres in and outside wilderness by alternative.

SPNM ROS Acres	A	B	C	D DEIS	D FEIS	E	F
Total SPNM Acres in Wilderness	78,850	78,850	78,850	139,709	106,881	83,403	350,207
Total SPNM Acres outside Wilderness	139,957	103,082	160,613	177,210	179,385	181,651	83,124

Winter Recreation Opportunity Spectrum

This section is an addition to the analysis, as a result of comments on the Draft Plan. The Geographic Information System (GIS) version of the winter ROS was developed from guidelines in the management area prescriptions (*Appendix B)*. The winter ROS assumes low densities of users in most areas outside roads, trailheads (staging areas), and developed ski areas. Higher use areas are classified as RN and Rural.

The following table shows the mix of semi-primitive motorized and non-motorized ROS classes in the winter, as derived from the GIS mapping process.

Table 3-106. Winter ROS class mixes (SPNM and SPM) - acres by alternative and changes from Alternative A.

Winter Recreation Opportunity Spectrum Analysis							
ROS Class	**A**	**B**	**C**	**D DEIS**	**D FEIS**	**E**	**F**
	Acres						
SPNM	185,139	180,125	192,909	317,239	342,455	483,411	940,119
Change from Alternative A	*NA*	*-5,014*	*7,770*	*132,100*	*157,316*	*298,272*	*754,980*
SPM	854,159	859,173	846,389	722,058	696,880	555,886	99,179
Change from Alternative A	*NA*	*5,014*	*-7,770*	*-132,100*	*-157,279*	*-298,273*	*-754,980*
RN	4,454	4,454	4,454	4,454	4,201	4,454	4,454
Change from Alternative A	*NA*	*0*	*0*	*0*	*-253*	*0*	*0*
Rural	22,193	22,193	22,193	22,193	22,197	22,193	22,193
Change from Alternative A	*NA*	*0*	*0*	*0*	*4*	*0*	*0*
Non Use	18,669	18,669	18,669	18,669	18,656	18,669	18,669
Change from Alternative A	*NA*	*0*	*0*	*0*	*-13*	*0*	*0*

Alternative B would provide fewer acres for non-motorized recreation than currently provided, and Alternative C would be no change from current, as a result of implementation. The remaining Alternatives would increase the SPNM and decrease SPM, progressively from Alternatives C through F.

Alternative D FEIS changes are based on current use, as evidenced by comments on the Draft. There are additional acres in the non-motorized ROS class as a result of changes in Management Areas for wildlife and Wilderness, and because of boundary re-alignment in the high use area around Greenrock Picnicground, and the Snowy Range RNA. The Plan takes into account popular motorized use areas, while providing for wildlife concerns. There are provisions to develop motorized trails across Management Area 3.5, where none currently exist (*Chapter 3* in the Revised Forest Plan).

The ROS class does not mean opportunities are already available. Opportunities need to be provided, including trail development, and other user conveniences. Winter trails and other facilities are dependent on funding. The State Trails program provides grant funds that would be available to the Forest in any Alternative.

Sheep Mountain is a special wildlife area where use is prohibited from November 15 through June 15; it is a 'non-use' area in all alternatives. Semi-primitive motorized and non-motorized areas coincide with the Standards and Guidelines for management areas. Snowmobile riding generally occurs in semi-primitive landscapes, although there is some riding occurring adjacent to the Snowy Range Scenic Byway on the west side of the Range.

All winter recreation will be affected by the lynx conservation plan, and subsequent standards and guidelines. Lynx standards call for no net gain in designated or groomed trails. The northern half of the Snowy Range (from Rob Roy Reservoir north), and the Sierra Madre mountains are Lynx Analysis Units (LAUs). These LAUs contain lynx habitat where additional compaction is considered a threat to the lynx. It's expected that use levels will increase, and that the proposed "no-net gain in trails" would eventually mean users would be more crowded on existing trails. This proposed action will be part of all alternatives.

Current motorized users would be most affected by Alternative F. The proposed restriction to roads and trails would change these users' experience. A percentage of users commented (on the Draft Plan) that they (or others) would not adhere to this restriction.

Specific provisions in federal law prohibit snowmobile riding in some specially designated areas (Wilderness Areas, Research Natural Areas (RNAs)), and authorize their use in others (national recreation areas). Motorized use is not allowed on non-motorized trails and inside the ski area. Alternative F has the most acres recommended for Wilderness designation, followed by Alternative D DEIS, D FEIS, and E. Alternatives D FEIS and F allocate additional RNAs in some current snowmobile use areas (i.e.; Ribbon Forest and on top of Browns Peak).Alternatives A, B, and C do not recommend any additional areas for special designation.

Alternatives C, D DEIS, D FEIS, E, and F separate winter users in areas near the Greenrock Picnicground (and winter trailhead). Although snowmobile riders' preferred alternative is 'no change' in riding area from current (Alternatives A and B), they agree that separation of users at the parking lot would help alleviate conflicts. Facility development would be possible in all Alternatives, depending on funding available. The annual operating budget for developed facilities would be highest in Alternative D FEIS, followed by C, D DEIS, A, B, E, and F.

Non-motorized users would like to separate some of the peaks for their exclusive use, which would occur only in Alternative F. Additional backcountry non-motorized opportunities would be available in Alternatives E, D FEIS, D DEIS, and C. Alternatives A, and B, would be a continuation of current management.

Direct and Indirect Effects

Developed Recreation

Budget levels will continue to affect the quality of services in developed facilities in all alternatives. New investments and rehabilitation projects that have been planned (and tentatively funded) will be completed in all alternatives, as budget levels allow. Improvements listed in the Forest accessibility transition plan will be a priority for facility development. Beyond the capitol investment program, any facility rehabilitation will be continuing on increased (full implementation) levels (see budget priorities in Chapter 2) and on the use of private and other government partners to assist in developing and managing facilities.

Over time, a decrease in funds for managed facilities can be expected in all alternatives. More funding would be provided in Alternative D FEIS, followed by C and D DEIS. Alternatives F, E, and B would result in a decrease in the recreation budget.

Trails and Areas

Trails help disperse users, and provide them with a sense of adventure and solitude. Estimates of available budgets indicate that more trails would be constructed and reconstructed in Alternative D FEIS, followed by C, D DEIS, and A. Alternatives B, E, and F would provide the lowest level of funding for recreation trails.

There was an expressed need for additional SPM opportunities, specifically for motorized trails. Alternative F represents an increase in SPM as a setting condition from roaded ROS, however the management priority of this Alternative not to provide motorized trail opportunities, rather it is to change existing roaded areas into semi-primitive non-motorized settings. As the ROS is a spectrum, roads in the roaded ROS class would take time to convert to natural areas. A SPM would be the most achievable condition for these areas by the end of the first decade.

All other alternatives would be a decrease in SPM from Alternative A, however the objectives for in Management Area 3.31 indicate a desired condition of providing motorized trail experiences (see Management Area 3.31 in Chapter 2 of the Plan). Alternative C would include the highest amount of MA 3.31, followed by Alternative D FEIS, B, D DEIS and E. Alternatives A and F have no MA 3.31.

User conflicts on ‘multiple use trails’ are a growing concern for everyone involved. The National Recreational Trails Advisory Committee identified trail-user conflicts on multiple-use trails is a major concern that needs resolution. The Advisory Committee recognizing the significant amount of literature and expertise on the topic, asked the Federal Highway Administration to produce a synthesis of the existing research to (1) foster understanding of trail conflicts, (2) identify promising approaches for promoting trail sharing, and (3) identify gaps in our current knowledge. The International Snowmobile Manufacturers Association has led

campaigns to educate users on the safe operation of snowmobiles. In addition, they support buffer zones and/or trail designs that help to protect sensitive environmental areas and wildlife (GAO/RCED-00-243 2000).

The Revised Forest Plan is a recognition that some user groups need to have their own space in order to enjoy the experience they come to the Forest for; Management Areas 1.31, 1.33, and 3.33 are an intentional separation of users. The following table illustrates the relative differences between Alternatives with regard to the use of these four management areas. Note these management areas were not used in Alternative A.

Table 3-107. Winter and summer management areas separating users – acres by alternative.

Management Area	B	C	D DEIS	D FEIS	E	F
	Acres					
1.31 Backcountry Non-Motorized Winter and Summer	0	13,584	44,080	63,067	25,711	4,866
1.33 Backcountry Recreation Non-motorized with Winter Snowmobile	48,933	104,704	90,474	64,561	64,525	0
3.31 Backcountry Recreation - Motorized	61,956	84,874	40,361	67,613	19,514	0
3.33 Backcountry Recreation Motorized with Winter Non-motorized	0	3,310	0	3,828	0	22,271

Alternative C has the highest number of acres specified for motorized use in winter, followed by Alternatives D DEIS, D FEIS, E, and B. Alternative F has the highest number of acres in a backcountry non-motorized winter, followed by Alternative D FEIS and C. There are no acres in year round motorized in Alternative F, and Alternative B has the fewest non-motorized acres.

Continental Divide National Scenic Trail

The Plan has the potential to affect users on the Continental Divide National Scenic Trail, where it traverses the northern half of the Sierra Madre. This segment of the trail has historically been available for motorized use; however it would be managed for non-motorized use in Alternatives F and E. Regardless of the other action alternatives, the District has plans to develop a non-motorized trail, within a reasonable distance of the Continental Divide.

Dispersed Recreation

Land intensive activities, like driving to view scenery, hunting, and primitive camping require roads, and road maintenance. Road maintenance funding will be similar to current levels in all alternatives.

Wildlife Recreation

Recreationists benefit from wildlife management. As use on roads becomes crowded, big game moves on to adjacent private lands. Fewer encounters with motorized vehicles might ensure more hunter success, and opportunities for wildlife viewing on the Forest. The 2000 Travel Management decision and the subsequent phase II decisions are meant to address this concern.

Recreating to view or capture wildlife and fish is dependent on adequate amounts and distribution of habitat. Alternatives E and F and would provide the most habitat improvement projects for wildlife, followed by Alternative D FEIS, D DEIS, C, A, and B. Alternative F provides the most semi-primitive opportunities, away from roads, followed by E, D DEIS, D FEIS, C, B, and A.

Ski Area

Allocation of land for potential ski area development is consistent with the Forest Planning process. The area mapped for ski area management includes some portion that's currently part of a cross-country ski trail system. Allocation does not preclude the need for a Master Plan, complete with NEPA, as required by Forest Service regulations. Potential downhill ski opportunities would be increased in Alternatives D FEIS, B, C, and D DEIS. Alternatives A, E, and F do not allocate additional acres for the Snowy Range Ski Area.

Wilderness Recreation

The current recreation opportunities in existing Wilderness would remain the same in all alternatives, however management and planning funds would be more available in Alternatives F, followed by D DEIS, D FEIS, E, B, C and A.

Additional Wilderness would be recommended in Alternatives D DEIS, D FEIS, E, and F. Alternative F would recommend 271,357 acres, or 25 percent of the Forest for Wilderness, Alternative E would recommend 4,553 acres Alternative D DEIS recommends 60,859 acres, or 5.6 percent more of the Forest, and D FEIS recommends 27,973, acres, or an additional 2.6 percent of the Forest for Wilderness.

Current users may be affected by restrictions on recreation, such as bicycle riding, motorized trail uses, and snowmobile riding. Off-road vehicle (ORV) use is not currently authorized in this area, so Wilderness designation would not result in a loss of opportunity. Both bicycling and snowmobile riding would be allowed to continue on a temporary basis, depending on conditions in the area, pending Wilderness designation.

Use levels will probably increase in these areas, as is the typical response of Wilderness users.

Special Uses Administration

Recreation special uses, including any need for more or fewer outfitter and guide operations, would be most affected by the amount of area managed for Wilderness and semi-primitive non-motorized areas. Additional Wilderness will increase the need for outfitted activities due to limitations on access. The greatest potential for additional summer outfitter and guide activities would be in Alternatives F, D DEIS, D FEIS, and E. Alternatives A, B, and C would mean no change from current.

Effects from Oil and Gas

Exploration could disrupt recreation in remote areas with noise and visual impacts. Potential long-term effects from the drilling operations include a change in the landscape. New permanent structures and road corridors would increase use, due to increased access. The associated roads may or may not be open to the public, depending on the approved activity. The effects on recreation use would be more interior Forest open to motorized use. Long-term noise from drilling operations would change any recreation experience, albeit short term. There is no leasing in Alternative A and all other alternatives have the same amount of area available, even though the Forest's RFD (Reasonable Forseeable Development) indicates there will only be 2 wells developed over the next 10 years.

Timing stipulations (TL) are restrictions on drilling during specific times of the year, primarily for wildlife considerations, and they would protect special areas for recreationists, as well. Acres with TL are highest in Alternatives E, followed by D FEIS, C, D DEIS, and F.

Alternative F has the most acres with a no surface occupancy (NSO) leasing restriction, followed by Alternatives D DEIS, D FEIS, C, and E. Alternatives A and B have no acres with NSO stipulations. Alternative B has the most acres available for leasing under standard lease terms with no supplemental stipulations, followed by Alternatives C, D FEIS, D DEIS, E, and F.

Effects from Livestock Grazing and Big Game Use

Issues related to recreation from grazing include: stream and lake contamination, trampled streambanks and trails, manure on trails and in campsites, odors, livestock inside campgrounds and picnicgrounds, and conflicts between livestock and recreationists. An example is when gates are left open by recreationists allowing livestock to winter or when campsites are taken over by a herd of cattle or sheep. Effects from range management are both direct and indirect, depending on the activity level in the allotment. Recreation would be comparably affected by range management in all alternatives.

Effects from Special Area Allocations – RNAs

Research Natural Area (RNA) designations can affect current recreation opportunities with additional restrictions on those uses. RNA designation prohibits motorized and mechanized uses as well as the construction of new trails. Non-motorized uses are restricted, depending on their potential to affect the purpose of the RNA. The proposed RNAs on top of the Snowy Range in Alternative F would especially affect snowmobile riding. The RNA on Brown's Peak in Alternative D FEIS would affect any snowmobile riders who currently use the area, however the RNA is on a steep, rocky slope, where the Forest Service would never recommend use.

Alternative F has the largest amount of proposed new RNAs (outside Wilderness), followed by Alternative E (26,719 ac), and D FEIS (5,433 ac). Alternatives E, D DEIS, and D FEIS propose RNA inclusions inside Wilderness, which would not limit current wilderness recreationists.

Effects from Roads Management

Recreationists need roads for moving onto and through the Forest. Out of 2,592 miles of road on the Forest, 250 miles are maintained to accommodate passenger cars and to provide a reasonably comfortable driving experience (*see the Travel Management section in this Chapter)*. Another 451 miles are maintained to accommodate passenger cars, but do not necessarily provide a comfortable driving experience. Roads must serve a compelling public need in order for the Forest Service to designate them open to public travel.

There are another 800 miles of unclassified roads (roads developed by users, or for temporary purposes). These roads, according to the 2000 Travel Management decision are illegal to use, and so further decommissioning of them will not affect motorized users, however depending on the method for decommissioning, foot, bicycle, and horse users may experience a loss of experience. The Forest will potentially decommission 18 miles of roads per year, over the life of the Plan (15 years), in all alternatives, except for E and F. Miles of road decommissioned in these two alternatives are 75 and 121, per year, respectively.

There are opportunities for increasing maintenance on existing roads. Alternatives A, B, and C would maintain a higher percent of open roads to standard than the other alternatives, followed by Alternative D DEIS and D FEIS, E, and F.

Effects from Roadless Area Management

Roadless areas provide opportunities for non-motorized recreation. Alternative F would retain more of the inventoried roadless acres fully consistent with roadless area resource conservation, followed by Alternatives D DEIS, D FEIS, C, E, B, and A.

Effects from Timber Management

Timber management has the potential to affect recreation experiences and opportunities in several ways; noise levels, log trucks sharing roads with sedans and snowmobiles, changes to the landscape from clearcutting and slash piles, and additional roads. Affects are short and long term, and compared to the amount of likely total harvest. Alternative A is the highest ASQ, followed by B, C, D DEIS, D FEIS, E and F.

Effects from Fire and Fuels Management

Active fuels management can reduce the threat of wildfire to all users. Alternatives F and E would emphasize prescribed burning, followed by Alternatives D DEIS, D FEIS, C, A and B.

Logging, and fuels management activities provide some fire breaks, and roads for fire fighting activities. Alternatives A, B, and C would emphasize logging, followed by D FEIS, D DEIS, E, and F. All alternatives will have associated fuel treatment scheduled, with the most in Alternatives D FEIS, D DEIS, E, B, C, F and A.

Cumulative Effects

Activities of other federal, state, local governments and private entities may cumulatively affect resources of the Medicine Bow. The following is a discussion of specific activities currently in the planning stages. Many of these activities are outside the scope of the Forest Plan, and their effects are the same for all alternatives. These and additional activities are listed in the Cumulative Activities Table of this document.

Coalbed Methane

Coalbed methane gas development in the area west of the Sierra Madre will combine with the oil fields and the High Savery Dam to bring an influx of people into the west side of the Sierra Madre. Workers in the gas fields will seek out the Forest for recreation, and most likely will use areas that currently don't receive much use from other Forest users.

This population growth, combined with the growth in the northern Colorado counties within 150 miles of the Forest will mean additional users on the forest, which translates into the need for more land management personnel (Colorado State Demographers Office, June 2001, Cordell, et al., 1993). As the Forest's 1991 Recreation Strategy indicated, the potential for "deterioration of outdoor recreation opportunities due to crowding and overuse on the Forests along the Colorado Front Range will produce long-term increasing pressure on recreation resources on the Medicine Bow" (USDA-FS, 1991).

The effect of coalbed methane gas development on the north side of the Sierra Madre on recreation and Wilderness will be the same for coalbed methane development

anywhere around the Forest. Workers in the gas fields will have to live and recreate somewhere; the most likely opportunity for their recreation will be on the Forest. .

Sage Creek Road (Rawlins to Battle)

This paving project is planned for in phases, and is under the jurisdiction of Carbon County. The first phase does not include work inside the Forest. There is currently an influx of users from Rawlins to this part of the Sierra Madre, and use levels will most likely increase as a result of this project, regardless of the chosen alternative. The route may bypass the locally famous "aspen alley" along this road. Plans are unclear, and there will be opportunity for public comment before the project is funded.

The Green Mountain Ski Resort

The Green Mountain resort is a proposed ski area, located inside the Forest boundary, on private land west of Encampment. Access to the Green Mountain section is through the Forest. The Hog Park Road is not currently plowed for vehicular use in the winter. Any plans to plow this road will be dependent on maintenance agreements between the Forest and the County. Plowing this road would potentially affect snowmobile use in the area, depending on the plowing width. The ski area would potentially provide the Forest and State Trails Program with nearby storage and battery power for the trail groomer for the snowmobile trails in the area. This would be the case in any of the alternatives, as the resort is a private development on private land.

ORV Use on Lands Adjacent to Forest

The Rawlins office of the BLM reported complaints are increasing around Arlington where ORVs enter BLM land from on the Forest. ORVs are restricted to roads and trails on both BLM and Forest Service lands, so user-created trails are increasing. Monitoring and law enforcement will be carried out as funding allows, but the potential increase for this activity may occur under all alternatives.

Guest Ranch Use Adjacent to Wilderness (uses on the Forest)

The A-Bar-A Ranch is located directly across the river from the Savage Run Wilderness Area. Users from this guest ranch access the Wilderness from across the Platte River. This is private access, including other users given permission to use the private land. The concern is the Forest Service isn't able to manage for unauthorized use of the Wilderness Area. These Ranch owners are partners and have a special use permit to guide hunting groups into the Wilderness. This private access will not change due to allocations, and so there will be no difference among alternatives.

Recently Enacted State Legislation Requiring Registration of ORVs

In 2002, the State legislature passed an ORV registration bill, which mirrors the current snowmobile registration requirements. Just as snowmobile use increased

dramatically in the 1990s, it is likely ORV use will increase due partially to an increase in use levels, and information and advertising by the Division of Tourism. The State has begun developing maps with motorized trails identified. Currently, the Medicine Bow National Forest has very few trails. Only the developed motorized trails on the Forest are recognized by the State as requiring the ORV registration.

All open Forest roads are also open to ORV use, as long as the ORV is licensed, and the driver has, at least a beginner's driver's permit. Anyone 18 years or under must wear a helmet. The concern with this requirement is that law enforcement officers on the Forest are spending excessive time addressing moving violations, rather than protecting the Forest resources. The funds from this registration program should help with enforcement, eventually, but the program has to build before there will be extra funds for additional law enforcement. There will be no difference in enforcement of this requirement among alternatives.

Two Elks Power Plant

The effect to recreation from this development will be an increase in use, as well as an influx of users unfamiliar with the area, beginning in the construction phase, and tapering off through the operation of the plant. The Douglas District will have to be alert to the population changes, and use trends that will be occurring throughout this time period, and make appropriate management changes. There will be a need to monitor additional use levels and types, and provide additional facilities to mitigate damage from additional dispersed use.

High Savery Dam

The High Savery Dam is being built for two purposes; replace the irrigation water that was removed when the Cheyenne Stage II pipeline was built, and water was diverted out of the Little Snake River drainage, and provide flatwater recreation when the water is still in the reservoir. The County and area economic development leaders are anticipating an influx of use from Craig, Colorado, and Rawlins and all points in between. Their hope is that people will want to remain in the area for the weekend (or longer), and spend money in Baggs or Savery.

The effect of this dam on the Forest will primarily be that many of these users will use the Forest on the west side of the Sierra Madre, an area of generally low use, except during hunting season. The potential for illegal uses of the Forest as a result of this influx of users, which increases the necessity for additional personnel. New facilities may have to be provided for this influx, since additional dispersed use will increase human waste, and the potential for other problems in dispersed campsites.

Research Natural Areas

Introduction – Research Natural Areas (RNAs) are selected to provide a spectrum of relatively undisturbed areas representing important natural ecosystems and environments: for example forest, shrub land, grassland, alpine, aquatic, and geologic environments. They are also selected to represent area with special or unique scientifically important characteristics. RNAs do the following (See Appendix F for further information on the function of RNAs):

- Serve as reference areas for evaluating the range of natural variability and the impacts of management in similar environments.
- Maintain representative and key elements of biological diversity at the genetic, species, population, community, and/or landscape levels.
- Serve as areas for the study of ecosystems and ecological processes including succession.
- Provide on-site and extension educational activities.
- Serve as baseline areas for measuring ecological change.

We reviewed the agency direction for RNA designation. We identified areas with extensive, relatively undisturbed plant communities and screened areas to find suitable sites in vacant grazing allotments, roadless areas, and areas that had not experienced timber harvest. The objective was to find RNA candidates while minimizing potential conflicts with existing land allocations. In the areas evaluated for potential RNAs, current human uses were generally compatible with RNA designation.

The Forest contracted with the Natural Conservancy to inventory potential RNA candidates. They conducted field visits, literature and database searches and provided reports on potential RNAs. The reports included detailed descriptions, photos, distinguishing features, and acreage by vegetation cover type.

Changes Between Draft and Final

The Draft EIS included a key indicator of acres of potential RNAs. This was modified to include number and acres of plant communities filled by RNAs. This change better measures the importance of plant community representation over acres. While size is important, designating RNAs that are representative of local communities and that contribute to the Regional and National network is even more important.

Criteria

The following criteria were used in evaluating 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.

Legal and Administrative Framework

36 CFR 219.25 - states that forest planning shall provide for the establishment of RNAs. We are directed to identify examples of important forest, shrub land, grassland, alpine, aquatic and geologic types with special or unique characteristics, types of scientific interest and importance that are needed to complete the national RNA network.

On July 19, 1993, the Chief of the Forest Service issued a national strategy for recognizing the expanding role of RNAs in ecosystem management. Giving Regional Foresters the authority to designate RNAs was an important part 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 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.

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 (RNA Guide) - A principle 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 National Forest System 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. The Medicine Bow National Forest resides in the Southern Wyoming and northern Colorado Subdivision in the Northern Parks and Ranges (M334I) Section

and North–central Highlands and Rocky Mountain (M334H) Section of the ecological hierarchy.

Key Indicators

- Number and acres of plants series filled by RNA designations.
- Location of individual RNAs.
- Changes in timber, grazing, recreation, and minerals outputs and accessibility when specific RNAs are approved for establishment.

AFFECTED ENVIRONMENT

The 734-acre Snowy Range Natural Area (page III-38 1985 Medicine Bow Plan FEIS says 771 acres but new surveys indicate smaller number) was established in January 1936 for the purpose of studying old-growth Engelmann spruce stands. The area is comprised of Engelmann spruce and subalpine fir, lodgepole pine, and very small areas of grassland, shrubland, and lakes. A detailed vegetation survey has not been completed. However, the GLEES Experimental Site nearby has been inventoried and the data from that site contributes to our knowledge about the Snowy Range RNA (1994 GTR-RM-251). The 1985 Medicine Bow Plan listed the approximately 950-acre Savage Run Lodgepole Pine RNA and the approximately 40-acre Standard Park Bog RNA as candidates but they were never established as RNAs.

The Forest Service contracted an inventory of sixteen areas as potential RNAs. The process for evaluating and recommending potential RNAs had three parts: 1) Evaluate using established criteria, 2) Rank potential RNAs considering quality, 3) include a reasonable range of potential RNAs in the plan revision alternatives, 4) Regional Forester decision that selects RNAs that will be managed according to Establishment Plan that is developed and approved by Regional Forester and Rocky Mountain Research Station Director.

Appendix F – Research Natural Areas describes the purpose and function of RNAs. The proposed RNAs were inventoried using the criteria described above. Once the inventory was completed, potential RNAs that did not meet the minimum criteria for designation were dismissed from further consideration. Those areas included Big Bear Canyon, Cedar Pass, and Many Ponds. The remaining potential RNAs were evaluated with the following results:

- Potential RNAs that appear to meet the criteria for RNA designation - (Battle Mountain, Ground Moraine, Platte Canyon (previously called Platte Ridge and North Platte River Canyon), Savage Run, and Sheep Mountain).
- Potential RNAs that appear to meet the criteria for RNA designation with easily made boundary changes – (Ashenfelder Basin, LaBonte Canyon, and Old Maid's Draw).
- Potential RNAs that appear to meet the criteria for RNA designation but have possible management or use conflicts – (Deep Creek, East Fork Encampment River, Ribbon Forest, Standard Park and Bogs, and Threemile*).

* After this evaluation and prior to comparing quality of the areas, Three mile was determined to be unsuitable for further consideration because it might come to excluding roads and that was not desirable.

The remaining twelve potential RNAs were then graded on quality relative to each other with the sense that A is an excellent grade and C is an average grade. The potential RNAs were graded as follows:

Sheep Mountain – A+	East Fork Encampment River – B
Platte Canyon – A+	Savage Run – B
Ashenfelder Basin – A	Ribbon Forest – B
Battle Mountain – B+	Old Maid's Draw – B-
Deep Creek – B+	Ground Moraine – C+
LaBonte Canyon – B+	Standard Park – C+

The following table displays the RNAs to be considered for designation, estimated acres and types of plant series or communities that would satisfy the gaps in the representation matrix. Brown's Peak was incorporated as a public proposed area so it was not given a grade like the areas considered through our contract with The Nature Conservancy.

Table 3-108. Potential RNAs, estimated acres and plant series or gaps that would be filled.

Potential RNAs District Location	Possible Acres	Plant Series or Gaps Filled
Sheep Mountain Laramie Ranger District (LRD)	13,536	Wide range of grassland, shrubland, riparian and montane forest ecosystem types (Lodgepole, Douglas Fir, Limber Pine, aspen and riparian communities)
Platte Canyon LRD	11,856	Wide range of grassland, shrubland, riparian and montane forest ecosystem types (Lodgepole, Douglas Fir) Also within Wilderness Area.
Ashenfelder Douglas Ranger District (DRD)	7,151	Provides a representative range of ponderosa pine forests in the Region.
Ribbon Forest LRD	4,350	High Elevation grasslands, wetlands, and old growth spruce fir.
Big Sandstone (old Deep Cr.) Brush Creek/Hayden Ranger District (BCH RD)	4,657	Aspen, sagebrush and grassland types.
Battle Mountain BCH RD	1,319	Only potential RNA that occurs in the North-Central Highlands and Rocky Mountain Section. (Aspen, lodgepole pine and sagebrush.)
Old Maids Draw DRD	990	Limber pine
Savage Run LRD	1,061	Lodgepole pine that has never been logged or tie-hacked and is within Wilderness area.
Ground Moraine LRD	1,271	Wetlands and Kettle Ponds similar to Kettle Lakes RNA on the Routt NF
La Bonte Canyon DRD	3,344	Provides a representative range of ponderosa pine forests in the Region.
Standard Park BCH RD	3,618	Subalpine grasslands, aspen and conifer forest and wetlands. Within Huston Park Wilderness Area.
East Fork Encampment River BCH RD	2,244	Lodgepole Pine and Spruce Fir Forest would not add significantly to the RNA system, but extensive research and monitoring has already occurred here.
Brown's Peak BCH RD	1,735	Area recommended by public. Alpine community of skree and high elevation mosses and lichens with interspersed Engelmann Spruce and Subalpine fir.

The following map shows the location of existing and potential RNAs.

Map 3-7. Existing and potential Research Natural Areas on the Medicine Bow National Forest.

ENVIRONMENTAL CONSEQUENCES

General Effects

The Forest Service Manual (FSM 4063) describes activities that are allowed in RNAs. Most of the changes that occur to established RNAs will result from natural disturbance events such as fire, insects and disease and windthrow. Most areas not undergoing natural disturbance events are expected to move through natural succession into late successional and old growth stands in all alternatives.

Every alternative retains the Snowy Range RNA. Alternatives A, B and C propose no new RNAs. Alternative D DEIS would designate Standard Park RNA (3480 acres), which is within the Huston Park Wilderness Area. Alternative D FEIS would designate five new RNAs on the Forest for a total of 15,476 acres with 10,043 acres in Wilderness Areas. Alternative E would designate six new RNAs for a total of 38, 575 acres with 11, 856 acres in Wilderness Areas. Alternative F would designate a total of nine new areas for a total of 33,825 acres. The following table displays the individual RNAs and acres included in each alternative

Table 3-109. Acres of RNAs by alternative.

Research Natural Area	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Snowy Range[1]	749	749	749	749	734	749	749
Ashenfelder						2,062	7,144
Battle Mountain					1,204	1,319	1,436
Big Bear Canyon							
Big Sandstone						4,657	4,987
Browns Peak[2]					472		1,735
Cedar Pass							
East Fork Encampment River							2,328
Ground Moraine							1,271
Labonte Canyon					3,023		
Many Ponds							
Old Maids Draw							990
Platte Canyon					8,982	11,856	
Ribbon Forest						4,350	4,350

Research Natural Area	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Savage Run					1,061		
Sheep Mountain						13,582	
Standard Park				3,480			
Three Mile							8,844
Total Acres	**749**	**749**	**749**	**4,229**	**15,476**	**38,575**	**33,825**

Source: GIS, 1 Existing RNA, 2 Public Proposed RNA

An indicator of meeting RNA goals is the number of plant associations represented in the R2 RNA program. Alternative E provides for 25 major and 14 minor communities; Alternative F provides for 13 major and 6 minor communities; and Alternative D FEIS provides for 12 major communities and 8 minor plant communities. Alternative D DEIS provides for 1 major and 1 minor community.

Direct and Indirect Effects

RNAs are managed to maintain natural and relatively pristine pre-settlement conditions, by allowing ecological processes to prevail with minimal human intervention. 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. Vegetation, habitat, soil productivity, water quality and ecological processes are to be in a natural condition or in as close a natural condition as practicable. Heritage resources are protected by RNA designation since ground-disturbing activities are limited.

A variety of uses are allowed in RNAs as long as the activity or uses do not become a threat to the values for which the RNA was proposed and as long as RNA management plan direction is followed.

Effects from Facilities Management

Buildings and developed recreation sites are prohibited, unless there are exceptional circumstances that do not threaten the values for which the RNA was proposed. No known adverse effects from facilities are expected in any of the alternatives.

Effects from Fire and Fuels Management

Human-caused wildfires would be controlled in all alternatives. Where excessive fuel build-up from past wildfire suppression threatens the RNA, fires would be controlled.

The use of scheduled prescribed fire may be permitted to restore a natural fire regime or to reduce unnatural fuel loads in all alternatives dependent on the objectives for each of the nominated or proposed RNAs. Fire control techniques would be used

that minimize ground disturbance. Natural barriers would be used to confine or contain fire where possible.

Effects from Fish and Wildlife Management

Habitat manipulation for wildlife is prohibited unless it is specifically needed to restore natural ecosystem conditions. Habitat manipulation is allowed if specifically designed for the protection of threatened, endangered, or sensitive species. No known adverse effects are expected from fish and wildlife management for any alternative.

Effects from Insect and Disease Management

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. Control methods will minimize disturbance. No known adverse effects are expected from insect and disease management in any alternative.

Effects from Oil, Gas and Minerals Management

Oil and gas leasing is allowed however, no ground disturbing activities are permitted within the boundaries of the RNA. Protecting recommended Research Natural Areas to maintain their consideration for designation would impact oil and gas exploration in proportion to the number of acres where surface occupancy is prohibited. Alternative E has the most acres with the NSO stipulation allocated to this management area, followed by Alternative F. Alternative A, C, and D have no acres allocated to MA 2.2 with the NSO stipulation.

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 in conformance with Section 204 of the Federal Land Policy and Management Act of 1976 (PL 94-576).

Extraction of salable mineral (sand gravel, hard rock for crushing, and landscape materials) would not be allowed in RNAs.

Effects from Livestock Grazing and Big Game Use

In some cases, but not all, creation of RNAs may result in the cessation of livestock grazing in the area; some areas may require the reduction or removal of livestock, but, in many cases, prior uses are honored as a compromise or condition of achieving the designation. In addition, the use of grazing as a management tool – on an incidental or infrequent basis – may be needed to achieve rangeland vegetation management objectives over all or a part of the area. In each case, the management plan for the RNA is designed to detail what level of livestock use is provided for in that area.

For Alternative D FEIS, livestock grazing is not expected to be a problem in any RNA. RNAs include either wildlife range allotments instead of domestic livestock range allotments or the boundary of a particular RNA has been modified to accommodate range allotments.

Effects from Recreation Management

Existing non-motorized recreation use would be allowed as long as the use does not become 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 impacted areas or administrative closures might be imposed.

Trails that exist prior to RNA designation are allowed for recreation, scientific, or educational access, except when they are a threat to the values for which the RNA was proposed. The construction of new trails is prohibited except when necessary to correct resource damage occurring from existing trails.

Motorized use is not allowed in RNAs, unless necessary for research or authorized administrative access. Physically challenged individuals may be less able to access these public lands.

Effects from Special Use Management

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 Threatened, Endangered, and Sensitive Species Management

Populations of federally listed threatened and endangered species located within any of the proposed 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 provide additional protection for these species.

Effects from Timber Management

The proposed RNAs are not available for timber harvest. For Alternative D FEIS, only one of the recommended RNAs has tentatively suitable timber located within the boundary; 233 acres included in LaBonte Canyon pRNA.

Table 3-110. Summary of tentatively suitable (actually common suited) timber acres by RNA.

Proposed RNA	Total Maximum Possible Tentatively Suitable Acres for Alternatives A, B, C, D DEIS, E, F	Tentatively Suitable Acres for Alternative D FEIS
Ashenfelder	2,246	
LaBonte Canyon	233	233
Old Maid's Draw	323	
Three Mile	7,494	
Ribbon Forest	684	
Ground Moraine	215	
Sheep Mountain	291	
Savage Run	5	0
Platte Canyon	0	0
East Fork Encampment River	1,949	
Standard Park	0	
Big Sandstone	3,174	
Battle Mountain	0	0
Brown's Peak*	0	0
*public proposed		

Source: GIS

Effects from Travel Management and Motorized Use

New road construction in RNAs would be prohibited. Existing roads are restricted from motorized use or decommissioned except when needed for necessary scientific, educational, or administrative purposes. Unclassified roads within proposed RNAs would be decommissioned.

Effects from Wilderness Management

Wilderness management is compatible with RNA management. Three potential RNAs are contained within three Wilderness areas. Standard Park is located within Huston Park Wilderness Area. Platte Canyon potential RNA is located within the Platte River Wilderness Area. Savage Run potential RNA is located within Savage Run Wilderness Area. Alternative D FEIS designates Platte Canyon and Savage Run. We do not anticipate any problems due to conflicting management in the areas where there is dual designation. Human use from non-motorized and non-mechanized recreation through outfitter guides and private individuals that exceeds requirements of either of the RNA establishment guidelines would need to be mitigated according to standards and guidelines in management Area 2.2

Cumulative Effects

The Forest Service Research Natural Area (RNA) network protects some of the finest examples of natural ecosystems for the purposes of scientific study and education and for maintenance of biological diversity. National Forests and Grasslands in eleven western states manage an exceptional suite of 273 established and 71 proposed Research Natural Areas. These areas represent a wide variety of habitats and ecosystems along elevational gradients from alpine to lowlands; and biogeographic gradients ranging from coniferous forests of the Northern Rockies to semi-arid deserts of the Southwest and prairie ecosystems of the plains.

There are currently 10 RNAs and 2 proposed RNAs totalling 39,653 acres in Wyoming. These areas are primarily high alpine meadows, spruce fir forests, and low elevation grasslands. Alternatives D DEIS, D FEIS, E or F would contribute additional areas to the RNA system. The Routt NF established three RNAs (Kettle Lakes, Mad Creek and Silver Creek for a total of approximately 31,000 acres) in the 1997 Revised Plan. These RNAs represent kettle ponds and beaver ponds, sedge meadows and high elevation spruce fir forests. Alternative D FEIS would complement the RNAs selected for the Routt in the Northern Parks and Ranges (M334I) Section. Alternative D FEIS would contribute ponderosa Pine communities (LaBonte Canyon RNA), pristine lodgepole pine communities (Savage Run RNA), very diverse array of communities including doug-fir (Platte Canyon RNA), sagebrush communities (Battle Mountain RNA), alpine skree fellfield, mosses and lichens (Brown's Peak) and high alpine Spruce Fir (Snowy Range) to the network of Region 2 RNAs.

Roadless Areas

Introduction – Inventoried Roadless Areas (IRA) are undeveloped areas typically exceeding 5,000 acres that meet the minimum criteria for wilderness consideration under the Wilderness Act. This section describes and evaluates the effects to wilderness characteristics within IRAs. The Forest Service inventoried 31 roadless areas, totaling 319,738 acres on the Forest.

Changes Between Draft And Final

Interim direction for roadless area management expired between the draft and final EIS so that direction has been removed from the document. One of the Key Indicators changed between Draft and Final. The DEIS analyzed roadless characteristics using a two-tailed test of 1) retains roadless characteristics or 2) does not retain roadless characteristics. The FEIS contains a three-tailed test in order to evaluate consistency with the Roadless Areas Conservation Rule (RACR). The three-tailed test includes Category 1 – Permit actions that will not retain roadless characteristics, Category 2- Permit actions that will retain roadless characteristics and are consistent with the prohibitions of the RACR that has been set aside by the Court, and and Category 3- Permit actions that retain roadless characteristics but are inconsistent with prohibitions of the RACR that has been set aside by the Court.

Legal and Administrative Framework

The Forest Service is required to inventory, evaluate, and consider all roadless areas for possible inclusion in the National Wilderness Preservation System. 36 CFR states: "Unless otherwise provided by law, roadless areas within the National Forest System shall be evaluated and considered for recommendation as potential wilderness areas during the forest planning process."

The Endangered American Wilderness Act of 1978 (PL-95-237) designated the first Wilderness Area on the Medicine Bow National Forest, the Savage Run Wilderness.

The 1984 Wyoming Wilderness Act (PL-98-550) designated three new wilderness areas on the Medicine Bow National Forest, the Platte River, Encampment River, and Huston Park. The act includes the following release language:

> "National forest areas not designated wilderness or wilderness study by this Act are released for multiple use management and need not be managed to protect their suitability for wilderness designation prior to or during revision of the initial land management plans."

The act further states:

> "The Secretary of Agriculture shall again review wilderness options for the national forest lands when the forest management plans are revised …If, in the revision of management plans, areas are recommended for wilderness, those areas are to be managed to protect their wilderness suitability. Areas not so recommended at that time need not be managed to protect their suitability for wilderness designation."

The act also protects rights for water diversion and use, including construction, operation, maintenance, and modification.

The Code of Federal Regulations at 36 CFR 219.17(a) states that "…roadless areas within the National Forest System shall be evaluated and considered for recommendation as potential wilderness during the forest planning process."

Forest Service Handbook (FSH) 1909.12.7.1 directs national forests to "…identify and inventory all roadless, undeveloped areas that satisfy the definition of wilderness found in section 2(c) of the 1964 Wilderness Act." FSH 1909.12.7 also details the means by which the capability, availability, and need for potential wilderness areas are assessed.

The Wilderness Act gives the statutory definition of wilderness (Section 2(c): "A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this act an area of undeveloped federal land retaining its primeval character and influence, without permanent improvements of human habitation, which is protected and managed so as to preserve its natural conditions and which:

- Generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;
- Has outstanding opportunities for solitude or a primitive and unconfined type of recreation;
- Has at least 5,000 acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and
- May also contain ecological, geological, or other features of scientific, educational, or historical value."

In 1970, the Forest Service studied all administratively designated primitive areas, and inventoried and reviewed all roadless areas in the National Forest and Grasslands greater than 5,000 acres. This study was known as the Roadless Area Review and Evaluation (RARE). RARE was halted in 1972 due to a legal challenge.

In 1977, the Forest Service began another nationwide Roadless Area Review and Evaluation (RARE II) to identify roadless and undeveloped areas within the National

Forest System that were suitable for inclusion in the National Forest Wilderness Preservation System. As a result of RARE II, 27 roadless areas were evaluated and five areas (Platte River, Snowy Range, Laramie Peak, Huston Park and Encampment River) on the Medicine Bow National Forest were recommended to Congress for addition to the National Wilderness Preservation System.

Congress passed the Wyoming Wilderness Act of 1984 (PL 98-550) that designated three new wilderness areas on the Medicine Bow National Forest. The three areas are the Platte River Wilderness 22,749 acres; the Encampment River Wilderness 10,024 acres; and the Huston Park Wilderness 30,588 acres. With the Savage Run Wilderness, 14,927 acres, there are a total of 78,288 acres (acres from Congressional legislation) of designated wilderness on the Forest. This constitutes approximately 7% of the forest.

Key Indicators

- Areas determined to be capable and available for wilderness.
- Acres and areas recommended for wilderness designation.
- IRAs and acres that 1) Will not retain roadless characteristics, 2) Are consistent with the RACR and will retain roadless characteristics and 3) Permit actions inconsistent with RACR, but retain roadless characteristics.

AFFECTED ENVIRONMENT

During forest plan revision, the Forest Service is required to inventory, evaluate, and consider all roadless areas for possible inclusion in the National Wilderness Preservation System (36 CFR 219.17)

The Forest Service inventoried and identified roadless areas and made recommendations for their management. Areas are qualified for study if they meet the following criteria:

- They are 5,000 acres in size or larger.
- They are less than 5,000 acres, but contiguous to an existing Wilderness Area,
- There are no classified roads (A classified road was defined at the time of inventory as a road constructed or maintained for long-term highway vehicle use. Therefore, IRAs contain motorized and non-motorized trails and user created roads.)

IRAs may contain improvements such as motorized trails, fences, outfitter camps, and evidence of historical logging activities. We mapped roadless areas on the Forest using the criteria listed above (FSH 1909.12). If an area met the criteria, the Forest Service studied it to determine eligibility for potential wilderness designation. The following table displays the number, name and size of each IRA. There are IRAs in three of the four discrete units of the Medicine Bow National Forest. Sherman Mountains (Pole

Mountain) does not contain any IRAs. The maps on the following pages show the distribution of the 31 Forest Service IRAs across the Medicine Bow National Forest.

Table 3-111. Inventoried Roadless Area numbers, names and size by mountain range.*

Sierra Madre Area		
Roadless #	**Name**	**Acres**
R20601	Strawberry Creek	5,876
R20602	Singer Peak	10,491
R20603	Big Sandstone	7,170
R20604	Little Sandstone	5,481
R20605	Battle Creek	5,894
R20606	Little Snake	9,920
R20607	Solomon Creek	5,756
R20608	Deep Creek	6,411
R20609	Bridger Peak	6,694
R20610	Mowry Peak	6,241
R20611	Huston Park Addition	8,401
R20612	Encampment River Addition	4,983
R20613	East Fork Encampment	7,429
R20614	Bear Mountain	9,426
Subtotal	14 roadless areas = 30% roadless	100,173
Snowy Range Area		
Roadless #	**Name**	**Acres**
R20615	Pennock Mountain	9,592
R20616	Rock Creek	18,859
R20617	Snowy Range	29,637
R20618	Campbell Lake	7,085
R20619	French Creek	5,924
R20620	Libby Flats	11,082
R20621	Middle Fork	13,232
R20622	Sheep Mountain	17,614
R20623	Savage Run Addition	2,370
R20624	Platte River Addition	7,947
R20625	Illinois Creek	6,707
Subtotal	11 roadless areas = 25% roadless	130,049
Laramie Peak Area		
Roadless #	**Name**	**Acres**
R20626	Soldier Creek	5,989
R20627	Gunnysack	12,881
R20628	Buffalo Peak	17,543
R20629	LaBonte Canyon	16,257
R20630	Laramie Peak	28,577
R20631	Cow Creek Mountain	8,269
Subtotal	6 roadless areas = 50% roadless	89,516
Total Medicine Bow roadless acres	**319,738**	
% of NFS lands on Medicine Bow NF	**29%**	

Source: RACR Medicine Bow National Forest Inventoried Roadless Areas

* Sherman Mountains (Pole Mountain) has no Inventoried Roadless Areas

Map 3-8. Location of Inventoried Roadless Areas – Sierra Madres and Snowy Range.

Map 3-9. Location of Inventoried Roadless Areas – Laramie Range/Sherman Mountains.

Roadless Area Conservation Rule

In January 2001, the Roadless Area Conservation Rule (RACR) was published in the Federal Register. This rule prohibits new road construction and road reconstruction in IRAs on National Forest System lands, except:

- To protect health and safety in cases of an imminent threat of flood, fire, or other catastrophic event that, without intervention, would cause the loss of life or property.
- To conduct environmental clean up required by federal law.
- To allow for reserved or outstanding rights provided for by statue or treaty.
- To prevent irreparable resource damage by an existing road.
- To rectify existing hazardous road conditions.
- Where a road is part of a Federal Aid Highway project.
- Where a road is needed in conjunction with the continuation, extension, or renewal of a mineral lease on lands that are under lease, or for new leases issued immediately upon expiration of an existing lease.

The rule also prohibits cutting, sale, and removal of timber in IRAs (IRA) except:

- For the cutting, sale or removal of generally small diameter trees which maintains or improves roadless characteristics and:
  - To improve habitat for threatened, endangered, proposed, or sensitive species, or
  - To maintain or restore ecosystem composition and structure, such as reducing the risk of uncharacteristic wildfire effects.
- When incidental to the accomplishment of a management activity not otherwise prohibited by this rule.
- For personal or administrative use.
- Where roadless characteristics have been substantially altered in a portion of an IRA due to the construction of a classified road and subsequent timber harvest occurring after the area was designated an IRA and prior to the publication date of this rule.

However, in February 2001, the effective date of the rule was delayed, and the Chief of the Forest Service later issued interim direction on the RACR (FSH 1920-2001-1).

A preliminary injunction order was issued in the Idaho Federal District Court on May 10, 2001, enjoining USDA and the Forest Service from implementing the January 2001 Rule. This order was appealed to the 9th Circuit Court of Appeals and a 2 to 1 split decision was issued on December 12, 2002, reversing the lower court's order. The 9th Circuit was requested to review their decision by the plaintiffs in the Idaho case and declined to do so on April 4, 2003. On April 14, 2003, the

preliminary injunction was officially lifted. On June 14, 2003, Interim Directive 1920-2001-1 expired. In July 2003, US Federal District Court Judge Brimmer of Wyoming issued a permanent injunction against the January 2001 Rule. There continues to be uncertainty about the RACR.

This Medicine Bow Revised Plan is being developed under the 1982 Planning Regulations, 36 CFR Part 219. As directed by 36 CFR 219.17(a), we followed regulation that states, "Unless otherwise provided by law, roadless areas within the National Forest System shall be evaluated and considered for recommendation as potential wilderness areas during the forest planning process as provided in paragraphs (a) (1) and (2) of this section". If the RACR goes into effect and is implemented it will override any agency policy and any management direction in this Plan. The RACR prohibitions will apply within the boundaries of the IRAs published in the November 2000 RACR FEIS.

ENVIRONMENTAL CONSEQUENCES

Direct and Indirect Effects

Areas Determined to be Capable and Available for Wilderness Designation

The Forest Service evaluated each of the 31 IRAs to determine its suitability as potential wilderness.

To be recommended as suitable for wilderness designation, an area must be capable, available, and there must be a need for additional wilderness:

- Capability is the degree to which the area contains environmental characteristics: opportunity for solitude and adventure, outdoor recreation opportunities, special features, and the ability to be managed as wilderness.
- Availability is determined by the value of and need for wilderness compared to the value of and need for other resources.
- Need is determined through public involvement and the need for more wilderness in the general area.

As specified in FSH 1909.12, the Forest Service evaluated each area's capability for wilderness. The Forest Service then evaluated the capable areas for availability. Areas that were both capable and available were then analyzed based on the need for additional wilderness.

Based on the capability rating for the Forest, each of the 31 Forest Service IRAs were found to be capable for wilderness designation. Each of these areas was also determined to be available for wilderness. See FEIS - Appendix C for individual roadless area analyses and determination of capability and availability.

Acres and Areas Recommended for Wilderness Designation

As described above, once capability and availability are determined, the capable and available IRAs are further scrutinized in a needs determination. FEIS Appendix C contains a needs determination for each individual IRA.

There are currently four congressionally designated Wilderness Areas on the Medicine Bow National Forest totaling 78,850 acres. Savage Run Wilderness Area and Platter River Wilderness Area are located in the Medicine Bow Mountains. Encampment River Wilderness Area and Huston Park Wilderness Area are located in the Sierra Madre Mountains.

Roadless areas were allocated to various management areas that differed for each alternative. Management Area 1.2 is the management area that is assigned to those IRAs or portions of the IRAs recommended for wilderness designation. Assigning areas to a Recommended for Wilderness Management Area prescription does not create Wilderness areas. Congress must pass legislation designating Wilderness areas.

Alternatives A, B, and C, have no acres or areas assigned from IRAs to MA 1.2, Recommended Wilderness. Five individual IRAs showing clear evidence of current and future public need for wilderness were allocated to Management Area 1.2 in Alternative D DEIS. Those areas are Little Snake, Huston Park Addition, Encampment River Addition, Rock Creek and Laramie Peak IRAs.

Little Snake and Huston Park Addition areas would each increase the size of the existing Huston Park Wilderness and are part of a site specifically noted for genetically pure populations of the Colorado River Cutthroat Trout. Aspen, wet meadows, and fellfields within these areas contain many uncommon plants.

Encampment River Addition area would increase the size of the existing Encampment River Wilderness Area and add the headwaters of creeks that are now outside a protected area. Currently, activities in the headwaters could compromise the water quality of downstream stretches. Inclusion of these headwaters would create a more logical ecological unit for both aquatic and terrestrial species.

The Rock Creek area has been the focus of local, national and international interest. This area is one of the most primitive areas on the forest. It is on the north end of the Medicine Bow Mountain Range just south of Interstate 80 with reasonable access from Casper, Laramie and Cheyenne, which account for the highest concentration of people in the State of Wyoming. The Forest Supervisor has received a petition signed by organizations and individuals, thousands of signed postcards and personal letters and emails requesting that the Rock Creek area be recommended for wilderness. In a 1998 survey of county residents, 45% of the Albany county respondents desired wilderness designation in the next ten years. (University of Wyoming 1998) Laramie is located in Albany County. The only known remaining sites with boreal toads, a Region 2 sensitive species, are located in this area.

Laramie Peak area overlaps the Ashenfelder Basin, noted for Laramie columbines and other sensitive plants too many to list, and for four rare low-elevation ponderosa pine community types.

Portions of four of the five areas were recommended in Alternative D FEIS. Portions of two of the five areas were recommended in Alternative E. Alternative F includes approximately 271,000 acres of the forest in Management Area 1.2, Recommended Wilderness. These areas include portions of acreage from 30 of the Forest Service IRAs, additional acres added to some of those roadless areas and two new areas, Battle Mountain and Vedauwoo.

The following table identifies agency-inventoried roadless acres and portions of IRAs that are recommended for wilderness in those alternatives that recommend NFS lands for wilderness designation.

Table 3-112. Inventoried Roadless Areas and acres recommended for wilderness. *

Inventoried Roadless Areas	Inventory Acres	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Strawberry Creek	5,876				4,027
Singer Peak	10,491				10,491
Big Sandstone	7,170				7,171
Little Sandstone	5,481				5,481
Battle Creek	5,894				5,894
Little Snake	9,920	6,594	3,956		8,858
Solomon Creek	5,756				5,726
Deep Creek	6,411				1,606
Bridger Peak	6,694				6,694
Mowry Peak	6,241				6,241
Huston Park Addition	8,401	3,108	4,127	498	8,383
Encampment River Addition	4,983	3,698	2,349	4,055	4,623
East Fork Encampment	7,429				4,100
Bear Mountain	9,426				9,426
Pennock Mountain	9,592				9,592
Rock Creek	18,859	18,859	17,530		11,358
Snowy Range	29,637				18,674
Campbell Lake	7,085				7,085
French Creek	5,924				5,924
Libby Flats	10,183				10,183
Middle Fork	13,232				12,662
Sheep Mountain	17,614				
Savage Run Addition	2,370				2,307
Platte River Addition	7,947				7,821
Illinois Creek	6,707				6,690
Soldier Creek	5,989				5,989
Gunnysack	12,881				12,881
Buffalo Peak	17,543				17,541
LaBonte Canyon	16,257				16,257
Laramie Peak	28,577	28,577			16,571
Cow Creek Mountain	8,269				8,269
Total		60,836	27,963	4,553	254,497

** Acres of individual roadless areas added together are within 1 percent of total recommended wilderness acres for that alternative.*

Alternative D DEIS recommends 60,836 acres from five IRAs for wilderness designation. Alternative D FEIS recommends 27,963 acres from four IRAs. Alternative E recommends 4553 acres from two IRAs. Alternative F recommends 254,497 acres from 30 agency IRAs and an additional 16,860 acres from NFS lands not included in the agency inventory of roadless areas. Those additional acres not included in the agency inventory occur on the following mountains: Sierra Madre (7006 acres), Medicine Bow Mountains (2373), Sherman Mountains or Pole Mountain (7026), and Laramie Peak Unit (579 acres).

The map on the following page displays Alternative D (FEIS) – Inventoried Roadless Acres recommended for wilderness.

Map 3-10. Existing and recommended wilderness in Alternative D FEIS.

The table below shows the roadless acreages assigned to each management area by alternative. To review a specific roadless area for its management area allocation by alternative, see EIS-Appendix C.

Table 3-113. Inventoried Roadless Area acres by management prescription for each alternative.

Mgmt RX	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
1.2				60,836	27,963	4,553	254,497*
1.31			8,164	38,981	52,314	19,196	
1.33		45,286	104,076	86,596	64,547	64,590	
1.41							4,027
1.5		395				395	
2.1	3,720	8,115	1,130	14,215	11,239	3,843	521
2.2	728	728	728	728	4,167	25,135	28,464
3.24							7,456
3.31		55,067	74,868	22,849	48,599	15,913	
3.32	46,950		1,488				
3.33			3,265				
3.4		554	189	574	574	3,525	621
3.5		1,627	945	43,584	42,281	143,384	
3.51						1,408	
3.54	5,352	17,614	17,614	17,614	16,826	4,032	17,614
3.56	30,759	12,892	3,599	1,143	6,752		
3.58		5,804	1,620	12,401	12,775	11,631	1,283
4.2		4,010	160	90	42	1,058	174
4.22	10,481						
4.3			11,850		9		
4.31	64,891						
5.11		227					
5.12	12,229	52,922	17,402		337		
5.13	37,897	72,936	19,788	2,326	1,459	19	
5.15		27,672	36,599	8,159	15,527	3,882	
5.21	3,665						
5.4	68,207						4,864
5.41	34,386	12,274	14,643	8,034	14,225	16,958	
5.42		1,395	1,393	1,393			
8.21	322	164	164	164	41	164	164
8.6	47	47	47	47	47	47	47

Source: GIS

** Alternative F includes 254,497 recommended wilderness from IRAs plus acres outside of agency inventoried wilderness for a total of 271,357 recommended wilderness.*

In the DEIS, the analysis of intended management in IRAs was grouped into two categories: 1) those acres that would retain roadless characteristics and 2) those acres

that would not retain roadless characteristics. With the release of the RACR, the analysis needed to incorporate a consistency test with the new rule. Therefore, this analysis will disclose acres that retain roadless characteristics, those that do not AND acres that are consistent with the RACR.

In an effort to disclose how alternatives vary in consistency with the RACR and whether roadless characteristics were retained or not retained, we grouped management areas into three categories:

- Category 1 - Permit actions that will not retain roadless characteristics,
- Category 2 - Permit actions that will retain roadless characteristics and are consistent with the prohibitions of the RACR that has been set aside by the Court, and
- Category 3 - Permit actions that retain roadless characteristics but are inconsistent with prohibitions of the RACR that has been set aside by the Court.

The management areas are assigned to categories. The management area allocations themselves will not directly affect the character of these roadless areas until a planned management activity (e.g. road construction, vegetative treatment) is scheduled and implemented.

These categories were developed from the desired condition statements, standards and guidelines, and overall management emphasis for each management area allocation. Category 1 Permit actions that will not retain roadless characteristics. Category 2 Permit actions that will retain roadless characteristics and are consistent with the prohibitions of the RACR that has been set aside by the Court. Category 3 Permits actions that retain roadless characteristics but are inconsistent with prohibitions of the RACR that has been set aside by the Court. In some cases, management area prescriptions allow activities which may be inconsistent with the prohibitions of the RACR, but do not schedule activities during the life of the Plan, so the Management Area could remain consistent with the RACR for the life of the Plan. For example, in Management Area Prescription 5.41 - Deer and Elk Winter Range, road construction and reconstruction are permitted, but may not be necessary over the life of the Plan, so it allows an action that is inconsistent with the prohibitions of the RACR, but if that action never takes place, the RACR is followed and the roadless character is retained. Management Area 5.41 is assigned to Category 3.

Table 3-114. Management areas - assignments to Categories 1, 2. and 3.

Category	Management Areas
Category 1 - Permit actions that will not retain roadless characteristics	5.11, 5.13, 5.15, 5.21, 5.4, 8.21, 8.22, 8.3, 8.6
Category 2 - Permit actions that will retain roadless characteristics and are consistent with the prohibitions of the RACR that has been set aside by the Court,	1.13,1.2, 1.31, 1.33, 1.41, 1.5, 2.1*, 2.2, 3.24, 3.21, 3.31, 3.54, 3.57,
Category 3 - Permit actions that retain roadless characteristics but are inconsistent with prohibitions of the RACR that has been set aside by the Court.	2.1*, 3.32, 3.33, 3.4, 3.5, 3.51, 3.56, 3.58, 4.2, 4.22, 4.3, 4.31, 5.12, 5.41, 5.42

* Management Area 2.1 (Special Interest Areas) varies for each area. Proposed Special Interest Areas Ashenfelder, Dry Park, Libby Flats Ribbon Forest, Sunken Gardens, Ribbon Forest, Platte Canyon, Many Ponds and Kettle Ponds are consistent with the RACR and are assigned to Category 2. The remaining proposed Special Interest Areas are assigned to Category 3.

The following table displays how each alternative allocates the IRAs to Categories 1, 2 and 3.

Table 3-115. Inventoried Roadless Areas: acres allocated to Categories 1, 2 and 3 for each alternative.

Category	Acres/ Percent	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F*
1	Acres	110,206	101,048	56,599	10,696	17,075	4,113	5,076
	Percent	34	32	18	3	5	1	2
2	Acres	8,709	126,078	205,451	232,397	220,370	134,910	312,576
	Percent	3	39	64	73	69	42	98
3	Acres	200,818	92,607	57,683	76,640	82,280	180,710	2,081
	Percent	63	29	18	24	26	57	<1

Source: GIS (ARC/Info), roadless inventory and allocation layers

** Alt F contains public-proposed recommended wilderness acres that are not part of the FS Inventoried Roadless Areas. Under Alt F, Those additional 17,000 acres on the four subunits of the Forest are Consistent with the prohibitions of theRACR or fall into Category 2.*

In order of most acres consistent with the prohibitions of the RACR to fewest acres consistent the alternatives are: F, D DEIS, D FEIS, C, E, B, A. In order of most acres that retain roadless characteristics to least acres that retain roadless characteristics, the alternatives are: E, F, D DEIS, D FEIS, C, B, and A.

Maps entitled Management in Inventoried Roadless Areas for Alternative D (FEIS) – Sierra Madres, Snowy Range and Laramie Peak are located on the following pages.

Map 3-11. Management in Inventoried Roadless Areas for Alternative D (FEIS) Sierra Madres.

Map 3-12. Management in Inventoried Roadless Areas for Alternative D (FEIS) Snowy Range.

Map 3-13 Management in Inventoried Roadless Areas for Alternative D (FEIS) Laramie Peak.

The individual Forest Service inventoried roadless areas that will retain roadless characteristics for the entire inventoried area for each alternative are listed in the following table.

Table 3-116. Inventoried Roadless Areas that will retain roadless characteristics for the entire inventoried area for each alternative.

Inventoried Roadless Areas	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Strawberry Creek				X	X		X
Singer Peak		X			X		X
Big Sandstone						X	X
Little Sandstone			X	X	X	X	X
Battle Creek		X	X	X	X		X
Little Snake			X	X	X	X	X
Solomon Creek					X	X	X
Deep Creek				X			X
Bridger Peak			X	X	X	X	X
Mowry Peak				X	X		X
Huston Park Addition							X
Encampment River Addition							X
East Fork Encampment				X	X	X	X
Bear Mountain			X	X	X	X	X
Pennock Mountain			X		X	X	X
Rock Creek				X			X
Snowy Range							
Campbell Lake		X		X	X	X	X
French Creek				X	X	X	X
Libby Flats							
Middle Fork							
Sheep Mountain	X	X	X	X	X	X	X
Savage Run Addition							X
Platte River Addition			X			X	X
Illinois Creek							
Soldier Creek	X	X	X	X	X	X	X
Gunnysack	X	X	X	X	X	X	X
Buffalo Peak	X	X	X	X	X	X	X
LaBonte Canyon		X	X	X		X	X
Laramie Peak			X	X	X	X	
Cow Creek Mountain		X	X	X	X	X	X
Approximate Acres	51,000	102,000	162,000	200,000	186,000	190,000	230,000
Number of Areas	4	9	14	19	19	18	27

Effects from Fire and Fuels Management

Roaded accessibility has advantages and disadvantages in terms of roadless areas and fire suppression. While roaded access to an area increases the risk of human-caused ignition, the same roads provide access to ground-based fire fighting personnel and equipment, aiding in shorter response times and providing access during extended attack. Currently, the Forest Service provides only ground-based initial attack forces

on the Forest. At certain times of the year, depending upon the severity of the fire season, air attack is available through helicopters and smoke jumpers. These air resources are available for initial attack on a case-by-case basis. The 31 IRAs were inventoried recently. There are no classified roads in 30% of the Sierra Madre Mountain, 25% of the Medicine Bow Mountains and 50% of the Laramie Peak Unit. In most cases, the roadless areas are smaller, are surrounded by areas that do have roads and access for suppression purposes has not been a large problem. The Laramie Peak area is larger at 28,000 acres and access is poor because it is too steep and rocky to consider for road building. We will continue to mitigate roaded access with air resources if necessary.

Fuels treatment is allowed in roadless areas. Wildland fire use may or may not be applicable in a roadless area. Wildland fire use may be appropriate if the roadless area is large enough itself and is assigned management areas that permit wildland fire use. Wildland fire use may be applicable if it would build on an existing area where wildland fire use was planned. An example of such an area may be recommended wilderness area.

Effects from Insects and Disease Management

Insect and disease occurrences are natural events that may cause tree distress and even mortality if the outbreaks are severe. Management Areas that permit easy access to outbreaks and schedule vegetative management are likely to result in areas where mortality can be limited through active management. Alternatives that are likely to limit mortality the most are those in Category 1. The order of alternatives from those that most limit mortality to those that least limit mortality is: A, B, C, D FEIS, D DEIS, F and E.

Effects from Oil, Gas and Minerals Management

Alternatives D DEIS, D FEIS, E and F include acres allocated to No Surface Occupancy (NSO) stipulation and fall within the moderate or low oil and gas resource potential areas. In this management area oil and gas leasing is allowed, but no surface occupancy or use is permitted. Alternative F has the most acres with the NSO stipulation allocated to this management area, followed by E, D DEIS, D FEIS. Alternatives A, B, and C have no acres allocated to MA 1.2 with the NSO stipulation.

In areas currently exhibiting roadless characteristics allocated to management areas allowing roads and motorized activities, oil, gas and minerals activities could change the roadless character of the area. In areas currently exhibiting roadless characteristics allocated to management areas not administratively available (MA 1.13 and 2.2), or available but where no surface occupancy or use is allowed (MA 1.2, 1.31, 1.33,1.41, 1.5, 2.2, 3.21, 3.24, 3.31, 3.33, 3.4, 3.54, 3.57, 8.21, 8.22, 8.6) roadless characteristics would not be impacted by oil and gas activities.

The projected level of oil and gas activity within roadless areas is low and therefore any effects from oil and gas on roadless areas are very small.

Effects from Livestock Grazing and Big Game Use

Livestock grazing is permitted in all management areas including congressionally designated Wilderness Areas, areas recommended for wilderness designation, research natural areas, and special interest areas. While grazing is permitted in all management areas, there are some restrictions on establishing developments in 1.2, 2.1 and 2.2. Management Areas 1.2, 2.1 and 2.2 contain standards and guidelines that will minimize the affects of livestock grazing that are incompatible with the major emphasis of those management areas. Alternative F has the greatest number of acres allocated to those management areas followed in descending order by D DEIS, D FEIS, E, B, A and C.

Big Game use occurs throughout the forest and Management Area 3.58 is established as crucial winter range. Deer and elk may be in high concentrations in those areas when snow cover reduces the food supply at higher elevations and the big game migrate to those lower elevation, less snow covered areas. High winter use can cause short term adverse impacts to vegetation in those areas. Alternative D FEIS has the greatest number of acres allocated to 3.58 followed by D DEIS, E, B, C, F and A.

Effects from Recreation Management

Areas that are recommended for wilderness will be managed to permit current uses if those uses do not foreclose on designating them as wilderness over the life of the Plan. Opportunities for primitive and nonmotorized recreation will be found in roadless areas recommended for wilderness designation. These areas provide the best opportunities for solitude and lack of human developments. Alternative F would provide the most additional opportunities for these types of experiences, followed by Alternatives D DEIS, D FEIS, and E. Alternative A, B, and C, provide no additional lands that would be managed for recommended wilderness.

Roadless areas that are assigned other management areas will be managed for the recreation opportunities appropriate to the assigned management areas. Management Area direction specifies motorized or non-motorized opportunities in winter and in summer. Winter motorized activities include snowmobiling, while summer motorized activities include on-road vehicle use and ORV use on designated roads and trails. Winter non-motorized activities include cross-country skiing, snowshoeing, and downhill sledding. Summer non-motorized activities include hiking and biking. Winter non-motorized opportunities occur to the greatest in Alternative F, followed in descending order by D DEIS, D FEIS, E, C, B, and A. Summer non-motorized opportunities occur to the greatest extent in Alternative F, followed in descending order by D DEIS, D FEIS, C, E, B and A.

Effects from Timber Management

Timber management on lands classified as suitable for timber production is scheduled in four Management Areas: 5.11, 5.13, 5.15, and 5.21. IRAs or portions of areas assigned to any of those management areas would be affected by timber management.

Alternative A contains the most inventoried roadless acres allocated to timber management prescriptions (232,157 acres), followed by B (100,835 acres), C (57,875 acres), D FEIS (16,986 acres), D DEIS (10,484 acres), F (4864 acres) and E (3901 acres).

Effects from Travel Management

Roadless areas may have a variety of travel opportunities depending on the management area assigned. Management prescriptions that do not allow motorized use now, and do not allow road construction would affect roadless areas the least, thus alternatives that contain more of those management areas would have the least effect on roadless areas. Alternative F, followed by E, D DEIS and D FEIS would have the most management prescriptions that do not allow additional road building. Alternative B, followed by Alternatives A, and C would have the greatest amount of acres that allow road building.

Cumulative Effects

This analysis considers IRAs and their management direction on the entire administrative unit of the Medicine Bow-Routt National Forests and Thunder Basin National Grassland. The Routt National Forest and Thunder Basin National Grassland Land and Resource Management Plans (LRMPs) were revised in 1998 and 2002, respectively. The Routt NF has 502,000 acres of IRA's and the Thunder Basin National Grassland has 59,000 acres of IRAs. Since the Medicine Bow NF has approximately 320,000 acres of IRAs, the total IRAs on the administrative unit, managed by three LRMPs, are approximately 881,000 acres.

There is no road building permitted on 279,000 acres of the Routt IRA's and no road building permitted on all 59,000 acres of the Thunder Basin inventoried acres except when there are existing rights, treaty rights or statute that permits road building. Total inventoried roadless acres with no roadbuilding on all three planning units based on alternatives will be: A- 347,000 acres; B - 464,000 acres; C – 543,000 acres; D DEIS – 570,000 acres; D FEIS – 558,000 acres; E – 473,000 acres; and F- 651,000 acres.

This analysis also considers areas recommended for wilderness on other National Forests in Wyoming, nearby forests in Colorado and on Bureau of Land Management (BLM) lands adjacent to the Medicine Bow National Forest. Neither the Routt Revised Plan nor the Thunder Basin Revised Plan recommends wilderness

areas. The Revised Plan for the Arapahoe Roosevelt NF in northern Colorado recommends 8,810 acres for wilderness.

Located just two miles south of Encampment, Wyoming, and easily accessible from the BLM's Encampment River Campground, The Encampment River Canyon 4,547-acre Wilderness Study Area (WSA) contains grasslands, riparian areas, and forested slopes. All 4,547 acres of this WSA were recommended for wilderness status in the 1992 report to Congress. This area is a northerly continuation of the approximately 10,000-acre Encampment River Wilderness Area on NFS lands that was designated by Congress in the Wyoming Wilderness Act of 1984.

Each alternative that recommends wilderness proposes additions to the Encampment River Wilderness Area, but in differing amounts. The cumulative effect of the alternatives that recommend additions to the Encampment River Wilderness Area along with the BLM study area would result in the following additions: D DEIS (8245 acres), D FEIS (6896 acres), E (8602 acres) and F (9170 acres).

The final cumulative effects analysis focuses on how the alternatives will affect the amount of wilderness in Wyoming should an alternative that recommends wilderness be selected. There are 3,111,232 acres of designated Wilderness Areas on NFS lands in Wyoming. That constitutes approximately 33% of the total NFS lands in the state, the highest percentage of NFS lands for any state. The Medicine Bow has approximately 78,000 acres of designated Wilderness Areas or 7% of the total NFS lands on the Forest. Over the next 15 years, it is possible that Congress could consider designating additional wilderness areas on the Medicine Bow National Forest as recommended by the revised plan.

Depending upon the alternative, the change in designated wilderness in Wyoming could range from an additional 0 acres to 271,000 acres. That range of results would be from no change in alternatives A, B and C to an increase of as much as much as 3% in Alternative F or up to 36% of total NFS lands in Wyoming designated as Wilderness.

Special Interest Areas

Introduction – Special Interest Areas (SIAs) are managed with emphasis on protecting or enhancing areas of unusual characteristics. These areas are managed to maintain their special interest values. SIAs are designated as botanical, geological, historical, paleontological, scenic, or zoological. They can be designated to protect and manage threatened, endangered, and sensitive (TES) species habitats and other elements of biological diversity. They can also be managed for their emotional significance, scenic values, or public popularity. SIAs range from small to large areas.

Legal and Administrative Framework

In the forest plan, management area prescriptions establish direction for future activities in designated areas (36 CFR 219.11 (c)). Special Interest Areas are one kind of management area. They are managed to maintain the values that make them unique.

Forest Service Manual, Title 2360 - provides specific direction concerning establishment and management of SIAs. Forest planning may be one means for establishment.

Key Indicators

- Acres and location of SIAs.

AFFECTED ENVIRONMENT

There are 6 existing SIAs totaling 4,306 acres and 21 potential SIAs totaling 83,068. The following table lists the SIAs and their acreages and unique features.

Table 3-117 Existing and proposed SIAs on the Medicine Bow National Forest.

Name	District	Unique Features	Acres
1985 Plan SIAs			
Ashenfelder	DGL	Botanical, natural area	2,099
Cinnabar Park	LRD	Botanical	204
Dry Park	LRD	Botanical	91
Gambel Oak on Battle Mountain	BCH	Botanical	270
Libby Flats Ribbon Forest	BCH/LRD	Geologic, botanical	492
Medicine Bow Peak	BCH	Botanical	1,150
Proposed SIAs			
White Rock Canyon	BCH	Geologic, zoological, scenic	684
Kettle Ponds	BCH	Geologic, botanical, zoological	9,111

Name	District	Unique Features	Acres
West Barrett	BCH	Geologic, botanical, zoological	9,586
East Holroyd	BCH	Zoological	2,702
Commissary Park	BCH	Zoological	133
Tramway Trail	BCH	Historical	1,050
Cottonwood Rim	BCH	Botanical, scenic	7,422
High Alpine Snowy Range/Libby Flats	BCH/LRD	Geologic, botanical, historical, scenic	24,025
Roper Cabin	LRD	Historical	65
Douglas Creek Tie Dam	LRD	Historical	3
Horse Creek Tie Dam	LRD	Historical	7
Muddy Park Tie Dam	LRD	Historical	20
Sunken Gardens	LRD	Botanical, scenic	236
Rainbow End	LRD	Historical, scenic	8
Centennial Ridge	LRD	Historical	4,628
Ribbon Forest	LRD/BCH	Botanical, geological, zoological, scenic, research	4,350
Platte Canyon**	LRD/BCH	Botanical	11,857
Big Sandstone**	BCH	Botanical	4,657
Battle Mountain**	BCH	Botanical	1,319
Many Ponds*	LRD	Botanical	899
Rudefeha*	BCH	Historical	306

*public proposed **originally proposed as RNAs

Note: Acreages for the individual SIAs vary slightly from the land allocation summaries in Chapter 2 of the DEIS due to GIS source coverages.

Resource Protection Measures

Forestwide, Management Area 2.1, and SIA specific standards and guidelines protect the values for which each SIA was recommended for designation.

The following map shows the potential SIAs on the Forest.

Map 3-14. Potential Special Interest Areas on the Medicine Bow National Forest.

Proposed and Existing Special Interest Areas on the Medicine Bow National Forest

Ashenfelder

This area is proposed for SIA designation because of its botanical and other (natural area) values. This area is a natural area practically untouched by humans. It is a rugged, highly scenic, non-motorized area. The area has large stands of ponderosa pine that have been devastated by beetles and fire. The riparian areas are in prime shape and condition. The naturalness of the area is what makes it unique.

Cinnabar Park

The largest, most puzzling mountain meadow in the Medicine Bow National Forest is Cinnabar Park. Like Dry Park, its origin is still not fully understood even though at least three studies have attempted to develop an explanation. The forest/meadow boundaries are sharp; there is little or no evidence of tree invasion. The value of this area for research and education is increased by the presence of, arguably, the world's longest ribbon forest and snowglade on the leeward side of the Park, and by a burned forest (1975) of about 40 acres on the upwind side. Because of the ribbon forest/snowglade complex, the recent burn, and Cinnabar Park itself, this area is of great interest to students from nearby universities and from people around the world.

Dry Park

Dry Park and the surrounding forests have been of interest to scientists for many years. Like Cinnabar Park and a few others in the Medicine Bow Mountains, the cause of this treeless park is still a puzzle. Trees do grow in the livestock exclosures in the middle of the park, initially suggesting that livestock grazing was the explanation. However, sources indicate that the trees were planted in the exclosures as young saplings. They did not become established from surrounding seed sources. Trees are not invading elsewhere in the Park. In addition to the cause of Dry Park, there is a small snowglade on the east end, near a very scenic overlook of the Centennial Valley. On the west end of Dry Park is a classic doghair stand of lodgepole pine, the apparent result of an abundance of seed shortly after the last fire (which probably burned a stand dominated by serotinous trees) and ideal climatic conditions for lodgepole pine seedling establishment in the first year or two after the fire. This doghair stand is an easily accessible example of this very natural forest type. This location is extremely valuable for educational purposes.

Gambel Oak on Battle Mountain

This area is proposed for SIA designation because of its unique plant communities. Gambel oak on the Sierra Madre represents the northernmost extension of this

species' range in the Rocky Mountains. From an aesthetic standpoint, oak adds a great deal of interest to the fall scenery with its brilliant orange foliage.

Libby Flats Ribbon Forest

This area is proposed for SIA designation because of its botanical and geological values. The ribbon forests are apparently a product of the interaction between wind and snow in a high elevation subalpine environment. Trees in the ribbon forest are aligned perpendicular to the prevailing westerly winds and function as snow fences. Heavy snow accumulations typically inhibit seedling establishment on the lee sides of the tree rows while the snowmelt enhances tree growth within the ribbons.

Medicine Bow Peak

This area is recommended as a special interest area because of its botanical values. It is the best example of alpine tundra in the Medicine Bow National Forest. Located at T16, R79, sections 17 and 18, it contains the unusual and rare species *Carex arapahoensis*, *Agrostis borealis*, *Chionophila jamesii*, and *Haplopappus pygmaeus*.

White Rock Canyon

This area is proposed for designation because of its geologic, scenic and wildlife values. The area is located in the northern portion of the Snowy Range, eight miles southwest of Arlington, WY. The area contains steep sandstone cliffs and outcroppings. The area is important to recreationists for the scenic views of Elk Mountain and the high plains to the north. The area's vegetation ranges from sagebrush communities to mountain shrub communities to coniferous forests. Because of this habitat mix the area can support a wide range of wildlife species.

Kettle Ponds

This area is proposed for SIA designation because of its geological, botanical, and zoological values. Most of the kettle ponds in the district are located in the Stillwater Park/Long Lake area and immediately west of Turpin Reservoir; both of these areas are situated in the Medicine Bow Mountains at elevations that range from 9,000 feet to approximately 9,500 feet. The kettle ponds are glacial relics that complement other glacial features that exist in this portion of the Medicine Bows. In addition, the most abundant populations of wood frogs - an R2 sensitive amphibian - extant in the Medicine Bow Mountains are found in the kettle pond area. Indian pond lily (*Nuphar* sp.), a strikingly beautiful, flowering aquatic plant is more abundant in the Kettle pond area than in any other location in the Forest. The kettle pond area supports diverse aquatic floral and faunal communities and constitutes what is likely the most densely populated lentic (pond) habitat in the Medicine Bow Mountains in Wyoming.

West Barrett

This area is proposed for designation for its botanical, zoological, and geological values. Located at the lower forested elevations on the western slope of Barrett Ridge and the Snowy Range, the West Barrett area supports a highly diverse mix of montane and subalpine plant communities. This area contains the highest concentrations of ponderosa pine within the Snowy Range. Currently, ponderosa pine dominates less than one half percent of the forest stands on the western slope of the Snowy Range. Though common in the Laramie Range portion of the Forest, a number of natural and human-related factors including: climatic change, elevation, growing season, control of fire, and early day logging-- have contributed to limit the amount of present day ponderosa pine stands. Along with ponderosa pine, the West Barrett has unique pure stands of Douglas-fir. The geomorphology of the area is unique. Unlike much of the rest of the Snowy Range, there has been little if any effects from past glaciation in the area. Made up of igneous rock the area has a different geologic parent material than the characteristic metamorphic rock which makes up the bulk of the Snowy Range.

East Holroyd

This area is proposed for designation for its botanical and zoological values. Located at the lower forested elevations on the eastern slope of the Sierra Madre Range to the east of Holroyd Park, the East Holroyd area supports a highly diverse mix of montane and subalpine plant communities. This area contains the highest concentration of Ponderosa pine within the Sierra Madre Range. Currently, ponderosa pine dominates less than one half percent of the forested stands within the Sierra Madre. Though common in the Laramie Range portion of the Forest, a number of natural and human-related factors including: climatic change, elevation, growing season, control of fire, and early day logging--have contributed to limit the amount of present day ponderosa pine stands. Along with ponderosa pine, the East Holroyd area has unique stands of Douglas-fir.

Commissary Park

The area is located within the Sierra Madre Mountains approximately 30 miles south of the town of Encampment WY, along the WY/CO state line. A portion of this area is in Colorado, and was proposed as a Special Interest Area in the Routt National Forest, Forest Plan Revision. Vegetation is dominated by grasses, lodgepole pines, subalpine fir, Engelmann spruce, and groves of aspen. Besides its scenic beauty and diversity of vegetation and wildlife, the area is special for its cultural resources. There are approximately 34 historic sites and several prehistoric sites within the area. Seventeen of the historic sites and one prehistoric site are eligible for nomination to the National Register of Historic Places. Also historically important is the East Fork Encampment Trail. This trail was the primary transportation route which tied together the many logging camps in the area. The historic properties recorded in the

area and the trail are related to the theme of historic Tie Hack logging and constitute a historic landscape which could be nominated to the National Register of Historic Places as a Historic District.

Tramway Trail

This area is proposed for designation because of historic copper mining. In 1884 copper was discovered west of Encampment, Wyoming in the Sierra Madre Mountains. There was an aerial tramway 16 miles in length that carried copper ore from the Ferris-Haggarty mine to a smelter in Encampment. The mine and many of the tram towers and equipment are still visible.

Cottonwood Rim

This area was recommended as an SIA because of its habitat for the Columbian sharp-tailed grouse. Gambel oak on the Sierra Madre represents the northernmost extension of this species' range in the Rocky Mountains. Here it occurs in mixed communities with aspen, serviceberry, chokecherry, and sagebrush. It is a fire-adapted species that sprouts well after burns, and it provides good hiding cover for a variety of wildlife species. Though not a premier browse species, it provides some forage for mule deer. Its acorn crop is too inconsistent to be a staple wildlife food, but it is utilized by rodents, mule deer, and black bears. From an aesthetic standpoint, the oak adds a great deal of interest to the fall scenery with its brilliant orange foliage.

High Alpine Snowy Range

This area is proposed for designation because of its geologic, botanical, Historical, Scenic and other-recreational values. The area is highly scenic with unique alpine tundra, and mountain scenery. It is mostly a non-motorized area and provides for a backcountry experience, but also contains motorized routes for access points. The area contains many recreational trails, trailheads, campgrounds, and dispersed camping sites. There are many small high elevation lakes within the area that provide for a unique recreational experience. Many historic values lie in the area including portions of 3 historic mining districts, the first fire lookout in the Rocky Mountain region, historic grazing and trailing of livestock, and part of an old CCC road (Towner Lake) that was the first to cross the range.

Roper Cabin

The Roper Place (also called Echo Lodge) is the oldest lodge on the Medicine Bow National Forest. It is located approximately five miles south of Keystone, Albany County, Wyoming; in the SE 1/4 of Section 3 and the NE 1/4 of Section 10, T.14N., R.79W. The site covers an area of approximately 60 acres. The site contains one barn, one lodge, four cabins, one skid shack, four privies, one grave site, one earthen dam and associated canal system, several prospect pits and scattered debris. The

buildings display a variety of construction types—fitted 4" x 4" and 4" x 6" timbers, hewn log, and tarpaper covered lumber.

Douglas Creek, Horse Creek, and Muddy Park Tie Dams

There are 3 (Muddy Park, Horse Creek, Upper Douglas Creek) standing tie or splash dams located on the Laramie Ranger District. All three dams are in excellent condition with only minor breaches. The dams were designed, constructed, and operated by local woodsmen in the early 1920s. The dams were constructed at the headwaters of their respective streams creating a reservoir of water. Concurrently with the melting of the winter accumulation of snow and the spring rains, the dams were opened at their gates to flush the streams below. On this elevated and swifter current of water, the crossties and logs were driven (floated) downstream to Douglas Creek and Platte River to the railhead at Fort Fred Steele. The dams were filled and opened several times during the driving season. Local materials were also used to construct the dams. The cribbed headgates were constructed with round logs filled with boulders and rocks. The sluiceway was controlled with a lift gate. The wings of the dam were constructed with round log posts and braces sheathed with wooden slabs (board and batten) and the face was then covered with five to six feet of dirt.

Sunken Gardens

This area is recommended because of its botanical and scenic values. A very wet drainage containing numerous small ponds surrounded by willow shrubs and scattered Aspen, Subalpine Fir, Engelmann Spruce and Lodgepole Pine. National Forest System Road 517 provides access to the southern boundary of the drainage and provides a wonderful view into the Centennial Valley looking north.

Rainbow End

This area is proposed for SIA designation because of its historical and scenic values. The area, a group of cabins, is a historic guest ranch on the North Laramie River. T.26N., R.71W., sec 27. It was the first guest ranch in the area and is currently being evaluated by SHPO because of its historic values.

Centennial Ridge

This area is recommended because of its historical values. The gold rush on Centennial Ridge began in late 1874, with the first claims staked on January 1, 1875. A stamp mill and tramway were in operation at the site by fall of 1875, and a post office and polling place soon followed. Eventually, a hotel, dining hall, and a stage line were established, followed by cabins, a boarding house, store, stables, and a blacksmith's shop. However, the initial discovery of gold proved rich, but limited, and by August of 1877, the stamp mill was moved to Cummins City (later called Jelm). The only mines which produced gold in any quantity were the Centennial, Utopia, and BillyWaters mines.

A second rush of mining activity occurred in the 1920s with prospector's looking for platinum and palladium. Several new mines included the Queen, Cliff, Columbine, and Empire mines. Hullsville and Platinum City were among the mining camps or towns established at that time. To this day, mining continues on Centennial Ridge - primarily recreational mining, but occasional commercial exploration is undertaken.

Several small mining towns are located on both public and private land within the Medicine Bow National Forest. However, little physical evidence remains. Centennial Ridge is an exception. Many of the mining camps on the ridge contain standing structures, as well as abandoned mining equipment. The area is unique in that many of the structures are in remarkably good condition or contain many elements missing in camps found in other parts of the Forest.

Ribbon Forest

This area is proposed for its geological, botanical, zoological, research, and scenic values. The Ribbon Forest potential SIA occupies approximately 4,350 National Forest acres in the Snowy Range on the Laramie Ranger District. Elevations in the area range from 10,200 feet at the northern boundary to 11,100 feet along portions of the southern boundary. The area occurs mostly in Precambrian metamorphic rock and glacial deposits. The SIA is somewhat isolated in rugged backcountry mountains. It has received only minimal impacts and disturbance from human activities (hiking, dispersed camping, hunting, and recent sheep grazing). Important features of the area include old growth Engelmann spruce-subalpine fir forests and bands of ribbon forests with an Engelmann spruce overstory and grouse whortleberry understory. Both forested types are scattered among a mosaic of subalpine meadows, wetlands and grasslands. Trees within the ribbons often have a 'krummholz" appearance. The ribbon forests are apparently a product of the interaction between wind and snow in a high elevation subalpine environment. Trees in the ribbon forest are aligned perpendicular to the prevailing westerly winds and function as snow fences. Heavy snow accumulations typically inhibit seedling establishment on the lee sides of the tree rows while the snowmelt enhances tree growth within the ribbons. The snow glades between the ribbons commonly have a parry clover/alpine avens plant association. The ribbon forests in the area represent some of the oldest forests in the Snowy Range, with trees dating from 150 to 300 years old. Two state designated-rare plant species, little sedge (*Carex magellanica*) and black-head fleabane (*Erigeron melanocephalus*), are known from the area. Potential habitat may occur for three Forest Service Region 2 sensitive species including the boreal toad (*Bufo boreas boreas*), wood frog (*Rana sylvatica*), and Canada lynx (*Lynx canadensis*). One state designated-rare animal species, the Medicine Bow Mountain pika (*Ochotona princeps saxatilis*), is known to occur in the area.

Platte Canyon (originally proposed as an RNA)

This area is ecologically diverse. It contains a wide range of grassland, shrubland, riparian, and montane forest ecosystem types.

Big Sandstone (originally proposed as an RNA)

This area is located in the Sierra Madre Mountains and contains aspen, sagebrush, and grassland ecosystem types.

Battle Mountain (originally proposed as an RNA)

This small area occurs in the North-Central Highlands and Rocky Mountain Section (M331H). All of the 8 plant associations found in the area, though relatively small in acreage, are in good condition.

Many Ponds (public proposed)

This area offers outstanding examples of beaver ponds and their ecological effects, and features habitat for saffron groundsel and the western boreal toad (WYNDD 1995f), a Region 2 Sensitive Species. The landscape of low but steep granite hills and isolated pockets of wetlands in the valleys also offers outstanding scenic resources.

Rudefeha (public proposed)

This proposed SIA encompasses the old Ferris-Haggarty copper mine and the associated aerial tramway that linked the mine with smelters in Encampment.

ENVIRONMENTAL CONSEQUENCES

General Effects

Designating SIAs will preserve and protect areas of local interest. SIAs are managed to protect their unique values and to develop areas for public education and to provide interpretative opportunities, where appropriate. Many uses are allowed in SIAs, including recreation, livestock grazing, mineral leasing, and road construction, but only if such uses do not degrade the characteristics for which these areas are designated.

Designation of SIAs by Alternative

The following table shows potential SIAs by alternatives and approximate acreages:

Table 3-118. Acres of Special Interest Areas by alternative.

SIA Name	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Ashenfelder	2,098	2,062			2,062		
Cinnabar Park	204	204	204	204	204	204	204
Dry Park	91	91	91	91		91	
Gambel Oak on Battle Mountain	270						
Libby Flats Ribbon Forest	492	492		492		492	
Medicine Bow Peak	1,150	1,150	1,150	1,150	1,135	1,150	
White Rock Canyon				684	684	684	
Kettle Ponds		9,111			4,721	9,111	
West Barrett							
East Holroyd						2,702	
Commissary Park							
Tramway Trail					1,050	1,050	
Cottonwood Rim						7,421	6,095
High Alpine Snowy Range							
Roper Cabin			65	65	65	65	
Douglas Creek Tie Dam		3	3	3	3	3	
Horse Creek Tie Dam		7	7	7	7	7	
Muddy Park Tie Dam		20	20	20	20	20	
Sunken Gardens		236	236	236	236	236	
Rainbow End							
Centennial Ridge				4,628	4,629		387
Ribbon Forest		4,350		4,350	3,893		
Platte Canyon**				11,857			
Big Sandstone**				4,657			
Battle Mountain**				1,319			
Many Ponds*						899	899
Rudefeha*							306
Totals	4,304	17,725	1,776	29,763	18,708	24,135	7,892

**originally proposed as Research Natural Areas (RNAs)

*public proposed

Direct and Indirect Effects

Effects from Fire and Fuels Management

The location and timing of wildfire ignitions are largely unpredictable. When such ignitions occur, fire suppression would be conducted as quickly as possible under the guidance of fire response plans. Response techniques are dictated by the resources and developments at or near the wildfire ignition. Protecting the resources for which specific SIAs have been designated would be weighed against the value of resources lost should wildfires spread beyond the boundaries of SIAs. Wildfire response would seek to minimize the adverse effects associated with fire.

Prescribed burning is conducted in order to achieve certain beneficial results, such as fuel-load reductions and wildlife habitat improvements. Such activities are conducted only after prescribed burning plans have been written and the effects of prescribed activities are analyzed. The implementation of prescribed burns would be conducted only when such activities do not significantly reduce the resource values for which an SIA has been designated.

Generally, adverse effects associated with fire and fuels treatment within SIAs are anticipated to be low to insignificant.

Effects from Insect and Disease Management

Insect and disease management can have significant adverse effects upon vegetation, wildlife, and other resources. Prior to treating an area to address insect or disease concerns, the Forest Service evaluates the effects of implementation in an environmental document. No such treatments would be conducted within an SIA if such treatments adversely affected the unique attributes for which the SIA was designated.

Effects from Oil and Gas and Minerals Management

Oil, gas, and minerals exploration and development can cause significant adverse effects, including major ground disturbances. Management guidance for SIAs, requires activities not to adversely affect the characteristics and features for which an SIA was designated. Environmental documents must be prepared in advance of any disturbances within an SIA resulting from oil, gas, and minerals management. If anticipated disturbances are considered significant, oil, gas, and minerals activities would have to be redesigned so as not to create adverse effects upon the characteristic for which an SIA was designated. Because the effects of oil, gas and minerals exploration and development will be evaluated prior to the implementation of associated activities within a SIA and because adverse effects will be addressed prior to exploration and development, effects from oil, gas, and minerals management is anticipated to be low, in all alternatives, where the mineral resources are under federal ownership.

Effects from Livestock Grazing and Big Game Use

Livestock grazing could pose potential effects within some SIAs, including ground disturbances, impairment of riparian areas, streams and bottom areas, and impacts to botanical resources. Management guidance for SIAs, however, requires that activities do not adversely affect the characteristics and features for which an SIA was designated. Environmental documents must be prepared periodically for grazing management. If anticipated disturbances are considered substantial, rangeland management activities and livestock grazing would be redesigned so as not to create adverse effects on the characteristics for which an SIA was designated. Therefore, adverse effects associated with livestock grazing are anticipated to be low to insignificant for all alternatives.

Effects from Recreation Management

Recreation use could disturb the characteristics for which some SIAs may be designated. Unauthorized and unpermitted collection of plants, artifacts or vandalism at cultural sites could adversely impact some potential SIAs.

Effects from Timber Management

The proposed SIAs are not scheduled for timber harvest and do not contribute to the ASQ. Thus, areas of SIAs that are tentatively suitable for timber harvest are removed from the suitable timber base. The following table illustrates the approximate number of acres of suitable timberlands within each of the SIAs that would not be available for timber harvest, if they were allocated to management areas that provide ASQ.

Table 3-119. Acres of suitable timberlands by SIA by alternative.

SIA	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Ashenfelder	379	369			379		
Cinnabar Park	64	64	64	64	64	64	64
Dry Park	61	61	61	61		61	
Gambel Oak on Battle Mountain	0					0	0
Libby Flats Ribbon Forest	121	121		121		121	
Medicine Bow Peak	0	0	0	0	0	0	
White Rock Canyon				267	267	267	
Kettle Ponds					2,537	4,192	
West Barrett							
East Holroyd						1,345	
Commissary Park							
Tramway Trail					574	577	

SIA	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Cottonwood Rim						0	0
High Alpine Snowy Range							
Roper Cabin			2	2	2	2	
Douglas Creek Tie Dam		1	1	1	1	1	
Horse Creek Tie Dam		2	2	2	2	2	
Muddy Park Tie Dam		0	0	0	0		
Sunken Gardens		48	48	48	47	48	
Rainbow End							
Centennial Ridge				395	395		11
Ribbon Forest		684		684	478		
Platte Canyon**				0			
Big Sandstone**				3,174			
Battle Mountain**				0			
Many Ponds*						752	752
Rudefeha*							6
TOTAL ACRES	625	1,350	178	4,819	4,746	7,432	833

**originally proposed as RNAs
*public proposed

Cumulative Effects

The Medicine Bow National Forest is managed under the administrative unit that also includes the Routt National Forest and the Thunder Basin National Grassland. SIA's managed within the same administrative unit should be considered in total. The Routt National Forest Plan includes seven Special Interest Areas scattered across the Forest and totaling 28,000 acres. The Thunder Basin Plan includes six SIAs totaling approximately 26,000 acres. Alternative D-FEIS schedules thirteen SIAs totaling about 18,000 acres. For the entire administrative unit, there will be 26 special interest areas totaling approximately 72,000 acres. Each SIA is unique and Plan direction provides protection of these areas for long term public use. These are locally special and not tied into a regional or national network.

Travel Management

Introduction – Travel is associated with virtually every activity that takes place on the Medicine Bow National Forest. Travel is necessary for outdoor recreation, fighting wildfires, managing livestock and wildlife, removing marketable natural resources such as logs and minerals, gathering fuelwood, access to private inholdings, maintaining electronic sites and utility corridors, and managing and monitoring the Forest.

Travel management is a tool used to facilitate the movement of people and products. It provides opportunities for the activities listed above and protects resources, mitigates impacts, and minimizes conflicts. Decisions that affect travel opportunities in a given area are generally emotional issues for many Forest users. Each time a travel management decision is implemented, some users will benefit and others may not. For example, when an area or road is restricted from motorized travel to protect wildlife, there may be a secondary effect on people. A closure prohibits motorized travel and protects the wildlife, but it also restricts access for persons with disabilities requiring vehicles for access, may limit firewood gathering, and may reduce opportunities for some forms of recreation. Conversely, it could likely give hikers, horseback riders, and those viewing wildlife or seeking solitude a more peaceful undisturbed experience.

Modes of vehicle travel on the Forest include large commercial trucks, automobiles, pickups, four-wheel drive vehicles, snowmobiles, all-terrain and off-road vehicles, motorcycles, mountain bikes, and wheelchairs. Other travel modes include cross-country skiing, horseback riding, and hiking. These various forms of travel may occur on designated paved highways, gravel and dirt roads, unimproved roads, four-wheel drive roads, and trails designated for motorized and/or non-motorized use. Off-road and off-trail vehicle travel is allowed only for snowmobiles unless an area is expressly designated open by Forest order. Of particular interest in travel management is the emergence of mountain bikes, increased off-road vehicle (ORV) and snowmobile use since the 1985 Plan.

As use of the Forest increases, travel management will be increasingly important as a tool for mitigating impacts on the various resources and for coordinating uses. The Forest needs to work closely with all user groups to maintain travel and recreation opportunities and identify routes where these activities can continue. Public information and education regarding travel management and the need for restrictions must be emphasized. A balance between motorized and non-motorized recreation opportunities needs to be achieved and is likely to require compromises by each user group to mitigate conflicting demands.

Motorized and non-motorized trails are discussed more thoroughly in the Recreation section of this document.

Legal and Administrative Framework

The Forest and Rangeland Renewable Resources Planning Act of 1974, Section 10.

The National Forest Roads and Trails Act of 1964.

36 CFR 212. Administration of the National Forest System Roads (NFSR) provides the principle regulations for administration of National Forest System roads.

36 CFR 219.11 provides resource management requirements that cannot be met without putting a viable transportation system in place.

Forest Service Manual (FSM) 7700. Transportation systems.

Forest Service Handbooks (FSH) 7709. Transportation and Related Activities.

Key Indicators

- Miles of roads on the Forest by inventory type.
- Miles of road construction, reconstruction, maintenance, and decommissioning.
- Miles of road maintained to standard.

Resource Protection Measures

The location, design, operation, and maintenance of roads and trails are specified in the forest-wide standards and guidelines and Forest Service manual direction. This direction assures that intended uses will be accommodated over time.

Maintenance and other activities accomplishments on Forest roads are directly dependent upon funding levels.

AFFECTED ENVIRONMENT

Roads

There are currently 2,592 miles of classified National Forest System roads (NFSRs) and approximately 500 miles of unclassified roads on the Forest transportation inventory. An additional 400 miles are considered an integral part of the Forest road system. These additional roads are mostly outside the Forest and are under the jurisdiction of counties, private individuals, or the state. U.S. and State highways that pass through the Forest are not included in this total.

There are three categories of classified NFSRs; arterial, collector and local roads. Arterial and collector roads are used to provide primary access to large portions of the National Forest. Arterials normally serve as connections between towns, major

county roads or state highways and are main thoroughfares through the Forest. Collectors link large areas of the Forest to arterials or other main highways. Local roads are usually single purpose transportation facilities.

Approximately 2,200 miles under Forest maintenance responsibility have surfaces consisting of the native material from which the roads are constructed. Some native soil surfaces retain moisture and will rut severely if used when wet. Some are highly erodible and can be easily washed away if proper drainage is not maintained. A few remain fairly stable under normal traffic conditions, even in wet weather.

About 400 miles (15%) of roads under Forest jurisdiction have aggregate surfacing, which may consist of pit-run or crushed gravel. The expected life of a gravel surface can be 10 to 20 years when adequate maintenance is performed, depending on the amount and type of traffic. Assuming an average life of 15 years, the Forest should be re-surfacing a minimum of 25 miles per year. Currently, the Forest does not meet that resurfacing goal due to budget constraints and other priorities.

National Forest System roads are maintained to varying standards depending on the level of use and management objectives. There are five maintenance levels used by the Forest Service to determine the work needed to preserve the investment in the road. The approximately 2600 miles of classified roads are managed to the standards listed in the following table

Table 3-120. Miles of classified road maintained by the Forest Service by maintenance level.

Maintenance level	Miles	Percent
1 – Basic custodial care (closed)	431	17
2 – Use by high-clearance vehicles	1,460	56
3 – Suitable for passenger cars	451	17
4, 5 – Moderate to high degree of user comfort	250	10
Total	2,592	

Source: Infra Travel Routes Database, 2000.

There are 1,891 miles of inventoried NFS roads either closed to full-size motor vehicle traffic (maintenance level 1) or managed only for high-clearance vehicles such as pickup trucks and four-wheel drive vehicles (maintenance level 2). These roads were designed for a single-purpose, low volume traffic normally single-lane and unsurfaced. An additional 17% are maintained to accommodate passenger cars but do not necessarily provide a comfortable driving experience (maintenance level 3). The remaining 10% of Forest roads are maintained to accommodate passenger cars and to provide a reasonably comfortable driving experience (maintenance levels 4 and 5). These roads receive the highest volume of traffic and are the most costly per mile to maintain to standard.

Public Forest Service Roads

National Forest System roads are not technically public roads. Although they generally are open and available for public use, they are authorized only for the administration, protection, and utilization of National Forest System lands.

The Forest Service is a public roads agency with the authority to designate certain National Forest System roads as public roads. By definition, a Public Forest Service Road (PFSR) is a National Forest System road that is designated "open to public travel" in accordance with 23 USC 101(a). The roads must serve a compelling public need. By definition, the roads would remain open and meet Federal Highway Safety Act requirements. Exceptions would be for scheduled seasonal closures or emergency closure needs. To date, and per agreement with the Federal Highway Administration, maintenance level 3-5 roads have been subject to the Highway Safety Act requirements, but without the public road designation.

The Forest Service has identified certain routes as "potential" PFSRs. Potential PFSRs are listed in the Medicine Bow Roads Analysis Report (2002). There are 56 roads identified as potential PFSRs for a total of 537 miles. In addition, necessary construction work to improve these roads to the appropriate standard has been identified. Roads may be designated as Public Forest Service Roads when they meet the appropriate standards. Further analysis through travel management and NEPA is also required.

Forest Highways

There are four Forest Highways on the Medicine Bow designated under the Federal Lands Highways program of the Transportation Equity Act for the 21st Century (TEA21). These routes are state, county, or Forest Service owned roads qualifying for Highway Trust funding for improvement or enhancement. They provide access to and within the National Forest. These roads are listed in the following table:

Table 3-121. Federally designated Forest Highways.

Forest Hwy Number	State Hwy Number	Route Name	Description of Termini	County	Length (miles)
11	SH 70	Battle Lake Road	State Hwy. 789 – State Hwy. 230	Carbon	57
12	SH 130	Snowy Range Road	State Hwy. 230 – St. Hwy. 11	Carbon / Albany	47
26	None	Sage Creek Road	State Highway 70 - Rawlins	Carbon	55
29	None	Douglas-Esterbrook Rd	Albany/Converse County Line – I-25	Converse	29

Forest highway funding can be used for planning, design, and construction or reconstruction of these designated routes. Other enhancement work can include parking areas, interpretive signing, acquisitions of scenic easements or sites, sanitary and water facilities, and pedestrian and bicycle paths. The Snowy Range Road was also designated as a National Forest Scenic Byway in 1988.

The portions of the Sage Creek Road and the Douglas Esterbrook Road that are within the Forest proclamation boundary are currently aggregate surfaced roads. As these roads are improved by the Federal Highway Administration, the character of these roads could change considerably. Sage Creek Road has recently been proposed for development with work expected to begin in 2005 from Rawlins to the Battle Highway. The proposed development would include reconstruction of the existing road and realignment of the road to avoid sensitive areas (such as Aspen Alley). Management area prescriptions for Alternative E would require winter seasonal closure for parts of the Sage Creek Road. Reconstruction and realignment would be restricted or prohibited in Alternative F.

Unclassified Travelways

In addition to roads and trails classified for motorized use, there are roads that have developed through off-road travel, old "temporary" roads that were never obliterated, abandoned roads that were never rehabilitated, and user-created roads. These routes are not maintained. They are inventoried and evaluated for possible classification, decommissioning or conversion to other uses during site-specific analyses. There were approximately 800 miles of these unclassified roads identified during the Forest-wide Roads Analysis Process. Approximately 314 of those miles were decommissioned with previous decisions. The remaining unclassified roads can be expected to be evaluated for possible classification, decommissioning or conversion to other uses in future site-specific analyses. If additional user-created routes are identified, they will be decommissioned unless a documented decision adds them to the transportation system as a road or a trail.

Future Trends

The last 10 to 15 years has seen a shift in the volume and mix of travel modes on the forest. Commercial use of the transportation system declined in the 1990s. All forms of recreation travel have increased in volume, some more dramatically than others. This shift in traffic composition and user types is a driving force for development of new travel management philosophies and strategies. Modes of vehicle travel include large commercial trucks, automobiles, high-clearance vehicles, four-wheel drive vehicles, all-terrain vehicles, motorcycles, snowmobiles, mountain bikes, and wheelchairs. Other modes of travel include cross-country skiing, snow-shoeing, horseback riding, pack animal driving, hiking, and boating. Variations in these increasing volumes can be attributed to a number of reasons: technology

advances, economic conditions, changing demands for recreational experiences, population increases, and other social influences.

Along with the multitude of diverse use has come an increasing demand for segregating the uses. The common conflicts are between motorized and non-motorized users, both in winter and summer. Management area designations have begun to address these concerns, and future travel management plans (as directed by the Travel Management decision of October 2000) will address travel on specific roads.

ENVIRONMENTAL CONSEQUENCES

General Effects

Maintaining or decommissioning existing roads and trails are emphasized in all the alternatives. Projections for new construction are much lower than was predicted for the previous planning period.

According to the decision made in October, 2000 Travel Management Decision, current travel management on the forest restricts motorized travel to designated routes and trails unless a Forest order specifically allows cross-country motorized travel (see following map). The environmental analysis led to a two phase decision. Phase I of the travel management decision closed areas not previously restricted to off-road use. Phase II of the decision is a process of inventory and public involvement, leading to a decision on which roads remain open. Phase II will be implemented with site-specific travel management analyses over the next five years. This decision would be implemented for all alternatives. The actual roads remaining open or closed will vary according to management area prescription in the alternatives and the subsequent travel management decisions.

The public use of forest arterial and collector roads will not be changed by this Forest Plan decision. Any needed changes will be determined by a separate analysis, which will also include public input.

New standards and guidelines have been developed to mitigate impacts on natural resources resulting from increased traffic on forest roads and trails. Nationally, the trend is to direct maintenance funding to decommissioning unneeded roads and improve the maintenance condition of those remaining. A smaller, more efficient transportation system is the expected outcome.

Methods of decommissioning include, but are not limited to, signing and physical closures such as earth berms, boulders, scattering downed vegetation, scarifying, seeding, recontouring, and removal of structures such as culverts. The goal is to return the roadway to a more natural state where the roadway is hydrologically self-maintaining and to permanently remove it from the transportation system. Roads could also be converted to motorized or non-motorized trails. Other roads may be

identified for closure for a period of more than one year (level 1 maintenance roads). These roads are identified as roads not needed for current use but possibly needed for future management access. The intent is to preserve the road investment while eliminating vehicular use. These roads are retained as part of the transportation system. Methods of closure include gates and signing, earth berms, boulders, scattering downed vegetation, scarifying, and seeding.

There was not a significant change in the transportation system between alternative D DEIS and D FEIS. Discussions that refer to Alternative D are valid for both the Draft and the Final.

Map 3-15. Travel management regulations for the Medicine Bow National Forest.

Roads Analysis

The Medicine Bow National Forest Roads Analysis was completed in the spring of 2002. It is not a decision document but it provides valuable information for managing the road system on the Forest. It offers many opportunities and guidelines for road managers and decision makers. "Conducted by an interdisciplinary team, the science-based roads analysis process provides Responsible Officials with critical information needed to identify and manage a minimum road system that is safe and responsive to public needs and desires, is affordable and efficient, has minimal adverse effects on ecological processes and ecosystem health, diversity, and productivity of the land, and is in balance with available funding for needed management actions." (FSM 7712.1).

The primary focus of the Medicine Bow National Forest Roads Analysis Process report (MB RAP) is the portion of the road system maintained for passenger car use (maintenance level 3, 4 and 5 roads). The analysis does not cover roads maintained for high-clearance vehicles (level 2 roads), closed roads (level 1 roads) or unclassified (user-created). Roads Analysis at the site-specific and watershed level will address these roads.

The recommendations in the Medicine Bow RAP were developed to respond to issues identified in the roads analysis specific to road management, operations, improvements, and maintenance. They are presented to help interpret their use for local conditions and focus on the areas of concern and opportunities on the Medicine Bow National Forest.

One recommendation in the Medicine Bow RAP is to require use of the forest-scale analysis as a starting point in all site-specific and watershed analyses. Through this process, the forest-scale RAP will be amended as decisions made update the information. The RAP is a living document that will identify new opportunities as they arise through subsequent analyses. Specific road information and recommendations may change as site-specific analysis updates the document.

Identification of the Potential Minimum Road System

The forest-scale roads analysis is a tool that helped identify a potential minimum road system. The analysis was completed in March 2002 and addressed only those roads maintained for passenger vehicle use on the Forest. Further analysis is needed at the site-specific level to determine the appropriate management of those specific roads. A value and risk rating system was used to evaluate those roads currently open for passenger vehicle use in order to help more effectively spend road maintenance funds. Any roads preliminarily identified as having a high resource value were considered to be the potential minimum road system needed to provide access to the Forest, and would be considered the highest priority for the investment of funds.

Access to the Forest also involves roads not maintained for passenger car use, but still necessary for management of the Forest. These roads were not addressed in the forest-scale roads analysis, but could also be considered as part of the potential minimum road system. Some of these roads include access to private land, special use and mineral rights access, and administrative needs. As Phase II of the October 2000 Travel Management decision is completed, a minimum road system to support the revised Forest Plan will be identified. This transportation system may change over time as future management decisions document a need to add or delete roads from the system, or change road standards upward or downward.

Roads identified in the RAP as having a low value include those that typically serve only one resource need, such as a road in a campground, a road to a communications site, a road for a range water development, or a timber sale road. Roads that are high priority for a single resource (such as campground loops) will not necessarily be closed. Low value roads are a lower priority for investment and have a variety of management available. These include changing the maintenance level of the road to better reflect traffic needs, decommissioning roads where access needs are met by other routes, reducing resource risks through mitigation including relocation and reconstruction, decommissioning the road where resource risks cannot be mitigated, or converting the road to a motorized or non-motorized trail.

Maintenance and Reconstruction

Annual road maintenance will vary across alternatives according to the total miles of system roads to be maintained. Past annual accomplishments are approximately 90% of roads maintained for passenger vehicle use (maintenance level 3, 4, 5) and 40% of roads maintained for high clearance vehicles and closed roads (maintenance level 2 and 1).

To meet standards for traffic safety and environmental protection, all alternatives anticipate reconstruction and maintenance of many existing roads. The objective is to return the road to its originally designed operating standard. This work is generally referred to as deferred maintenance; the level of work required is beyond that of routine, or annual, maintenance. An existing backlog of deferred maintenance is common across the National Forest System. Assuming current funding levels, lack of adequate funding for this work is expected to continue for some time and be similar across alternatives. Alternatives with fewer road miles in the transportation system (D, E, F) will have more opportunity to reduce deferred maintenance needs as more funding is available for each road. Alternatives with higher road miles overall (A, B, C) can result in deferred maintenance needs increasing as the transportation system continues to deteriorate.

The following table is an estimate of the miles of road that could be maintained at the experienced budget level in the first decade of Plan implementation. The budget for road management includes maintenance, reconstruction, and decommissioning. Spending on road maintenance is prioritized by: 1) health and safety, 2) resource

protection, and 3) forest mission. Additional funding over and above current levels would be needed to accomplish accelerated road decommissioning or increased road maintenance.

Table 3-122. Roads maintenance desired condition and experienced budget levels.

	Alternative						
	A	B	C	D DEIS	D FEIS	E	F
Total System Road Miles (estimated)	2,403	2,400	2,350	2,223	2,244	2,210	1,754
Decade 1- Desired Condition Level							
Miles Maintained	1,898	1,898	1,898	2,291	2,291	2,099	1,666
Percent of total system roads maintained	79%	79%	79%	95%	95%	95%	95%
Decade 1- Experienced Budget Level							
Miles Maintained	1,265	1,265	1,265	1,250	1,250	920	667
Percent of total system roads maintained	53%	53%	54%	56%	56%	42%	38%
Decade 5 – Experienced Budget Level							
Miles Maintained	1,333	1,333	1,333	1,473	1,473	1,473	1,392
Percent of total system roads maintained	55%	56%	57%	66%	66%	67%	79%

Fewer miles would be maintained in the first decade for Alternatives E and F due to a greater portion of the budget being focused on decommissioning roads at the experienced budget level. By the fifth decade, the percentage of the road system maintained would increase as more roads are decommissioned. Alternatives with fewer miles overall (D, E, F) will be able to maintain a higher percentage of the road system and will see more opportunity to address resource protection concerns once health and safety issues are corrected. At the desired condition budget level, more of the road system could be maintained.

Unauthorized use of closed roads by motorized vehicles contributes to increased maintenance costs by requiring additional work to keep the roads closed, and protected from resource damage. Development and maintenance of a motorized trail system could help reduce resource damage on closed roads. However, an increase in funding would be necessary for developing and maintaining such a trail system.

Resource Protection

In all alternatives, protection of soil, aquatic, and riparian systems will be given more attention in future road operations. Current inadequate stream crossings will either be rebuilt or removed. Bridges and arches will be preferred over round culverts to improve aquatic conditions. As the need for repair or replacement of existing structures arises, design will provide for added streambed and bank stability as well as for fish migration. Reconstruction of roads will include moving the travelways away from streams where feasible and reducing the size of the connected disturbed area.

Access Needs

Under all alternatives, coordination and collaboration with other federal, state, and county officials in the management of transportation facilities to and through the Forest would be continued to ensure that access is maintained, standards are consistent, safety issues are addressed, and efficiency is considered at all times.

Reasonable access to private inholdings has to be considered in travel management. In addition, existing and future rights-of-way and easements would continue to ensure that public access to National Forest System lands is maintained. As lands adjoining National Forest have shown a change in use patterns over time, previous access by the public across these private lands is also changing. Without public access, the portion of the roads on the Forest can lose their value and could be recommended for closure. Where public access is not available, roads on the Forest may be closed, motorized use eliminated, or a special use permit will be required for motorized access. This may restrict motorized access to portions of the Forest from some private lands.

Direct and Indirect Effects

Effects from Management Area Prescriptions

The number of miles of Forest transportation system roads will remain relatively stable among alternatives A, B, C, D, and E. Reductions in the road system will mostly result from site-specific level decisions to close unneeded roads and will be similar across those alternatives. Maintenance, improvement, and reconstruction of most Forest roads will continue and remain at levels similar to the present depending on the allocation of acres to management areas with emphasis on roadless characteristics, such as wilderness, proposed wilderness, wildlife corridors, wildlife emphasis areas and backcountry non-motorized recreation. Alternative F has a greater portion of the Forest allotted to these management area prescriptions and will show significant decreases in the Forest transportation system. Roads in these management area prescriptions could either be decommissioned or converted to motorized or non-motorized trails.

The road system for passenger car vehicles is expected to change with further site-specific analysis regardless of the alternative selected. Alternatives focusing on commodity production and recreation use (A, B, and C) will have a higher amount of roads maintained for passenger car use, while alternatives with more emphasis on non-motorized management area prescriptions (D and E) will have fewer roads maintained for passenger car use. Alternatives focusing on ecological restoration (F) will have even fewer roads maintained for passenger car use. More significant changes between alternatives are evident in the number of single purpose, local roads available for high clearance vehicle use.

All alternatives will implement Phase II of the Travel Management decision (October 2000), and actual number of miles of road to be retained as part of the transportation system will be determined in Phase II Travel Management decisions. Actual miles of road to be decommissioned will be determined through these decisions and will likely vary from the estimate made in this analysis and as shown in the Supplemental Tables (FEIS Chapter 2). Even Alternative A (no-action) shows a net reduction in miles from the current road system (2,592 miles) based on how Phase II of the 2000 Travel Management Decision might be implemented.

The method used to estimate total system miles in the table below was based on estimates of miles of road that might be decommissioned within each management area prescription. This percentage reduction was applied to the total miles of road in each management area. Roads were not considered individually to determine specific resource concerns that might close a particular road, or management needs that keep a certain road open to travel. The process to evaluate individual roads will occur during Phase II of the Travel Management Decision.

The Management Area Prescription will not actually close any roads. Phase II NEPA decisions with public involvement and subsequent forest closure orders would be required to close a road. Any existing designated motorized routes in non-motorized management areas will still be evaluated with Phase II Travel Management. Attempts were made to minimize designated routes inside of non-motorized management areas.

The miles of road planned for decommissioning includes classified roads as well as existing unclassified roads that are not part of the transportation system. At the desired condition budget levels, approximately 27 miles of road per year could be decommissioned each year for both classified and unclassified roads. For Alternatives A, B, C and D it would take 21 to 27 years to accomplish the decommissioning. Since road decommissioning would have a higher emphasis to meet the themes in Alternatives E and F, it is proposed to meet those objectives within the first decade. Additional budget needs to accomplish an accelerated rate of decommissioning for Alternatives E and F would need to be supplemented from other resources. Other alternatives would accomplish decommissioning at the desired condition budget level (27 miles per year).

Table 3-123. Road system miles by alternative (Estimated).

	Alternatives						
	A	B	C	D DEIS	D FEIS	E	F
High Clearance & 4-Wheel Drive Roads (open)	1,271	1,268	1,218	1,161	1,182	1,148	722
Low Clearance Vehicle Roads (open)	701	701	701	631	631	631	601
System Roads Closed to Vehicular Traffic	431	431	431	431	431	431	431
Total Estimated Road System Miles (estimated)	2,403	2,400	2,350	2,223	2,244	2,210	1,754
Miles to Decommission (includes unclassified roads)	558	561	611	738	711	751	1,207
Years to accomplish decommissioning at desired condition budget levels	21	21	23	27	26	7	7
Miles per year to decommission at desired condition budget levels	27	27	27	27	27	112	181
Years to accomplish decommissioning at experienced budget levels	31	31	34	41	41	10	10
Miles per year to decommission at experienced budget levels	18	18	18	18	18	75	121

Effects from Timber Management

Most of the arterial and collector road system is in place to access timber; however new roads would be necessary to get to specific units for the most economical harvest. These roads will primarily be low standard, local roads and usually closed to public motorized use following harvest activities. Temporary roads used for access would be decommissioned when activities are completed. Alternatives A, B, C, and D would have higher levels of construction and reconstruction than alternatives E and F. Since most new roads would be closed after use regardless of alternative, there is little effect on the final miles of system roads from timber activity. Alternatives that would enter previously unroaded areas for timber

management (A, B, and C) could expect to see some of the new roads added to the transportation system to support future activities in those areas.

In the short term, some roads may be temporarily closed to public travel during timber hauling operations and certain roads will see increased traffic due to hauling. Roads that are currently closed to vehicle travel may be open for the period of the activity. Such roads will be closed again after hauling is complete.

Table 3-124. Miles of annual road construction and reconstruction by alternative, at desired condition and experienced budget levels.

	Alternatives						
	A	B	C	D DEIS	D FEIS	E	F
Desired Condition Budget Level							
Construction	5	5	5	4	4	4	0
Reconstruction	11	11	11	10	9	9	0.5
Experienced Budget Level							
Construction	4	2	2	2	2	2	0
Reconstruction	4	5	4	4	4	3	1

A more significant impact to the road system is the amount of road maintenance accomplished. Timber and other commodity users contribute to road maintenance commensurate with their use. While timber hauling is active, the purchaser performs maintenance on those roads and Forest maintenance funds can be used on other roads. However, increased traffic from timber haul can create user conflicts and increase public safety concerns. These risks can be minimized through proper signing, road management, and contract administration.

Timber haul during winter can have both positive and negative effects. Snowmobile trails often follow existing roads; when timber hauling is active, use of the trail can be disrupted. Often, the solution is to temporarily relocate the trail while logging is active. One benefit to winter travelers is that roads and trailheads may be plowed open by the timber operator, allowing greater access for recreation traffic. Plowing additional roads can open up more area to public travel in the winter, which can adversely impact lynx. Plowing roads can also increase access for competitors for lynx.

Effects on trails from timber harvest will be minimal. During project planning, trail locations are identified and mitigation measures applied when appropriate. Beneficial effects can be derived through removal of potentially hazardous trees adjacent to trails, improving access to trailheads, and maintaining vistas.

Effects from Oil, Gas, and Minerals Management

Oil, gas and mineral exploration and development requires roads to be available for drilling, construction, maintenance and production. The amount of new roads would likely be small, and some may be temporary. Alternatives with a high percentage of the area not administratively available for leasing or available for leasing but where

no surface occupancy is allowed will result in reducing or eliminating the wells projected to be drilled in those areas (wells may be located outside those areas).

Alternative A is the no leasing alternative and therefore will have no impacts from oil and gas roads. It is projected that no wells will be drilled in Alternative F due to the amount of surface occupancy restrictions and therefore these alternatives will have no impact due to oil and gas roads. It is projected that only one well would drilled in Alternative D due to the large amount of surface occupancy restrictions. Fewer additional roads would be needed in Alternative D than in Alternatives B, C and E. In Alternatives B, C, and E, areas affected by surface occupancy restrictions are smaller and spaced sufficiently so that no impact to the number of wells drilled is anticipated (two wells expected to be drilled); therefore, these alternatives have the greatest and the same number of roads needed for oil and gas activities.

Effects from Recreation Management

Increasingly, National Forest System lands are likely to be destinations of choice for people looking for high-quality outdoor recreation experiences. As recreation use increases, travel management may need to respond with more opportunities, a well-designed transportation system, and more mitigation techniques for addressing impacts. Increases in recreation use without adjustments in the transportation system could lead to lower visitor satisfaction and more conflict between users.

New road construction for recreation purposes is expected to be low. Recreation traffic has a large impact on road and trail conditions due to the high traffic volumes. Most road and trail damage occurs when traffic peaks during wet weather conditions when the road surface and subgrade are saturated. Travel during these conditions can damage the road requiring more frequent maintenance or increased travel restrictions to prevent damage.

The varied type of experiences recreation users expect adds complexity to travel management. On some roads, road standards will need to be upgraded to accommodate increased traffic volume and provide for user comfort and safety while protecting resources. Increasing demand for all trail types, motorized and non-motorized, indicate a need for additional trails. Converting unneeded roads into trails could provide for some of these uses.

Alternatives C and D includes the most increase in road reconstruction and maintenance to accommodate increased recreation use.

Alternative F would likely concentrate traffic onto fewer roads. This use concentration could lead to the need to improve those roads to accommodate the increased traffic levels.

Effects from Aquatic and Soil Management

Preventing sediment movement and promoting fish passage will require decommissioning, reconstructing, or relocating some existing roads in all

alternatives. Sediment movement will be seen in alternatives with accelerated levels of decommissioning; however the effects would be short-term. Increased emphasis on soil and water protection in Alternatives E and F will lead to correcting problems on high risk roads at a more accelerated rate than the other alternatives as more funding would be available for decommissioning roads. Increases in sediment movement will also be evident in alternatives with higher levels of reconstruction work (A, B, and C). Since much of the reconstruction work is aimed at correcting drainage and sediment problems, the effects should also be short-term.

Effects from Wildlife Management

Habitat improvement for wildlife can lead to fewer miles of road open to motorized travel in certain areas. Seasonal closures can be utilized to best protect wildlife during critical periods, while allowing for motorized use during less critical times. Road closure efforts focused in critical habitat areas will provide for greater increase in habitat. Travel patterns will change as site-specific analyses identify areas that would most benefit from eliminating motorized travel in all alternatives. The effects will be greatest in Alternative F, with fewer miles available for motorized travel.

Protection measures for lynx and lynx habitat will have minimal impacts on road activities. Most of the measures identified are already required under current Forest Service policies and procedures. Coordination with other agencies would be required to evaluate wildlife crossing at major highways to reduce the impacts to lynx mortality and linkage areas. Location of new roads will be subject to additional scrutiny near lynx habitat, including developing alternatives to avoid locating roads on ridgetops and saddles. A plan for construction, operation, restricting snowplowing, and closure/obliteration of new roads could be required. These activities should minimize the unwanted intrusion caused by public access, reducing hunting, trapping and recreational use impacts on lynx. There may be some adjustments in use or constraints on specific roads, but site-specific analysis (including Roads Analysis), will be required to determine whether it precludes actual construction or reconstruction of an individual road.

Cumulative Effects

Effects from Travel Management Decision

The Medicine Bow Travel Management decision (October 2000) restricted motorized travel to designated roads and trails unless a Forest order specifically allows cross-country travel. Phase I of the travel management decision closed areas not previously restricted to off-road use. Phase II of the decision is a process of inventory and public involvement, leading to a decision on which roads remain open.

The Medicine Bow Travel Management decision prohibits use of motorized vehicles off of designated roads and trails. A National Forest System road (NFSR) is marked and numbered. The accompanying order allows such use, under authorized permission, for purposes of rescue or fire fighting; use within 300 feet of a road for

recreational purposes such as camping or picnicking; and for fire wood gathering. Persons with a disabled hunting license are also allowed further than 300 feet off roads as long as they take a direct route.

Phase II involves identifying previously uninventoried routes, assigning them an interim number with a route marker, then mapping them as "unclassified" routes. These routes will go through a site-specific decision process to determine whether or not they will be added to the Forest transportation system. Future site-specific analyses can adjust the travel to meet resource and access needs. The implementation of the travel management decision will continue under the Revised Plan.

The process requires site-specific roads analyses to look at the roads as a system, followed by NEPA to decide which roads are not necessary for management and use of the Forest. This process includes public involvement. Road decommissioning will most likely follow, if and when this decision is made. The goal for decommissioning is to remove the route from the landscape and the transportation system. There has been an average 15 to 20 miles of road decommissioned per year in recent years.

Phase II of the Travel Management Decision would be implemented in all alternatives. The Revised Plan Management Area Prescriptions will influence the outcome of the Travel Management decision. Specific roads to remain open or closed will be identified in Phase II. The specific roads to remain open or closed vary by alternative in the Plan (see Effects from Management Area Prescriptions). Management area prescriptions would not actually close individual roads. Roads Analysis and a NEPA decision are still needed in order to issue a closure order that would actually close the road or add a road to the Forest transportation system.

Effects from OHV use on Lands Adjacent to Forest

The Rawlins office of the BLM reported complaints are increasing around Arlington where OHVs enter BLM land from on the Forest. OHVs are restricted to roads and trails on both BLM and Forest Service lands, so user-created trails are increasing. Monitoring and law enforcement will be carried out as funding allows, but the potential increase for this activity may increase under all alternatives.

Effects from Recently Enacted State Legislation Requiring Registration of ORVs

In 2002, the State legislature passed an ORV registration bill, which mirrors the current snowmobile registration requirements. Just as snowmobile use increased dramatically in the 1990s, it is likely ORV use will increase due to an increase in information and advertising by the Wyoming State Division of Tourism. The State has begun developing maps with motorized trails identified, but as yet, the Medicine Bow National Forest has very few trails. Only the trails are recognized by the State as requiring the registration.

All open Forest roads are also open to this ORV use, as long as the vehicles are licensed, and the driver at least has a beginner's driver's permit. Anyone 18 years or under must wear a helmet. The concern with this is that law enforcement officers on the Forest are busier being traffic cops than protecting the Forest resources. The funds from this registration program should help with enforcement, eventually, but the program has to get on its feet, first, before there will be extra funds for law enforcement.

Effects from Revised Statute 2477 (RS 2477)

RS 2477 grants rights-of-way for public highways constructed across public domain lands in the late 1800s to early 1900s. A RS 2477 highway must have been constructed across public domain lands before the date of the national forest reservation; for example, before the land became a National Forest or Grassland. The Federal Lands Policy Management Act (FLPMA) repealed RS 2477 in 1976. However, rights-of-way that predate the establishment of the National Forest are still in effect, unless they have been subsequently relinquished.

There are no known RS 2477 claims currently being pursued on Forest roads. There is currently a moratorium on processing RS 2477 claims. Any reviews are undertaken on a case-by-case basis.

Effects from Cheyenne Stage I and II Water Diversions

No known cumulative effects on travel management are expected as a result of Cheyenne Stage I and II Water Diversions.

Effects from Sage Creek Road Improvement (Rawlins to Battle Highway)

Sage Creek Road has been proposed for improvement with work beginning in 2005 from Rawlins to the Battle Highway. Approximately 10 miles of the 55 mile project are within the Forest boundary. Increased traffic after the work is completed can be expected as driving conditions for the road improve. Adjacent Forest roads could likely have increased travel as the area attracts more visitors. Sage Creek Road would also be a potential route to access the proposed High Savery Dam from the south, which could contribute to additional travel on the road.

Effects from High Savery Dam

Sage Creek Road would be a potential route to access the proposed High Savery Dam from the south. Additional recreation traffic accesssing the dam may result. See discussion on Sage Creek Road Improvement.

Scenic Resources

Introduction – Many people value the scenic quality of national forests and grasslands. The high quality scenery enhances people's well being and is a vital part of quality recreation experiences and settings. Forest visitors on many of the National Forests rate viewing scenery as one of the top recreation activities.

The Scenery Management System (SMS) replaces the Visual Management System (VMS) used in the 1985 Medicine Bow National Forest Land and Resource Management Plan. The SMS provides an overall framework for the orderly inventory, analysis, and management of scenery. The new system applies to all national forests and grasslands administered by the Forest Service and to all Forest Service management activities.

The SMS helps Forest Service planners and managers identify landscape character, including existing landscape attributes, scenic integrity and scenic sensitivity of the landscape being viewed.

Legal and Administrative Framework

The National Environmental Policy Act of 1969 (NEPA) – one of the purposes of the act is to ensure aesthetically pleasing surroundings for all Americans. To accomplish this, all federal agencies are to utilize a systematic, interdisciplinary approach, which will integrate environmental design arts in planning and decision-making.

The Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) – this act requires the assessment of potential esthetic impacts and the protection of esthetic resources.

The Multiple Use Sustained Yield Act of 1960 –.

Wilderness Act of 1964 –

Wild and Scenic Rivers Act of 1968 –

National Trail System Act of 1968 –

Environmental Quality Act of 1970 –

National Forest Management Act of 1976 –

Surface Mining Control and Regulations Act of 1977 –

FSM, Chapter 2380, Landscape Management defines Forest Service policy and regulations for visual resources.

Key Indicators

- Existing scenic integrity (ESI).
- Scenic classes.
- Scenic integrity objectives (SIO).

Resource Protection Measures

Resource protection is provided in the following USDA handbooks:

- National Forest Landscape Management, Vol. 1. Agriculture Handbook 434: 1973.
- Nation Forest Landscape Management, Vol. 2, Chapter 1: The Visual Management System. Agriculture Handbook 462: 1974.
- Utilities, Chapter 2. Agriculture Handbook 478: 1975.
- Range, Chapter 3. Agriculture Handbook 484: 1977.
- Roads, Chapter 4. Agriculture Handbook 483: 1977.
- Timber, Chapter 5. Agriculture Handbook 559: 1980.
- Fire, Chapter 6. Agriculture Handbook 608: 1985.
- Ski Areas, Chapter 7. Agriculture Handbook 617: 1984.
- Recreation, Chapter 8. Agriculture Handbook 666: 1987.
- Landscape Aesthetics, A Handbook for Scenery Management. Agriculture Handbook 710: 1995.

AFFECTED ENVIRONMENT

The numerous characteristic landscapes of the Medicine Bow National Forest have landscape character attributes that contribute to scenic integrity. The Medicine Bow National Forest includes Medicine Bow Mountains, Sierra Madre and Laramie Ranges (Marston and Clarendon 1988). These mountain ranges are covered with a variety of forest landscapes interspersed with open plains and meadows, rivers, streams, and ponds.

Landscape changes on the Forest occur naturally through events such as insects and disease, winds, and wildfires. Landscapes also have been changed by human activities such as logging and associated road building, livestock grazing, mining, and recreation.

Landscape Character Description

Landscape character is an overall scenic impression of the landscape that currently exists. It provides scenic and cultural image with combination of physical,

biological and cultural attributes, which creates a sense of place. The geographic areas (see Chapter 3 – Revised Land and Resource Management Plan) identify settings and unique features that establish existing landscape character. Each geographic area has the desired condition direction. It provides a reference on how the landscape would appear after 10 years and after 50 years of plan implementation. Most changes would be small and the overall landscape character would remain.

Existing Scenic Integrity

The existing scenic integrity (ESI) rates the current state of the landscape considering the human-caused deviation of form, line, color, and texture of the landscape character being viewed. Timber activities and associated road construction are examples of human alterations of the forest landscape. Two viewing positions were used to develop the ESI map: from the air (aerial photos) and from existing travel ways and use areas (on-the-ground observations). There are 6 different levels of existing scenic integrity:

- **Very High (Unaltered)** refers to landscapes where the valued landscape character is intact with only small deviations, if any. The existing landscape character and sense of place is expressed at the highest possible level.
- **High (Appears Unaltered)** refers to landscapes where the valued landscape character appears intact. Deviation 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 (Slightly Altered)** refers to landscapes where the valued landscape character appears slightly altered. Noticeable deviation must remain visually subordinate to the landscape character being viewed.
- **Low (Moderately Altered)** refers to landscapes where 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 within or 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 (Heavily Altered)** refers to landscapes where the valued landscape character appears heavily altered. Deviation may strongly dominate the valued landscape character. They may not 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 so that elements such as unnatural edges, roads, landings, and structures do not dominate the composition.
- **Unacceptable Low** refers to landscapes where 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.

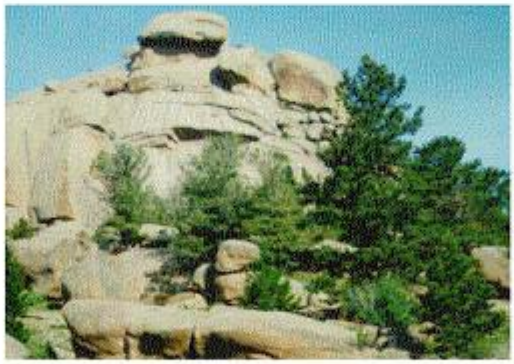
The following table displays the number and percent of acres by Existing Scenic Integrity levels for the Forest.

Table 3-125. ESI acres on the Medicine Bow National Forest.

Existing Scenic Integrity Levels	Acres	Percent of Acres
Very high	248,137	23
High	352,488	33
Moderate	291,347	27
Low	111,792	10
Very low	36,256	3
Unacceptable low	44,518	4
Total	1,084,538	100

Examples of Existing Scenic Integrity Levels:

Laramie Peak Area - Douglas District
Very High ESI



Vedauwoo Area - Laramie District
High ESI

Hog Park Reservoir - Brush Creek/Hayden District
Moderate ESI

Regenerated young lodgepole pine stand -
Laramie District
Moderate ESI

Clearcut units adjacent to Battle Highway - Brush
Creek/Hayden District
Low ESI

Recent clearcut unit - Laramie District
Very Low ESI

Old strip cuts - Brush Creek/Hayden District
Unacceptable Low ESI

Scenic Attractiveness

Scenic attractiveness is the primary indicator of the intrinsic scenic beauty of a landscape and of the positive responses it evokes in people. There are three scenic attractiveness classes on the Forest.

- Class A (Distinctive) – areas where landforms, vegetation patterns, water characteristics, and cultural features combine to form unusual, unique, or outstanding scenic quality. The Medicine Bow Peak with snow covered cirques and alpine glacial lakes is an example of Class A area. 14 percent of the Forest is rated as Class A.
- Class B (Typical) – areas where landforms, vegetation patterns, water characteristics and cultural features combine to provide ordinary or common scenic quality. The Libby Flats area with spruce/fir forests, alpine meadows with krummholz vegetation stands, and mountain streams is an example of a Class B area. 51 percent of the Forest is rated as Class B.
- Class C (Indistinctive) – areas where vegetation patterns, water characteristics and cultural land use have low scenic quality. Pure lodgepole pine forests on flat to rolling terrain and sagebrush/grass plains are examples of Class C areas. 35 percent of the Forest is rated as Class C.

Examples of Scenic Attractiveness:

Class A - Medicine Bow Peak

Class B - Spruce/fir stand with natural meadow adjacent to Snowy Range Highway

Class C - Lodgepole pine forest with regenerated clearcut unit near Battle Highway

Landscape Visibility

Concern Levels and Distance Zones

Concern levels are a measure of the degree of public importance placed on landscapes viewed from travel ways and use areas. There are three concern levels:

- Concern Level 1 – where people have the highest interest in scenery from primary and secondary travel ways and use areas. The number of visitors using Concern Level 1 travel ways and uses areas can be high, moderate, or low. The Snowy Range highway, Battle Mountain Highway, and the Medicine Bow Peak Trail are examples of Concern Level 1 travel ways.
- Concern Level 2 – people have a moderate interest in scenery from primary and secondary travel ways and use areas. The number of visitors using Concern Level 2 travel ways and uses areas can be high, moderate, or low. Ehlin Road (FDR 338) and Cedar Pass Road (FDR 261) are examples of Concern Level 2 forest roads.
- Concern Level 3 – people have a low interest in scenery from primary and secondary travel ways and use areas. The number of visitors using Concern Level 2 travel ways and uses areas can be moderate or low. All local and service roads and all remaining areas not seen from travel routs, use areas, and water bodies are Concern Level 3.

Distance zones are mapped when viewed from Concern Levels 1 and 2 travel ways and use areas. No distance zones were mapped when viewed from Concern Level 3 travel ways and use areas. The three distance zones are:

- Foreground – 0 to ½ mile from the observer's position. At this distance, the observer can view detail of trees, shrubs, wildflowers, and animals.
- Middleground – ½ to 4 miles from the observer's position. At this distance, the observer can see forest stands, natural openings, masses of shrubs, and rock outcrops.
- Background – 4 miles to horizon from the observer's position. At this distance, the observer can view mountain peaks, ridgelines, and patterns of forest stands and openings.

Scenic Classes

Scenic classes measure the relative importance or value of scenery of landscapes on national forests. Scenic classes are used during forest planning to compare the value of scenery with the value of other resources. Scenic classes are determined and mapped by combining three classes of scenic attractiveness with distance zones and concern levels of landscape visibility. Classes 1 and 2 have high value. Classes 3 through 5 have moderate value. Classes 6 and 7 have low value.

Table 3-126. Scenic classes on the Forest.

Scenic Class	Gross acres	Percent
1	314,936	29
2	446,660	41
3	104,643	10
4	46,515	4
5	129,421	12
6	41,305	4
7	1,134	-

Constituent Information

Constituent information examines the significance of scenic quality and aesthetic experience of Forest visitors. A County Land Management Study Survey was conducted to determine how land management activities affect the Wyoming residents. One of questions on intangible values asked for input on favorite types of places to visit/things to do on the Medicine Bow National Forest. Most of the Wyoming residents listed their favorite/special places that are located in areas with high scenic values. Among several areas are Medicine Bow Peak/Libby Flats, Rob Roy Reservoir, Vedauwoo, Silver Lake, Battle Lake, Hog Park Reservoir and Laramie Peak.

ENVIRONMENTAL CONSEQUENCES

General Effects

Scenic changes of landscapes on the Medicine Bow National Forest by natural events and human activities can be noticed or not noticed by visitors depending on their viewing location, distance, season, landform and vegetation screening, weather conditions and time spent viewing the landscape.

Management activities such as timber harvest and associated road building, mining, grazing, utilities, trail construction, ski area development and developed and dispersed recreation can affect scenic resources. Activities that are designed to blend in with the surrounding landscape can have a positive effect on scenic integrity while poorly designed activities that contrast sharply with the surrounding landscape can result in a negative effect on scenic integrity. Approximately 4% of the landscapes on the Medicine Bow National Forest have the old strip cut pattern and would need to be rehabilitated. These landscapes are located in the Snowy Range area of the Brush Creek/Hayden District and the Laramie District.

Each alternative developed for the draft forest plan revision provides a range of management area prescriptions and each management area prescription is assigned the proposed scenic integrity objective(s) based on existing scenic integrity, scenic classes and theme, setting, and desired condition of management area. Scenic integrity objectives assigned to management area prescriptions guide the amount, degree, intensity, and distribution of management objectives needed to achieve the desired condition of the landscape. Distribution includes space and time. Standards and guidelines in the Revised Plan include the scenic integrity objectives. Refer to existing scenic integrity level (ESI) for definition of scenic integrity.

Table 3-127. Proposed Scenic Integrity Objectives (SIO) for alternatives in acres.

SIO	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
V High	78,848	78,850	78,850	139,709	106,881	83,403	350,331
High	10,405	88,325	151,085	235,226	217,916	337,623	307,236
Moderate	505,092	371,667	404,149	338,016	388,556	343,066	217,084
Low	490,270	545,773	450,529	371,664	371,035	320,522	209,963

Each alternative differs from each other on scenic integrity based on the primary emphasis of the alternative.

Alternative A follows the 1985 Forest Plan goals and objectives. The Scenery Management System (SMS) would replace the Visual Management System (VMS) and use in the project implementation. Renewable resource use would continue to be the primary use. This alternative would continue to have the appearance of working forest landscape in renewable resource use management areas.

Alternative B provides a mix of multiple-use activities with an emphasis on vegetation management. Timber harvest and clearcut are included. The landscape would appear more altered than Alternative A due to higher number of acres available for timber activity.

Alternative C provides a mix of multiple-use activities with an emphasis on providing a mix of recreation opportunities while maintaining vegetation management. Timber harvest and clearcut are included. This alternative would have a higher percentage of Forest lands available for recreation use than other alternatives. Natural appearing landscapes would appear unaltered or slightly altered in both motorized and nonmotorized recreation areas.

Alternative D DEIS provides a mix of multiple-use activities with emphasis on providing a mix of recreation opportunities with a stronger emphasis on nonmotorized opportunities. Timber harvest and clearcut are included. This alternative would have more landscapes that would be maintained as unaltered or appear unaltered than in Alternative C due to more acres of nonmotorized recreation areas and areas recommended for wilderness.

Alternative D FEIS is similar to Alternative D DEIS. The difference between the draft and final is some shifting of management area prescriptions on forest areas and acres, which resulted in reduction of approximately 32,828 acres in Very High SIO, 17,310 acres in High SIO and 629 acres in Low SIO. Approximately 50,540 acres were increased in Moderate SIO. Alternative D FEIS would have less landscapes that would be maintained as unaltered or appear unaltered than in Alternative D DEIS.

Alternative E provides a mix of multiple-use activities with an emphasis on protecting existing roadless character and emulating natural pattern. It would allow clearcuts to be greater than 40 acres. The potential scenic impact of a large size clearcut emulating natural pattern would depend on the location, distance and viewing areas. This alternative would have naturally-function landscapes.

Alternative F emphasizes on providing non-game wildlife habitat with mature Forest core and linkage systems. No clearcut would be used. Alternative F would have less scenic impacts than other alternatives.

Direct and Indirect Effects

Effects from Facilities Maintenance

Forest Service facilities are required to comply with the scenic integrity objectives. Facilities that are properly designed and located to fit in with the surrounding landscape can enhance visitors' experience and it can positively reflect the Forest Service image. Improperly designed and poorly built facilities that clash with the landscape setting can result in an adverse effect on scenic resources. Effects on all alternatives would be similar.

Effects from Cultural Management

Scenic attributes of the cultural landscape contribute to the landscape character of the area. Cultural landscapes can be found anywhere on the Forest. Civilian Conservation Corps-constructed facilities are examples of cultural features of the cultural landscapes. Eliminating or damaging cultural facilities can result in the loss of scenic attributes of the landscape character. Effects on all alternatives would be similar.

Effects from Insects and Disease, and Fire

Dense stagnated forest stands are susceptible to insects and disease and wildfires. Trees killed by insects can result in adverse scenic impacts depending on the location (i.e. near or far view) and the number of trees killed. When large wildfires burn these stands adjacent to home communities, recreation areas, and travel ways with high concern on scenery, there would be some short to long-term effects on scenic quality depending on fire severity, timing, climatic conditions and capability of

different vegetative types to regenerate. Some severe wildfires can leave lasting visible scars.

Fire management can affect scenic resources in several ways. Prescribed fires that are used to reduce fuel, improve forest, range and habitat conditions can cause a short-term effect on scenery. The ground would appear blackened and charred after the burn. Over time, the new mosaics of vegetation in the burned area would be established and the scenic quality would be enhanced. Prescribed fire projects would have scenic resources mitigating measures to minimize scenic impacts.

Alternatives D FEIS, D DEIS and E would have the highest number of acres available annually for fuel treatments (70 % prescribed burning and 30 % mechanical treatment) which would minimize the most on wildfire damage to forest and rangeland landscapes followed by Alternatives B and C, A and F. Most of prescribed fires would be used for improving wildlife habitat and range condition and which would reduce surface fire intensity.

Timber management can reduce fire hazard by decreasing tree canopy density through silvicultural treatments, for example, salvaging trees infested by insects and disease with proper slash treatment. Fuel load still would be high after the harvest due to remaining slash that may be left on the ground to protect soil and to provide seed source, but overtime when the slash is decomposed, fuel load would be reduced. Natural or human caused wildfire damage to the forest landscape would be the most in Alternative F with the lowest ASQ followed by Alternatives E, D FEIS, D DEIS, C, B and A. Alternative A with the highest ASQ would have the most effect on reducing wildfire damage to forest landscape.

Effects from Land Exchanges

NFS lands that are exchanged for lands with high scenic integrity can positively benefit the public than lands with low scenic integrity. High quality scenic landscapes enhance visitor's experience and their well-being. Effects on all alternatives would be similar.

Effects from Mineral and Energy Development

Mineral and energy development can affect scenic resources on the Forest. Scenic integrity can be reduced when the landscape is modified by the energy development. Site location of the proposed structural development such as pipes, pumpjacks, tanks, and fences can potentially affect the scenery.

Many old underground mines are located throughout the Forest and are not evident from the travel ways. Old wooden mine structures, that can be viewed from Snowy Range Highway and Battle Highway, contribute positively to the landscape character of the area.

A Controlled Surface Use (CSU) stipulation on scenery would be applied for areas with scenic integrity objectives of high and moderate (see the Oil and Gas Effects from Scenery Management).

Alternative E would have most acres to be included in the leasing stipulation for maintaining the scenic integrity followed by Alternatives C, D DEIS, D FEIS and F. No oil and gas leasing would be available in Alternative A. Alternative B has standard lease terms (SLT) that would mitigate scenic impacts.

Effects from Livestock Grazing and Big Game Use

Livestock grazing occurs in many areas of the Forest. Livestock permittees have built structural improvements such as fences, water structures, and corrals on the allotments. Most range improvements blend in with the surrounding landscape and do not negatively affect scenic resources. Some grazing sites may have small areas of exposed bare soil from overgrazing or livestock management activities and have some effects on scenery. These sites generally are localized and can be reseeded for a time until recovered with healthy vegetation. The effects would be similar in all alternatives.

Effects from Recreation Management

Nearly all of the existing recreation facilities on campgrounds and picnic grounds complement the surrounding landscapes. New recreation facilities are required to comply with scenic integrity objectives and minimize scenic impacts when viewed from travel ways and use areas. The Recreation Opportunity Spectrum (ROS) and Built Environment Image Guide (BEIG) provide guidance on the appropriate use of exterior materials, exterior colors and site setting for each ROS class. Inappropriate use of material and color on building can detract from the landscape character of the area and reduce the scenic quality.

Dispersed recreation sites are less developed than developed sites. Some dispersed sites near travel ways are overused with bare soil and scarred trees and affect scenery. These sites should be rehabilitated to enhance the scenic quality. Effects on all alternatives would be similar.

Effects from Timber Management

Timber harvest and associated road building commonly introduce more noticeable landscape changes than other ground-disturbing activities on the Forest. New fresh cut units with exposed soil and slash on the ground can affect scenery for a time until the ground is covered with new grass and saplings.

Treatment of lodgepole pine forest would continue to utilize clearcuts as the preferred silvicultural method in all alternatives except for Alternative F. Harvest units that are well designed to blend in with the surrounding landscape can minimize the scenic impacts and maintain the landscape character of the area.

Alternative B would have the most effect on scenic resources followed by Alternatives A, C, D DEIS, D FEIS, E, and F. Alternative F would have no clearcuts.

Effects from Travel Management

Roads and trails can affect scenic resources. Poorly designed and located road or trail with exposed cut and fill slopes can detract from the surrounding landscape when viewed from other travel ways and use areas. Roads and trails built to fit in the landscape can complement the surrounding landscape. Both the Snowy Range Scenic Byway and Battle Highway are examples of well-designed roads that blend in well with the surrounding landscapes.

Areas with few roads generally have higher scenic integrity and are more intact than areas with high miles of roads. Unneeded roads that will be decommissioned and rehabilitated can improve the scenic integrity of the landscape. Alternative B would have the most effect on scenic resources followed by Alternatives A, C, D DEIS, D FEIS, E, and F.

Effects from Utilities Corridors

Utility corridors on the Forest can be noticed or not noticed depending on the viewing locations, utility structure, landform, and vegetation. Some powerlines can be noticed from travelways on the Forest. Improper linear vegetation treatment for powerline corridor can contrast with the surrounding landscape and have a long-lasting effect. Scenic analysis of new powerline corridor can minimize the scenic impacts on scenic resources. Effects on all alternatives would be similar.

Effects from Wilderness Management

The landscape character of all wilderness areas with the Forest would be maintained. There would be no landscape alteration except for trails. Only natural events such as insects and disease, winds and wildfires would alter the wilderness landscapes. Effects on all alternatives would be similar.

Effects from Wildlife and Fisheries Management

Habitat improvements can affect scenic resources. All types of management tools are used to create new habitats and if used correctly, can complement the surrounding landscapes. Most habitat projects are small in scale and localized. Effects on all alternatives would be similar.

Cumulative Effects

A number of adjacent non-national Forest System lands (i.e. Bureau of Land Management lands, state lands and private lands) lie adjacent to the Medicine Bow National Forest. Any activities implemented on Forest lands can affect scenery when viewed from any of these adjacent lands. The Adjacency Report for the

Medicine Bow National Forest Land and Resource Management Plan Revision (May 2002) indicated several concerns on scenic values by individuals and governmental entities representing adjacent lands. For instance, the BLM and National Park Service mentioned that the Forest Service should consider potential impacts of management activities on Forest that are within the viewsheds of several National Historic Trails, and several representatives for a new mountain resort on an adjacent private land near Encampment expressed in potential impacts of Forest management activities within their viewshed.

Activities and facilities off the Forest such as oil and gas development, mining, logging, housing development, and a private ski resort can affect scenery when viewed by Forest visitors on Forest travel ways and use areas. When activities both on and off the Forest degrade the scenic values, we do not meet their expectations.

Cumulative effects on scenery would be similar in Alternatives A, B and C due to the high number of acres assigned to Low SIO followed by Alternatives D DEIS, D FEIS and E. Alternative F would have lower effects on scenery than all other alternatives as clearcut would not be used for timber activity. Natural events such as large scale windthrows, wildfires, insects and disease can affect scenery in all alternatives.

At project level, all proposed management activities are reviewed for cumulative effects on scenery and meeting the assigned scenic integrity objective(s) of the management areas. All past, present and foreseeable future projects are included in the review for short- and long-term effects on scenic resources.

Wild and Scenic Rivers

Introduction – The Wild and Scenic Rivers Act is an important piece of conservation law enacted by Congress to preserve select rivers in a free-flowing condition and to protect other river-related values. As of September 2002, 160 river segments and 11,292 miles have been afforded protection as a component of the National Wild and Scenic Rivers System. These nationally recognized rivers comprise a valuable network of natural and cultural values.

For a river to be included in the Wild and Scenic Rivers System, it must meet the tests of eligibility and suitability. To be eligible, a river must be free-flowing and possess outstandingly remarkable river values. To be suitable, the benefits of designation should outweigh the disadvantages. It involves considering land ownership in the area; the land uses that would be affected; public, state, and local government interest in the river's designation; estimated costs; and any other issues raised during the planning process. Despite Congressional legislation that creates a mechanism to establish Wild and Scenic Rivers, a recommendation by the USDA-Forest Service for any particular river or river segment does not guarantee that Congress will proceed with the recommendation. The agency can only recommend the inclusion of a river within the National Wild and Scenic River System. Congress must act upon the recommendation.

Legal and Administrative Framework

Wild and Scenic Rivers Act of 1968, as amended – this act established national policy to "preserve selected rivers or sections thereof in their free-flowing condition, to protect water quality of such rivers and to fulfill other vital national conservation measures." The act also states that these rivers "shall be preserved in free-flowing condition and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations."

The act also provides two methods by which rivers are identified for study as potential additions to the National System: by Act of Congress under Section 5(a) or through agency-initiated study under Section 5(d)(1). Section 5(d)(1) of the Act requires that "in all planning for the use and development of water and related land resources, consideration shall be given by all Federal agencies involved to potential wild, scenic and recreational areas." Through Section 5(d)(1), the Forest Service is required to assess rivers under its management jurisdiction and determine whether any rivers are worthy additions to the National System.

The **Forest Service Handbook 1902.12 (Chapter 8)** directs the Forest Service, during forest plan revision, to evaluate rivers for inclusion in the National Wild and Scenic Rivers System.

Wild and Scenic Rivers Assessment and the Forest Plan Revision Process 11/21/96 – Washington Office guidance letter regarding the Land and Resource Management Plan revision process and wild and scenic rivers assessment process.

Department of the Interior and Agriculture Interagency Guidelines for Eligibility, Classification and Management of River Areas - USDA and USDI - provides additional guidance to agencies on how to consider Wild and Scenic Rivers eligibility, suggesting that Wild and Scenic rivers be considered during forest planning.

Key Indicators

- Locations and miles of eligible rivers.

Resource Protection Measures

The assessment of a river's potential as a Wild and Scenic River follows a three-step process:

1. Determination of eligibility.
2. Potential classification (wild, scenic, or recreational).
3. Determination of suitability.

The following guidelines set forth standards for making these determinations on rivers by classification (wild, scenic, or recreational). These guidelines should be applied to the extent of the Forest Service's jurisdiction over Federal lands, Federal scenic or access easements, and other interests.

Eligible Wild Rivers

- Timber production – cutting trees will not be allowed unless needed to meet management objectives (clearing trails, fire control).
- Water supply/Flood control – no major diversion or other structures will be allowed in the channel or river corridor.
- Mining – new mining claims and minerals leases are prohibited within ¼-mile of the river. Valid claims would be recognized. Existing mineral activity must be conducted to minimize surface disturbance, sedimentation, and visual quality. Reasonable access is allowed.
- Road construction – no new roads and no motorized travel will be allowed outside designated routes.

Guidelines for Eligible Wild Rivers, cont.

- Recreation development – major public use sites (campgrounds, administrative buildings) are located outside the wild river corridor.
- Utilities – new transmission, gas, and water lines are discouraged. Where no reasonable alternative exists, additional or new facilities should be restricted to existing rights-of-way.

Eligible Scenic Rivers

- Timber production – timber harvest may be allowed with the river corridor, provided it doesn't have substantial adverse effects on the river or the landscape in the river corridor. Outside the river corridor, timber is managed and harvested with special emphasis on visual quality.
- Water supply/Flood control – major diversions and flood control dams are prohibited.
- Mining – subject to regulations (36 CFR 228), new mining claims and mineral leases could be allowed and existing operations allowed to continue provided surface disturbance, sedimentation, and pollution are minimized and the visual character of the landscape is maintained.
- Road construction – roads may occasionally bridge the river. Short, conspicuous road stretches or longer, inconspicuous, well-screened road stretches could be allowed.
- Recreation development – public use sites (moderate-sized campgrounds, administrative facilities) are allowed, provided they are outside the river floodplain and screened from view.
- Utilities – new transmission, gas, and water lines are discouraged. Where no reasonable alternative exists, additional or new facilities should be restricted to existing rights-of-way.

Eligible Recreation Rivers

- Timber production – timber harvest would be allowed under standard restrictions to protect the immediate river environment, water quality, fish and wildlife, and scenic and other values.
- Water supply – existing low dams, diversion structures, rip-rap, and other minor structures are allowed provided the river stays generally natural in appearance. New structures are prohibited.
- Mining – subject to regulations (36 CFR 228), new mining claims and mineral leases could be allowed and existing operations allowed to continue provided surface disturbance, sedimentation, and pollution are minimized and the visual character of the landscape is maintained.

Guidelines for Eligible Recreation Rivers, cont.

- Road construction – parallel roads or railroads could be constructed on one or both riverbanks. There can be several bridge crossings and numerous river access points.
- Recreation development – campgrounds and picnic areas may be established close to the river. However, recreational classification does not require extensive recreation development.
- Structures – small communities as well as dispersed or cluster residential developments are allowed. New structures are allowed for both habitation and for intensive recreation use.
- Motorized travel – this activity, on land or water, may be permitted, restricted, or prohibited. Controls will usually be similar to surrounding lands and waters.
- Utilities – new transmission, gas, and water lines are discouraged. Where no reasonable alternative exists, additional or new facilities should be restricted to existing rights-of-way.

AFFECTED ENVIRONMENT

The 1985 Forest Plan Record of Decision states:

> "The segments of the Platte and Encampment Rivers that are eligible for Wild or Scenic River consideration are within Wilderness and adequately protected so they will not be studied for possible inclusion in the Wild and Scenic River System."

Therefore, there are currently no rivers recommended for Wild, Scenic, or Recreational designation.

Wild and Scenic River Eligibility/Classification Process

1. Identify streams to study.

Must include:

- Rivers listed in the Wild and Scenic Rivers Act
- Rivers listed in the National Rivers or Outstanding Rivers List
- Rivers identified during scoping

All streams on the Forest, perennial and non-perennial, were reviewed. There were no congressionally designated study rivers nor any rivers identified on the Nationwide Rivers Inventory list for the Medicine Bow National Forest. Other rivers looked at included those generated through discussion with the districts as well as those contained in the list American Rivers (a list showing state-wide

significant recreational fisheries). Douglas Creek, Encampment River, French Creek North and South, Little Missouri (being study under another planning process), North Platte, and Pioneer Ditch were all on the American Rivers list.

Two of the rivers reviewed were already deemed suitable by the 1985 Forest plan (the North Platte and Encampment River).

2. Determine if river segments are free flowing

- This means the section must be riverine in appearance and be free of high head dams and extensive rip-rap or diversions.

The Pioneer Ditch was deemed to not meet the free-flowing requirement and so was not carried further along in the process.

3. Determine if the rivers possess any outstandingly remarkable values (ORV)

- These values should be directly river related which means they must be located in the river or river corridor (1/4 mile back from the river), must contribute substantially to the functioning of the river ecosystem, and must owe their location or existence to the river. In order to be assessed as "outstandingly remarkable" a river related value must be a unique, rare or exemplary feature that is significant at a regional or national level.

Those rivers deemed to have outstandingly remarkable values were then given a classification rating of wild, scenic or recreational.

- Wild – rivers or sections of rivers without impoundments. Watersheds or shorelines are essentially primitive. These rivers/sections are generally inaccessible except by trail and have undisturbed landscapes.
- Scenic - rivers or sections of rivers without impoundments. Watersheds or shorelines are still largely primitive and undeveloped. These rivers/sections can be accesses in places by inconspicuous, well-screened roads.
- Recreational – rivers or sections of rivers that are readily accessible by road or railroads. They have some degree of development along the shoreline where minor structures are allowed, provided the river generally maintains a natural appearance.

The following table and map display the results of the Forest Service eligibility inventory and evaluation of streams on the Forest.

Table 3-128. Wild and scenic river inventory.

District	River/Stream	Eligible	Length (miles)	Classification	Outstandingly remarkable values
Brush Cr/Hayden Laramie	North Platte	Yes	16.35	Wild/scenic	S, R, W, F
Brush Cr/Hayden	Encampment	Yes	11.7	Wild/scenic	S, R, W, V, F
Brush Cr/Hayden	North Fork Little Snake	Yes	9.36	Scenic	F
Brush Cr/Hayden	West Branch North Fork Little Snake	Yes	7.72	Scenic	F
Brush Cr/Hayden	Roaring Fk. Little Snake	Yes	3.73	Wild	F
Brush Cr/Hayden	Rose Creek	Yes	.89	Scenic	F
Brush Cr/Hayden	Big Sandstone*	No	14.0	Wild	S, W, V, F
Brush Cr/Hayden	Solomon Creek*	No	4.0	Scenic	F
S= Scenic, R=Recreational, W=Wildlife, F=Fish, V=Vegetative					

* These public proposed rivers did not meet the FS eligibility requirements, but they were included as proposed Wild or Scenic River in Alternative F.

Map 3-16. Wild and Scenic Rivers on the Medicine Bow National Forest.

ENVIRONMENTAL CONSEQUENCES

Recommendations by Alternative

The table below shows Wild and Scenic River recommendations by alternative, classification, and miles. Two rivers, Big Sandstone and Solomon Creek, are public proposed rivers that did not meet the eligibility criteria developed by the Forest Service.

Table 3-129. Recommendation by alternative (miles).

River/Stream	Classification	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
North Platte	Wild	0.0	13.44	13.44	13.44	13.44	13.44	13.44
	Scenic	0.0	2.91	2.91	2.91	2.91	2.91	2.91
Encampment	Wild	0.0	10.03	10.03	10.03	10.03	10.03	10.03
	Scenic	0.0	1.30	0.0	1.30	1.30	1.30	1.30
Roaring Fork Little Snake	Wild	0.0	3.73	0.0	0.0	0.0	3.73	3.73
	Scenic	0.0	0.0	0.0	0.0	0.0	0.0	0.0
West Branch Little Snake	Wild	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Scenic	0.0	0.0	0.0	0.0	0.0	7.72	7.72
North Fork Little Snake	Wild	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Scenic	0.0	0.0	0.0	0.0	0.0	9.36	9.36
Rose Creek	Wild	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Scenic	0.0	0.0	0.0	0.0	0.0	.89	.89
*Big Sandstone	Wild	0.0	0.0	0.0	0.0	0.0	0.0	14.0
	Scenic	0.0	0.0	0.0	0.0	0.0	0.0	0.0
*Solomon Creek	Wild	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Scenic	0.0	0.0	0.0	0.0	0.0	0.0	4.0
Total Wild Miles		0.0	27.20	23.47	23.47	23.47	27.20	41.20
Total Scenic Miles		0.0	4.21	2.91	4.21	4.21	22.18	26.18
Total Combined Miles		0.0	31.41	26.38	27.68	27.68	49.38	67.38
* Public Proposed Rivers								

General Effects

Alternative F provides the greatest combined miles of wild and scenic designations (67.38 miles), followed by Alternative E at 49.38 combined miles. Alternative B has the next most with 31.41 combined miles, and Alternative D DEIS and D FEIS with 27.68 combined miles. Alternative C has 26.38 miles and Alternative A has 0.0 combined miles.

Direct and Indirect Effects

Effects from Minerals Management

Anticipated effects from mineral management would be low in all alternatives. The likelihood of future mineral development in stream segments for locatable and leasable minerals is low. There would be no anticipated adverse effects from mineral material removal as mitigation measures would be included in project level plans. Impacts from oil and gas leasing are mitigated with a No Surface Occupancy stipulation so there would be no impact from oil and gas leasing.

Effects from Livestock Grazing and Big Game Use

Effects from rangeland management and livestock grazing are anticipated to be moderate under any recommended river designations Livestock can adversely affect water quality, fisheries, soils, and vegetation within and outside of riparian and aquatic zones through compaction; alteration to streams, stream beds and stream banks; and the creation of cattle trails. These concerns would be addressed within the Comprehensive River Management Plan developed for designated river segments. In addition, livestock grazing and its management would be addressed within the appropriate allotment management plans for designated river segments.

Effects from Recreation Management

Effects from recreational use and management within designated river segments are anticipated to be low. Although designated river segments may be used for camping, canoeing and hiking, and other anticipated activities, the anticipated impact of these activities on the river segments is expected to be minimal.

Recreational users expect to experience primitive conditions within wild river segments, and so recreation development would not be allowed. Recreational development would be allowed under scenic designation however, the development would be carried out in such a way as to not adversely affect the reasons for scenic river designation.

Additional effects, such as some additional trash not disposed of properly and the possibility of escaped fires from recreational use can be expected but are anticipated to be low.

Fishing and hunting would not be prohibited under a wild or scenic classification. Fishing and hunting are regulated under state laws.

Effects from Travel Management

In general, the effects from travel management and motorized use are anticipated to be low within designated wild river segments. Effects from non-motorized use and permitted motorized use are anticipated to be low in scenic river segments. Within scenic segments, road building or river crossing developments to accommodate

motorized traffic would be allowed. However, construction of such developments might be more costly as design specifications seek to reduce visual impacts and the number or river crossings. If motorized use, such as recreational vehicle use, were shown to be causing adverse environmental effects, travel-closure orders may be applied at the discretion of the district ranger.

Even though some eligible river segments, especially those classified as wild, are very remote and quite inaccessible, the Wild and Scenic Rivers Act does not prohibit motorized use within designated segments. Because of the remote nature or wild river corridors, versus scenic, the volume of motorized traffic by land vehicles would be extremely low.

Non-motorized access within designated river segments would not be restricted. Canoeing the river corridor or hiking in on foot or horseback would likely be the primary ways to access wild or scenic river segments.

In addition, motorized boats, jet skis, hovercraft and other types of water-bound craft are allowed in wild, scenic, or recreational river segments, consistent with Congressional intent and the river management objectives as outlined in the enacting legislation and the Comprehensive River Management Plan. Motorized use would be prohibited in those river segments within established wilderness areas.

Effects from Scenic Management

Positive effects on wild and scenic rivers are expected from scenic resource management. River segments determined suitable will be treated as sensitive viewing zones.

Effects from Timber Management

Timber management has the potential to change the character of rivers and the adjacent areas. Within eligible wild river corridors, the cutting of trees will not be allowed unless needed to meet management objectives (such as trail clearing or fire control). Eligible scenic river corridors allow vegetative treatment of timber stands, as long as the treatment meets recreation or scenery objectives. Vegetative treatments outside all river corridors can be accomplished with an emphasis on meeting scenery objectives.

Cumulative Effects

There are more than 160 rivers and over 11,000 miles of wild, scenic and recreational rivers in the National Wild and Scenic Rivers System in 37 states. There are only two officially designated rivers in Region 2 of the Forest Service; Clarks Fork of the Yellowstone River in Wyoming and the Cache la Poudre River in Colorado. The Clarks Fork is a 20.5-mile stretch of wild river running through the Shoshone National Forest. The Cache la Poudre runs through Rocky Mountain National Park and the Arapahoe and Roosevelt National Forest. It is 76 miles long

with 30 miles of wild designation and 46 miles of recreational designation. Therefore, there are 96.5 miles in Region 2 that are part of the National System. Based on the alternative for this plan revision, the number of rivers and miles in Wyoming, in Region 2 and in the National River System could increase according to the following table.

Table 3-130. Increase in number and miles of river in the National River System by alternative.

	Alt A	Alt B	Alt C	Alt D-DEIS	Alt D-FEIS	Alt E	Alt F
Rivers (#)	0	3	2	2	2	6	8
Miles	0	31	26	28	28	49	67

The Routt National Forest Revised Land and Resource Management Plan was approved in February 1998. The Routt NF is administered as part of the Medicine Bow-Routt National Forest and Thunder Basin National Grassland administrative unit. In the 1998 approved Plan, 48.5 miles of the Elk and Encampment Rivers are recommended for wild and scenic river designation. In addition, 15 miles of the North Platte River, Rock Creek, Red Canyon River and Roaring Fork River are eligible wild and scenic rivers candidates and are given interim protection until a suitability study is conducted. The Thunder Basin National Grassland Revised Plan does not recommend any rivers for wild or scenic designation.

Although the effects of non-designation may not significantly increase recreation or tourism in or near the designated river segments, non-designation may represent a lost opportunity to protect stream characteristics that are unusual to the region.

Wilderness

Introduction – The Medicine Bow National Forest manages three Wilderness areas entirely—Savage Run, Encampment River, and Huston Park—and shares management of one with the Routt National Forest—North Platte (see the following map). Collectively, these Wilderness areas total 78,301 acres. Congressionally designated Wilderness is one type of special area designation on the forest.

The *Wilderness Act of 1964* established the National Wilderness Preservation System. It mandates that these areas are to be "administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as Wilderness," however Wilderness is not solely for recreation.

Since the Wilderness Act of 1964, the National Wilderness Protection System (NWPS) has grown dramatically. As of 1998, Congress had designated more than 100 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 Bureau of Land Management (BLM). Since 1994, however, little new Wilderness has been established.

The Wilderness system has been built through enactments of approximately 104 Wilderness bills, typically establishing Wilderness areas in a particular state. The Wilderness Act allows additional undeveloped and unroaded lands to be added to the NWPS. The Forest Service initially inventories Wilderness potential by identifying roadless areas 5,000 acres or larger. There are three tests applied to roadless areas before they are considered for Wilderness recommendation: capability, availability, and need. In the latest Forest Service evaluation, nearly 300,000 of the recently inventoried roadless area were Capable and Available (*Appendix C*).

Wilderness is part of the National Forest multiple use management mission. Wilderness provides opportunities for solitude and for primitive and unconfined recreational experiences. Wilderness is important for maintenance of species diversity, protection of threatened and endangered species, protection of watersheds, scientific research, and various social values.

Inside the boundary, the area is protected from development, including development of roads, dams, or other permanent structures; from timber cutting; and from the operation of motorized vehicles and equipment. Outside the boundary, multiple use continues, including logging, road building, development, and in many cases, private land development.

Changes Between Draft and Final

- Some individuals commented that Wilderness is discriminatory. Information on the Americans with Disabilities Act is included in this final.
- Grazing and livestock use authority is clarified. Reference FSM 2323 for specific regulations inside designated Wilderness.

Legal and Administrative Framework

The Wilderness Act of 1964 directed the Secretary of Agriculture to initiate reviews of the initial 34 primitive areas and to submit recommendations regarding their future to Congress within 10 years of the act's passage. Section 2 of the Wilderness Act defines Wilderness and sets forth policy and implications for Wilderness designation. Lands are designated as Wilderness … "in order to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition."

The Endangered Wilderness Act of 1978 designated the Savage Run Wilderness Area (14,440 acres).

The Wyoming Wilderness Act of 1984 designated the Platte River (23,000 acres), Huston Park (31,300 acres), and Encampment River (10,400 acres) Wilderness Areas.

USDA-Forest Service Manual and Handbook System – 2320 Wilderness Management

Key Indicators

- Acres managed to standard.

Resource Protection Measures

The Wilderness Act established the National Wilderness Preservation System. Forest wide standards and guidelines apply under any alternative. These standards and guidelines don't allow degradation of the Wilderness resource.

Map 3-17. Existing Wilderness areas on the Medicine Bow National Forest.

AFFECTED ENVIRONMENT

The size and geography of the Medicine Bow National Forest Wilderness Areas are unique in the Forest Service Rocky Mountain Region. Unlike the 14,000-foot rock and ice peaks in Colorado and the Wind River Mountains (WY), less than 1 percent (.8%) is rock and ice, 80 percent is forested, and nearly 20 percent is grass and forbs.

The Savage Run Wilderness Area

The Endangered American Wilderness Act of 1978 (PL-95-237) designated the first Wilderness Area on the Medicine Bow National Forest. The Savage Run Wilderness covers approximately 23 square miles (15,260 acres).

The Platte River, Encampment River, and Huston Park Wilderness Areas

The Platte River, Encampment River, and Huston Park Wilderness Areas were created with the passage of the Wyoming Wilderness Act in 1984 (PL-98-550).

Legal Authority

Wilderness management is in accordance with the enabling legislation, and Forest Service policy, which regulates human use and influence, in order to preserve the quality, character, and integrity of the Wilderness lands. Section 4(c) of the act prohibits the public from certain activities in Wilderness. "Except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act (including measures required in emergencies involving the health and safety of persons within the area), there shall be no temporary road, no use of motor vehicles, motorized equipment, or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area."

Congress acknowledged that, even though certain activities are prohibited, exceptions [will] be necessary for administration of Wilderness areas. The act protects private property rights, legal permits, and it protects rights for water diversion and use, including construction, operation, maintenance, and modification. Direction in FSM 2324 provides managers with prohibition, policy and requirements for conducting activities not consistent with Wilderness preservation.

Supply and Demand

The Savage Run Wilderness: The Wilderness is part of the western foothills of the Snowy Range with drainages flowing into the North Platte River. Elevations range from 8,000 feet to 10,000 feet. Thick stands of spruce and fur dominate the steep-sided canyons in the north and east. On the central and southern part of the Wilderness, slopes fall gently to the west with aspen groves lining the streambeds of

Cottonwood and Savage Run creeks. South facing slopes above Cottonwood and Savage Run Creeks are covered with grass and sagebrush. Views of the Saratoga Valley and Sierra Madres can be enjoyed from several vantage points lower, rolling, plateau-like terrain located in the southwestern area.

The Wilderness is accessed from three main trailheads, including Cottonwood Trailhead and Extension Trailhead on the south side off of Forest Service Road #512, and Savage Run Trailhead on the north side of Forest Service Road #500. There is access of Forest Service Road #502; however there is no maintained trail or trailhead in this area.

Hunting is one of the most popular activities in this Wilderness.

The Platte River Wilderness: Established by Congress in 1984, the Platte River Wilderness is managed by three Ranger Districts in two States. A small portion (743 acres) is located in Colorado's Routt National Forest, and the remaining 22,006 acres are in Wyoming's Medicine Bow National Forest. The Wilderness receives its name from the North Platte River, which flows south to north along its western edge.

Identified threatened and endangered species present include the transitory use of a bald eagle nest. A breeding pair of bald eagles has been noted on the Wyoming side of the Wilderness. There are also a wide variety of other water and shore birds. Rocky Mountain bighorn sheep, elk, moose, black bear, and a variety of smaller animals make their home above the river. The elevation ranges from 7,420 feet along the lower reaches of the North Platte River and Douglas Creek to over 9,000 feet on the rolling plateau-like terrain of Platte Ridge.

The Platte River Wilderness includes about 36 square miles of forested land lying primarily north and east of the North Platte River. Use is dependent on runoff. The river has the distinction of a "blue ribbon" trout stream, even though the Wyoming Game and Fish does not stock streams in Wilderness.

A popular use of the Wilderness is through Northgate Canyon, a popular white-water rafting section of class III-IV water. There are 14 permitted commercial outfitters that use the river through the Wilderness Area. These outfitters provide scenic fishing floats, overnight trips, and exciting whitewater adventures. There are also many private groups that regularly enjoy the Wilderness from the river. Over the last few years, use levels have dropped off with low water levels since 1998, but most likely increased this past summer with increased flows. That data is not yet available. The following table illustrates the drop off in use levels at the two North Platte launch sites.

Table 3-131. Number of boating parties on the North Platte River 1998 - 2002

North Platte River Boating					
Launch Site	1998	1999	2000	2001	2002
Platte Access	142	117	23	13	1
Six Mile	35	33	26	41	1

Other uses are from hikers using the four different trails, backpackers, fishermen, and hunters. Camping is limited due to the canyon terrain.

The Huston Park Wilderness: The Huston Park Wilderness is the largest Wilderness Area on the Medicine Bow, at 30,588 acres. With approximately 48 square miles of high forested land, Huston Park Wilderness rises beyond 10,500 feet and contains alpine bogs and stands of lodgepole pine, spruce, fir, and aspen, interspersed with open parks and brushy meadows. The streams are small and their water drains into the Little Snake and North Platte Rivers. A few of the streams are home to native Colorado cutthroat trout and some sport species.

Straddling the Continental Divide, this area includes 18 miles of the Continental Divide National Scenic Trails (CDNST) at an average elevation of 9,750 feet. This section of the CDNST is undeveloped and marked with posts, rock cairns and blazed trees. The Baby Lake, Green Mountain, Verde Mine, and Roaring Fork Trails provide access to and from the CDNST. The Green Mountain Falls trail is also located in the Wilderness. This is a popular destination for picnickers and day hikers. These pathways are all undeveloped and marked in primitive ways within the Wilderness.

Human use is very low most of the year, with the exception of the various hunting seasons in the fall. Although primarily used during hunting season, this area is also utilized by backpackers, day hikers, picnickers, stock users, and fishermen. Huston Park Wilderness provides many spectacular and panoramic views of the Platte Valley in Wyoming and scenic areas in Colorado.

The Encampment River Wilderness: The Encampment River Wilderness is the smallest Wilderness Area in the Rocky Mountain Region, at 10,024 acres. Visitors to the Encampment River Wilderness come to fish, camp, backpack, and hike along the scenic Encampment River trail. The river runs wildly over rocks, creating class IV-V rapids and a deafening roar in the spring that only expert kayakers and rafters dare to attempt. The Encampment River cuts through jagged cliffs and steep slopes covered with lodgepole pine, spruce, and fir. Mule deer, elk, Rocky Mountain bighorn sheep, black bear, and mountain lion inhabit the canyon.

Here in the northernmost extension of the Southern Rocky Mountains, the Encampment River flows north out of Colorado, past the town of Encampment and into the North Platte River. Along part of the river's canyon lies Wyoming's smallest Wilderness, approximately 16 square miles, a strip less than one mile wide in the southern portion that widens to about five miles near the northern boundary. Throughout the canyon, the river runs from wild rapids to peacefully placid stretches, and is home to brook, rainbow, and brown trout. Sagebrush grows on the open slopes, and the canyon is full of riparian vegetation.

The Encampment River Trail runs the length of this narrow, rugged river canyon, one of the main attractions of the Wilderness. The lower five miles are relatively easy to hike, although the terrain becomes increasingly difficult in the remaining 10

upper miles. The trail receives moderate use by hikers. Along the way you'll pass ruins of old cabins and mining operations.

Uses and Values

Wildness has been a part of America since its beginnings. For this reason, Americans have a special attraction to Wilderness areas. In effect, this is a diverse and complex society for whom the relevance of Wilderness may not be clear.

Wilderness is managed in accordance with the

The 1999 National Survey on Recreation and the Environment (NSRE) asked people to choose an ending to the sentence, "The 'naturalness of Wilderness' is considered to be extremely important for ..."

Protecting air quality	58.4%
Protecting water quality	55.9%
Protecting wildlife habitat	52.7%
Protecting endangered species	49.8%
Legacy for future generations	49.1%
Preserving unique ecosystems and genetics	44.3%
Future option to visit –	37.5%
Just knowing it is preserved –	36.9%
Providing scenic beauty –	35.4%
Providing recreation opportunities –	27.8%
Providing spiritual inspiration –	25.9%
Undisturbed area for scientific study –	23.9%
Providing income for tourism industry –	9.7%

Americans with Disabilities Act (ADA)

The Americans with Disability Act (ADA) addresses the issue of discrimination against individuals with disabilities in Wilderness in Title V Section 507 c. In general, nothing in the Wilderness Act prohibits wheelchair use in a Wilderness area by an individual whose disability requires its use. *The term wheelchair means a device designed solely for use by a mobility-impaired person for locomotion that is suitable for use in an indoor pedestrian area*.

The Wilderness Act requires no agency to provide any form of special treatment or accommodation or to construct any facilities or modify any conditions of lands within a Wilderness area to facilitate such use, and according to Forest Service policy, units aren't required, nor are they restricted from providing special

accommodations for wheelchairs. However, there are millions of acres of 'near Wilderness' experiences that may better facilitate wheelchair use. Wheelchairs are not the only devices serving the disabled. According to Joe Meade (Forest Service National Access Program Manager), Forest Service policy is not to hinder a person with a disability from using a non-motorized mechanical device different than just a wheelchair in order to access the Wilderness.

Water Development

The Cheyenne Water Board of Public Utilities manages the flow of water from the Snake River drainage over two mountain ranges, through three reservoirs on the Forest, and into the North Crow Reservoir for domestic use by residents of Cheyenne. This transbasin diversion is very closely monitored, but originates south of the Huston Park Wilderness. The Board has a road, specifically for maintenance of the diversion and pipeline. In June 1983, US District Court for the district of Wyoming, ruling prohibited public vehicular access, including snowmobiles on newly constructed Stage II roads, except for the board, the Forest Service, the private landowner, or by special use permit on the gated portions of NFSR 809.1a and 809.1b.

Recreation Use and Values

Recreation is the primary use of Wilderness Areas on the Forest; however when managers have to make a choice, preserving the Wilderness resource is the overriding value over visitor use. Recreation values, like self-reliance, are particularly important as they teach us something about the human relationship with nature.

The Wilderness Areas on the Medicine Bow are of such a small size, it's possible to hike across them in one day. This makes weekend excursions to the Wilderness possible for overnight and day users. This also explains why the average length of stay in the National Visitor Use Monitoring (NVUM) (USDA-Forest Service 2003) was 11 hours.

According to the 1998 Monitoring Report, recreation density was a consistent 0.03 people-at-one-time per acre or less than 50% of the most restrictive standard listed in the 1985 Forest Plan. Current use levels and projections of use types specific to Wilderness indicate a slow, steady growth through 2050 (Bowker, D.B.K. English et al. 1999)

The NVUM(USDA-Forest Service 2003) survey provided information on Wilderness use, and the satisfaction levels of those users (see *Recreation in this section for a discussion on use).* For these individuals, the most important aspect of the visit was the condition of the natural environment. On a scale of 1 to 5, this item was rated as 5.0 in importance, and 4.9 in satisfaction. Scenery was also important, rating 4.9 in importance, and 5.0 in satisfaction. Other items rating a high 4.8-5.0 in

satisfaction included the feeling of safety, condition of trails, available parking, and condition of parking lots, and the condition of the trails. Signs and helpfulness of employees rated 4.6.

ENVIRONMENTAL CONSEQUENCES

General Effects

Simply designating an area as Wilderness does not assure its preservation. Careful management is needed to minimize the impacts from human activities inside and outside the Area. There is no difference in current Wilderness acreages among alternatives. Area restrictions presently in effect for resource protection will be applied to each alternative. All alternatives will provide education opportunities to encourage low-impact camping methods and use the Leave No Trace program to maintain a quality Wilderness experience.

Direct and Indirect Effects

Effects from Areas Recommended for Wilderness

There were numerous comments from the public over potential additions to the Wilderness Preservation System based on the most recently inventoried roadless areas on the Forest. Some individuals mentioned the fact that the small size of the current Wilderness Areas is the main reason use is so low. Recommendations were made for enlarging currently designated areas, as well as adding to the total number of Wilderness Areas. Planning and monitoring provide opportunities to more effectively manage Wilderness. At the end of the first decade, there would be more acres to standard in Alternative F, followed by D DEIS, D FEIS E, B, A, and C.

For a discussion on Areas Recommended for Wilderness, see the *Roadless* section of this chapter, and Appendix C of the EIS.

Effects from Recreation Use

Recreation use of the four existing Wilderness Areas is low, compared to other Wilderness Areas in the Region. Changes in use may occur in response to additions to the Wilderness system. The designation of new Wilderness oftentimes produces a new level of demand. Alternative F would recommend the most acres in Wilderness, followed by Alternative D DEIS, D FEIS, and E.

By managing for semi-primitive non-motorized opportunities outside Wilderness, the Forest Service can decrease social and physical impacts inside Wilderness. Alternative C would add the most SPNM acres outside Wilderness, followed by Alternatives E, and D FEIS. Alternative F would recommend adding all but 83,124 semi-primitive non-motorized acres to the Wilderness system, followed by Alternative D DEIS.

Table 3-132. Existing and proposed Wilderness acres, and semi-primitive non-motorized acres by alternative.

Wilderness and SPNM Acres	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Total SPNM ROS	213,928	209,535	261,970	316,992	286,266	265,206	433,331
Total SPNM inside Wilderness including MA 1.2	78,850	78,850	78,850	139,709	106,881	83,403	350,207
Additions to Wilderness	0	0	0	60,834	27,973	4,553	271,357
Total SPNM outside Wilderness	135,078	130,685	183,120	177,283	179,385	181,803	83,124
Percent of Total Forest in SPNM	19.7%	19.3%	24.2%	29.2%	26.4%	24.5%	40.0%

Boundary management is an issue on the Medicine Bow National Forest. Indiscriminate four-wheeling and snowmobiling into designated Wilderness Areas are a management concern. Campsite and boundary monitoring, and Wilderness planning are dependent on budget. At the end of the first decade, more acres would be managed to standard in Alternative F, followed by D DEIS, D FEIS, E, B, A, and C.

Effects from Air Quality Degradation

Road maintenance adjacent to the Wilderness Areas will continue to help abate dust particulates from road use, and will occur in all Alternatives. In addition, there were air quality impacts from the Hammer Sawmill in the Encampment River Wilderness when it was in full production. This would be more likely to occur in Alternatives A through D FEIS, and not in Alternatives E and F. There are currently no industrial types of use occurring upwind from any of the Forest's four designated Wilderness areas. Air quality monitoring will continue to occur in all Alternatives.

Effects from Water Quality Degradation

There are management challenges with water quality in Wilderness areas on the Forest since headwaters are in other management prescriptions, and drain into Wilderness areas. Physical and biological integrity of Wilderness area water quality must be maintained at the level that existed at the time of designation. Alternatives E and F include management areas in headwater areas that provide the highest levels of protection for water quality. These alternatives would therefore minimize the risk of water quality degradation.

Surface waters within Wilderness Areas on the Forest are given the highest level of protection under the Clean Water Act and "no further water quality degradation by point source discharges other than from dams will be allowed" (WYDEQ, 2002 p.1-10). Alternatives A, B, C, D DEIS and D FEIS include management areas in

headwater areas with an emphasis on commodity uses and may require additional best management practices to prevent water quality degradation.

Wilderness monitoring is dependent on budget. At the end of the first decade, there would be more acres to standard in Alternative F, followed by D DEIS, D FEIS E, B, A, and C.

Since human use is often the source of water degradation, additional opportunities for a semi-primitive non-motorized experience might help ensure use levels remain low in existing Wilderness Areas. Alternative C would add the most SPNM acres outside Wilderness, followed by Alternatives E, and D FEIS. Alternative F would recommend adding all but 83,124 semi-primitive non-motorized acres to the Wilderness system, followed by Alternative D DEIS.

Effects from Fire Management

Historically, Wilderness fires on the Medicine Bow have been suppressed, resulting in changes to fuel accumulations and fire regimes. The objectives of fire management in wilderness are (1) to permit lightning caused fires to play, as nearly as possible, their natural ecological role within wilderness, and (2) to reduce, to an acceptable level, the risks and consequences of wildfire within wilderness or escaping from wilderness (Forest Service Manual 2300). Operational wildland fire use guidebooks are prepared to supplement the Forest Fire Management Plan to guide wildland fire use implementation, prior to allowing natural fires to burn under appropriate conditions.

Wildfires are part of the ecosystem processes within Wilderness, but as the Wilderness Areas of the MBNF are contiguous with forested lands, fires are generally suppressed to avoid their spread. Some Alternatives emphasize either natural processes or commodity production, while others are somewhere in between. Natural processes would be emphasized outside Wilderness most in Alternative F, followed by D DEIS, E, D FEIS, C, B, and A.

Effects from Native Fish and Wildlife Management

Wildlife and Fish management are a joint effort between the Forest Service, the Wyoming Game and Fish Department, and the U.S. Fish and Wildlife Service to ensure that Wilderness management decisions are compatible with maintaining wildlife. . The Wyoming Game and Fish Department is not stocking fish in Wilderness. There are no trout native to the North Platte basin. All activities are conducted in accordance with the Wilderness Act's purposes for protection of natural processes.

Although not mapped as such, the Savage Run, North Platte and Encampment River Wilderness Areas provide crucial winter range for wildlife. Recreation, especially during the winter, could be restricted in these Wilderness Areas if human activity is determined to disturb wildlife. Areas potentially affected include the river corridors of the Encampment and North Platte Rivers.

Some species benefit from Wilderness as a result of fire and other natural processes. Natural processes would be emphasized outside Wilderness most in Alternative F, followed by D DEIS, E, D FEIS, C, B, and A.

Effects from Threatened, Endangered, and Sensitive Species Management

Recreational use within Wilderness Areas may be regulated where or when it threatens recovery of any threatened, endangered, or sensitive species or impacts critical wildlife. Standards for TES would most affect current use in the Platte River Wilderness, where the bald eagle nest is on the river.

Effects from Livestock Grazing

Grazing would continue in wilderness in accordance with Congressional guidelines, provide additional clarification on grazing in Wilderness pertaining specifically to stocking levels, number and type of improvements, use of motorized equipment, and emergency situations. Commercial livestock grazing activities are managed through term grazing permits, and allotment management plans direct monitoring and compliance with those provisions, as well as the Forest Plan standards and guidelines. There would be no difference in this process with any of the Alternatives.

The numbers of pack stock allowed in the Wilderness are limited by the Standards and Guidelines in the Forest Plan; party sizes are restricted to no more than 25 people and pack stock, combined. This is no change from current regulations, but may change as management plans are developed for the Wilderness Areas, as is directed in the Goals and Objectives of Chapter 1 of the Plan.

Effects from Noxious Weed Management

Standards and Guidelines in the Forest Plan prohibit users with stock from bringing in weed seed in their feed, but this isn't the only way these seeds are spread. Forest Service roads are typical methods of import for weed seeds, and there are arterial roads directly alongside all four Wilderness Areas. The Forest currently monitors for non-native plant species, and has received approval from the Regional office to treat leafy spurge along the North Platte River below the Six Mile Access with herbicide. The stand of spurge has been treated twice, once in 2001, and again in 2002. There are plans to treat this stand through 2006. Further biological controls (musk thistle beetle) have been used for musk thistle in the Six Mile/Prospect area for approximately ten years.

Effects from Oil, Gas and Mineral Development

Designated Wilderness Areas are withdrawn for Oil and Gas development. Of the four Wilderness areas on the Medicine Bow National Forest, only the Huston Park Wilderness on the Sierra Madre range has lands with any known oil and gas resource potential. Noise from oil and gas exploration in areas adjacent to Wilderness could

have a temporary effect on Wilderness character. However, drilling stipulations vary in management areas within 1 mile of the Wilderness. Most of the stipulations in areas adjacent to the Wilderness are either controlled surface or no surface occupancy. The following table compares alternatives according to acres available with low or medium oil and gas potential within 1 mile of Wilderness (not including the Wilderness).

Table 3-133. Federal mineral acres for areas with oil and gas potential (low or medium) within 1 mile of existing Wilderness.

Stipulation	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Controlled Surface Use	0	0	3,214	3,563	4,908	4,673	816
Controlled Surface Use & Timing Limitation	0	0	0	0	0	375	0
Not Administratively Available (Alt A Only)	8,830	0	0	0	0	0	0
No Surface Occupancy	0	0	5,516	5,246	3,924	1,908	7,993
Standard Lease Terms Only	0	8,829	100	21	0	1,874	21
Timing Limitation	0	0	0	0	0	0	0
TOTAL Federal Minerals	8,830	8,829	8,830	8,830	8,832	8,830	8,830

For each alternative, there are approximately another 60,500 acres of land with no known oil and gas leasing potential that were coded to Site Specific Analysis Required in the Oil and Gas Leasing Analysis. There are approximately another 3,770 acres of private surface and subsurface ownership not covered by the Oil and Gas Leasing Analysis, and another 960 acres of land where the surface is owned by the Forest Service but the minerals are privately owned.

The four Wilderness Areas on the Medicine Bow National Forest have been withdrawn from location and entry under the 1872 Mining Laws. This means that no new mining claims can be entered in the any of the MBNF Wilderness Areas. All but one unpatented mining claims/operations have lapsed since the designation of these four Wilderness Areas. The Golden Eagle mine located on the southern boundary of the Savage Run Wilderness Area (NT14, WR80, Section 30, NW ¼) is an active load claim of 20 acres.

There are non-federal lands, inside the Huston Park Wilderness Area. The parcel commonly known as the Itmay has both private surface and private minerals, known as a split estate that predates the Wilderness Area. The Huston Park Wilderness Area also has several private parcels that are privately reserved mineral (subsurface) ownership.

There are two Federal Energy Regulatory Commission (FERC) and Bureau of Reclamation (BOR) power encumbrances on the Platte and Encampment Rivers, inside and outside these Wilderness areas boundaries. The 1984 Wyoming

Wilderness Act specifically allows for future development of listed FERC or BOR projects, either for energy generation or water development projects.

Effects from Special Interest Area (SIA) Designation

Special interest areas (SIAs) are one of the multiple management prescriptions possible inside Wilderness. Special interest areas are managed with an emphasis on protecting or enhancing areas of unusual characteristics. There are currently no SIAs inside Wilderness. Alternative D DEIS proposes 11,857 acres of special interest areas in Wilderness.

Effects from Research Natural Area (RNA) Designation

In general, the RNA designation is complementary and compatible with Wilderness. Three proposed RNAs are within three Wilderness areas; Standard Park in Huston Park Wilderness Area, Platte Canyon in the Platte River Wilderness Area, and Savage Run in Savage Run Wilderness Area. Alternative D FEIS designates Platte Canyon and Savage Run.

Existing non-motorized recreation use would be allowed as long as the use does not become 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 impacted areas or administrative closures might be imposed.

Trails that exist prior to RNA designation are allowed for recreation, scientific, or educational access, except when they are a threat to the values for which the RNA was proposed. The construction of new trails is prohibited except when necessary to correct resource damage occurring from existing trails, in accordance with standards and guidelines in Management Area 2.2. This is not expected to cause problems, due to the current low use levels. However, where monitoring indicates a concern, a shift in use may be encouraged to semi-primitive non-motorized areas outside Wilderness.

Effects from Wild and Scenic Rivers Designation

Like RNA designation, Wild and Scenic Rivers designation is not incompatible with Wilderness management. Non-motorized use on and alongside the rivers would be allowed to continue with the designation. With the exception of Alternatives B and E, all Wild River recommendations are inside Wilderness. Alternative F recommends the highest acreage to a Wild designation, followed by B, E, C, D DEIS and D FEIS. There are currently (Alternative A) no acres designated Wild on the Forest. This designation does not supersede private water rights.

Alternatives E and F have Scenic River designations inside Wilderness, which have lower levels of protection. This dual designation would still provide maximum protection to the Wilderness resource.

Effects from Timber Management

Logging and related road building activities near the Wilderness boundary has the potential to affect use levels by creating motorized entry points. Improved access may result in increased recreation use. In addition, use in areas adjacent to the existing Wilderness Areas change with road building. In the short term, noise levels ruin the perception of being in a remote area. This would be a change from a semi-primitive non-motorized experience to a roaded modified experience. Timber management (MA 5.13) and the associated road building is proposed adjacent to Huston Park, Savage Run, and Encampment River Wilderness areas in all Alternatives, except E and F.

Cumulative Effects

Coalbed Methane Development on the North End of the Forest

This development would be off the Forest, and downstream from any Wilderness Area on the Forest, that there would be no expected effects from drilling. Development on the west side has a slight potential to affect Wilderness values, which should be considered prior to development.

Green Mountain Ski Resort

Wilderness Area boundary management will continue to be a problem, in the Huston Park Wilderness Areas in any of the alternatives, but the development of the Green Mountain Ski Resort will increase winter use. This increase may increase uncontrolled motorized use, which would require more aggressive environmental education program by the resort owners, the State Trails program, and the Forest Service. There will also be a need for more continuous patrols by Forest Service employees.

Long-term Effects from Historic Mining

Water quality issues relative to mining are created from situations left over from the early 1900s. Water pollution problems typically are created by water running over dump rock, or from the inside of underground mines, rather than from contaminated soils. As the water moves over the dump rock or through the workings it becomes acidic. If this drainage develops in a working mine that has copper mineralization, the copper may be leached out during which time the pH is usually reduced. The Huston Park Wilderness is located in what was the southern portion of the Grand Encampment Mining District. Portions of the area received extensive mineral exploration and activity during the mining boom.

There is still one private surface inholding south of Standard Park, known locally as the Itmay Mine. The historical adit or mine tunnel associated with the Itmay Mine development does discharge water. This water has been sampled and found to have water quality problems. The water was sampled during field survey work on

abandoned mines, at the adit only, with no further investigations made of the water draining into the Roaring Fork of the Little Snake River or from the dump rock below the adit. There are several physical fall hazard adit/vertical tunnels; one is located just up the hill from the Itmay mine. There are several other physical hazards located within Huston Park Wilderness Area. Just west of the Itmay location is another adit, a vertical tunnel with a greater than 50-foot physical fall hazard.

Over time, these mineral developments will erode and rot away. The prospect pits (adits with dump rocks) will be evident for many years to come, but the structures will slowly fade away. At this time, most of the trails and roads used during the mine boom days are gone, and would remain so in any of the alternatives.

Production of Natural Resources

Minerals

Introduction – Mineral resource use on the Medicine Bow National Forest has historically been widespread but sporadic. Mineral activity is presently concentrated in a few scattered areas. Activity has fluctuated with demand, and current low prices for many minerals make exploration and development uneconomical.

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.

Legal and Administrative Framework

The General Mining Law of 1872 allows exploration, development, and production of minerals from mining claims on public lands.

The Mineral Land Leasing Act of 1920 established the leasing system for the acquisition of coal, phosphate, oil, oil shale, gas, and sodium.

The 1947 Mineral Leasing Act for Acquired Lands 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.

Mineral Material Act of 1947 authorized disposal of common variety minerals. It also allows free use by government agencies, municipalities, and non-profit organizations.

The Surface Resources Act of 1955 allows the sale of mineral materials such as sand and gravel and provides direction for the multiple use of surface resources of mining claims.

The Endangered Species Act of 1973 requires protection of habitat for endangered species.

Organic Act of 1944 - provides for the protection and management of resources of Federal lands.

Federal Land Policy and Management Act of 1976 Section 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.

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 historic or scientific interest" on the National Forest System lands. This law applies to paleontological resources.

Code of Federal Regulations (CFR) 36 CFR 261.9 – This regulation prohibits "excavating, damaging, or removing any vertebrate fossil or removing any paleontological resource for commercial purposes without a special use authorization."

Key Indicator

- Acres open to locatable mineral entry.

Resource Protection Measures

Locatable minerals

36 CFR 228 requires the mining 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 Forest would work with the claimant to assure that standards and guidelines in the forest plan are met. The operation plan requires an environmental analysis and decision before the plan is approved.

AFFECTED ENVIRONMENT

Mineral resources on federally owned lands are separated into three categories—locatable, leasable, and mineral materials—by statutory and regulatory direction. The following section discusses locatable and mineral materials. Leasable minerals (oil/gas) are addressed separately.

For lands patented under the Stock-Raising Homestead Act (SRHA), the mineral estate was reserved to the United States. The Supreme Court has held that the mineral estate included all deposits of mineral materials, and such deposits on SHRA lands belong to the United States. The 1947 Mineral Materials Act gives the Secretary the authority for disposing common variety minerals belong to the government, and the Multiple Use Mining Act of 1955 (PL-167) amended the 1947

Act to mean the Secretary of Agriculture where the lands involved are under his/her jurisdiction. The Medicine Bow National Forest does have SRHA lands within the Forest boundary. Therefore the Medicine Bow National Forest has the authority for disposing of Mineral Materials from these lands within the Forest boundary. Activities associated with the exploration, development, and disposal of minerals from these lands is guided by the Forest Service regulations at 36 CFR 228.

Locatable Minerals

Locatable minerals are those valuable deposits subject to exploration and development under the Mining Law of 1872 (as amended). Examples include iron, gold, copper, silver, lead, and zinc. The public has statutory right to explore for, claim, and mine mineral deposits found on federally owned lands subject to U.S. mining laws. Through a Memorandum of Understanding with the BLM, the Forest Service administers most aspects of operation under the U.S. mining law on NFS lands.

The Forest does have some areas with high-to-moderate potential for locatable minerals (Hausel and Sutherland 1999). The potential commercial production of these minerals is concentrated in a few areas. Much of the surface within the MBNF was prospected during the late 1800s and early 1900s. Many areas show an almost continuous coverage by historic prospects and mines. Most mines and prospects were not developed to any great extent, a few yielded attractive base and/or precious metal assays and were developed into commercial ventures. Mine operations ceased at most of these mines due to a variety of circumstances including declining metal prices, ore complexity, outbreak of war, and other political or human-related factors.

Several areas have the potential for building stone and decorative stone. The Forest Service has received several requests for information concerning these areas, but no formal proposals to quarry or produce the materials. This may change with future price fluctuations.

Most of the current mining activity on the Forest has been considered “recreational” in nature. This includes panning, and suction dredging with a suction diameter of 3 inches or less for short durations in specified timeframes. The U.S. Army Corps of Engineers considers the use of a 3-inch or smaller suction dredge “recreational” and does not require a 404 permit for this activity. Wyoming’s Department of Environmental Quality, Land Quality Division, issues Letters of Authorization for these activities. The Letter of Authorization issued by the State serves as the Notice of Intent. The Forest Service then assumes responsibility for inspecting the mining operation and making sure it complies with spacing and other requirements in the Letter of Authorization. The State’s guidelines are some of the most stringent in the nation. There are between 9 and 11 bonded small mining operations on the Forest annually. They are seasonal, covered by a Plan of Operations, and usually utilize a small backhoe to dig exploratory trenches.

There are exploratory core drilling operations on the Forest about every third year, but after the exploratory drilling is done, there has been no further interest shown. Exploration, development, and production of locatable minerals will continue to depend on market prices and commodity supply and demand. As technological advances are made, the MBNF should expect an increase in exploration demands due to the conclusion of some geologists that this may be one of the more highly mineralized forests in the United States. The significant mineral potential should be considered and weighed in any and all future planning processes.

The Forest Service may request withdrawal of areas from mineral activity if the activity might conflict with other management objectives. The following table displays the reasons for withdrawals.

Table 3-134. Current locatable mineral withdrawals on the Forest.

Type of Withdrawal	Acres
Special designated areas (Wilderness RNAs, SIAs, etc.)	107,829
Roadside zones (Scenic Byways)	1,031
Power/coal	15,460
Dams/reservoirs	1,960
Ski areas	980
Recreation areas	25,569
Administrative sites	1,554
Campground/picnic areas	2,841
Total	157,244

SOURCE: These are not management area allocation withdrawals, but are site specific administrative withdrawals

Mineral Materials

Mineral saleable materials are generally low-value deposits of sand, clay, and stone used for building materials and road surfacing. Extracting these materials from NFS land is at Forest Service discretion. The major statutes are the Minerals Materials Act of 1947 and the Surfaces Resources Act of 1955. The Forest has identified potential aggregate source on the Forest. The demand for gravel will increase as campgrounds, forest roads, and county roads are improved. Forest Service policy is to make mineral materials on National Forest System lands available to the public and to local, State and Federal government agencies where reasonable protection of, or mitigation of effects on, other resources is assured, and where removal is not prohibited. At this time there are off-Forest sources to meet private needs.

ENVIRONMENTAL CONSEQUENCES

General Effects

Mineral Materials

Common variety minerals may be sold for fair market value or disposed of through free use in any of the proposed alternatives. Potential aggregate sources have been identified across the Forest. The demand for gravel will increase as campgrounds, Forest service Roads, and county roads are improved. Sources to meet private needs are available off-Forest.

There may be adverse affects from the development of sources for these materials. Requirements for development include site specific Pit Development Plans where size of disturbance, volumes of materials, values of materials, length of disturbance, and reclamation strategies and requirements are identified. Environmental analysis is required for all proposals to ensure proper protection of the environment and improvements, including timely reclamation of disturbed lands.

Locatable minerals

The areas with moderate to high geologic potential for discovery of locatable minerals include the Eagle Rock-Happy Jack area for Kimberlitic indicator minerals, and the Mullen Creek, Lake Owen, and Puzzler Hill geologic complexes for platinum-palladium mineralization indicators. There have been exploratory core drilling operations in each of these complexes, but there has been no further interest shown. Market prices, commodity supply and demand, and technological advances will influence future interest in exploration, development and production.

Paleontological Resources

Based on geological formations, there is potential for paleontological resources to occur on the Medicine Bow National Forest. However, very limited information is currently available. An assessment of these resources is currently being planned. Paleontological resources are protected in a similar fashion to heritage resources in that during site-specific project analyses, their presence is identified and the resource protected through project mitigation measures. Effects to these resources are similar under all alternatives since potential impacts will be mitigated as a result of surveys conducted prior to site-specific project implementation. Alternatives with a higher level of resource management activities will have a greater likelihood of identifying these resources. Alternative ranking for identifying paleontological resources in the order of most to least are A, B, C, E, D FEIS, D DEIS, and F.

Direct and Indirect Effects

Effects from Management Area Allocations

The Forest Service may withdraw areas from mineral activity if the activity might conflict with other management objectives. The following table displays proposed withdrawals by alternative based on Management Area allocations. Existing withdrawals, many dating back to the 1930s, are not based on management area allocations. Overlap exists in many areas proposed for withdrawal in the alternatives. The table shows the relative change between alternatives based on management areas only.

Table 3-135. Locatable mineral withdrawals by alternative (acres based on management area allocations and GIS acres).

Alternative	Base Yr (2001)	A	B	C	D DEIS	D FEIS	E	F
Acres withdrawn from minerals exploration	157,244	91,504	162,524	214,365	319,422	272,880	240,366	448,534
Acres available for minerals exploration	927,614	993,110	922,090	870,249	765,192	811,734	844,278	636,080

Areas withdrawn from mineral entry would result in a loss of potential production of placer metals and gemstones. Adverse impacts to the locatable minerals resource from most to least are F, D DEIS, D FEIS, E, C, B, and A.

Under the 1872 mining law, the Forest Service is required to provide reasonable access for locatable minerals exploration. The analysis of this access is addressed during site-specific project analysis.

Withdrawal of areas for minerals production is not automatically implemented with the Record of Decision for the Plan Revision. For example, recommended Wilderness areas are not withdrawn until congress designates the area. However, until designation is completed, activities in these areas may not preclude future designation.

Cumulative Effects

Areas withdrawn from mineral entry would result in a loss of potential production of placer metals and gemstones. Adverse impacts to the locatable minerals resource from most to least are F, D DEIS, D FEIS, E, C, B, and A.

Commercial development of these statutory rights conferred by United States mining laws (30 U.S.C. 21-54) could have significant impacts on surrounding resource management, impair the intent of the management prescription area, and degrade the existing values or conditions in the area. It is the responsibility of the Forest Service to ensure that activities are conducted in a manner that minimizes adverse environmental impacts to National Forest System surface resources. Activities are regulated through a Plan of Operations. The requirements and contents of a Plan of Operations are found at 36 CFR 228.4.

Farris Haggerty Mine Reclamation

This is an ongoing project controlled by the Abandoned Mine Land Division of the State Department of Environmental Quality that is nearing completion. Resources that may be affected and require monitoring are aquatics and fisheries.

Oil and Gas

Introduction – The Federal Onshore Oil and Gas Leasing Reform Act of 1987 expanded the authority of the Secretary of Agriculture for oil and gas leasing and authorized the Secretary to develop procedures and regulations governing leasing and development of oil and gas resources in the National Forest System (NFS). The regulations, completed on April 20, 1990, set forth procedures for making leasing decisions, and required a schedule for analyzing lands that have not already been analyzed for leasing. The leasing analysis for the Medicine Bow National Forest was scheduled for the forest plan revision and is being conducted as part of this analysis. After the Forest Service completes required National Environmental Policy Act analysis and oil and gas decisions, the Bureau of Land Management (BLM) can offers the leases for sale consistent with the decisions.

The leasing decisions are based on and closely tied to the forest plan. The following oil and gas analysis applies to about 272,524 acres of federal minerals (270,981 acres federal surface estate). These are in the areas of moderate and low oil and gas occurrence potential (see following map). The remaining 1,115,252 acres of the planning area are not included in this oil and gas leasing analysis for the following reasons:

- The federal government has no authority over privately held minerals regardless of surface ownership (193,994 acres)
- Most of the Forest is located on uplifts of crystalline rocks, lacks sedimentary rocks, and has no known oil and gas occurrence potential (921,258 acres).

With management responsibility and authority for the federal mineral estate, the BLM also plays a role in management of oil and gas resources underlying NFS lands. The BLM is a cooperating agency in this analysis in accordance with the 1991 Interagency Agreement for Oil and Gas Leasing between the Forest Service and BLM. This oil and gas analysis addresses all federal minerals including those under non-federal surface (split estate) lands with either moderate or low oil and gas development potential within the boundaries of the NFS units to which this analysis applies. Based on this oil and gas analysis the Forest Service will issue leasing decisions pursuant to 36 CFR 228.102, and the BLM will issue decisions for leasing federal mineral estate under Forest Service administered surface and under non-federal surface (split estate lands) within Forest Service units, as appropriate.

Map 3-18. Reasonable Foreseeable Development for oil and gas on the Medicine Bow National Forest.

The following table displays the federal and non-federal mineral estate for the entire analysis area, the Medicine Bow National Forest, and for the area within the Medicine Bow National Forest with moderate and low oil and gas occurrence potential .

Table 3-136. Land status and oil and gas potential within the boundaries of the Medicine Bow National Forest (acres).

Status	Oil and Gas Potential			Total Acres
	No Known	Low	Moderate	
Federal Surface, Federal Minerals	805,799	104,404	166,578	1,076,780
Federal Surface, Private Minerals	5,899	552	1,787	8,238
Private Surface, Federal Minerals	115,459	439	1,104	117,002
Private Surface, Private Minerals	164,204	6,035	15,519	185,757
Total	1,091,360	111,429	184,987	1,387,776

Legal and Administrative Framework

Oil and gas resources on NFS lands are managed under a large body of laws and regulations. A few, however, are specific to the mineral resource itself and provide direction on the disposition of federally owned oil and gas resources, as well as administration of surface activities associated with development of these resources.

Mineral Leasing Act of 1920 – This act authorizes the Secretary of Interior to issue leases for the disposal of certain minerals (currently applies to coal, phosphate, sodium, potassium, oil, oil shale, gilsonite, and gas). The act applies to National Forest 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 Leasing Act for Acquired Lands of 1947 - This act states that all deposits of coal, phosphate, oil, oil shale, gas, sodium, potassium, and sulfur that are owned or may be acquired by the United States and that are within lands acquired by the United States may be leased by the Secretary of Interior under the same conditions as contained in the leasing provisions of the mineral leasing laws. No mineral deposits shall be leased without the consent of the head of the executive department having jurisdiction over the lands containing the deposit and subject to such conditions as that official may prescribe.

Mining and Minerals Policy Act of 1970 - 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

Energy Security Act of 1980 - 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 any management plan being prepared.

The Federal Onshore Oil and Gas Leasing Reform Act of 1987 - This act granted the Secretary of Agriculture the authority to regulate all surface-disturbing activities conducted pursuant to any lease issued under the Act. It also prohibited the Secretary of Interior from issuing leases on National Forest System Lands reserved from the public domain over the objection of the Secretary of Agriculture.

Title 36 of the Code of Federal Regulations, Part 228E – These regulations specify how the Forest Service will implement the Leasing Reform Act. They prescribe methods by which the Forest Service will schedule and make oil and gas leasing decisions, and how it will subsequently manage oil and gas operations on NFS lands. These regulations lay out the process for determining lands administratively available for leasing, including the designation of stipulations and the projection and analysis of post-leasing activity. These regulations describe the Forest Service process for authorizing the BLM to offer leases for sale.

Title 43 Code of Federal Regulations, Parts 3000 and 3100 – These regulations provide the regulatory basis for federal leasing by the BLM. Both the Forest Service and BLM have responsibility for leasing decisions on the federal mineral estate underlying NFS administered lands. However, BLM is solely responsible for making leasing decisions on split estate lands where the federal government owns the mineral estate (oil and gas) but does not own the surface. These regulations describe lease rights, responsibilities, and operating requirements, and how the BLM will offer competitive and non-competitive leases.

Executive Order 13212, Energy Policy - On May 18, 2001, President Bush issued Executive Order 13212 (EO 13212) to "take additional steps to expedite the increased supply and availability of energy to our Nation". On July 13, 2001, the Secretary of Agriculture approved the Forest Service Energy Implementation Plan in accordance with the Presidents EO 13212.

Terms Used in This Section

Within the oil and gas section, there are several terms used that are specific to oil and gas leasing. A brief description of these terms is given below.

- **Not Administratively Available (NAA)**: Designation given to lands that have been identified in a leasing analysis as closed to leasing through exercise of management direction.
- **Stipulation**: A provision that modifies standard lease rights and is attached to and made a part of the lease. Stipulations have been developed for the categories of: 1) No Surface Occupancy (NSO), 2) Timing Limitations (TL) or seasonal restrictions, and 3) Controlled Surface Use (CSU).
- **No Surface Occupancy (NSO)**: Use or occupancy of the land surface for fluid mineral exploration or development is prohibited to protect identified resource values.
- **Timing Limitation (TL) (Seasonal Restriction)**: Prohibits surface use during specified periods to protect identified resource values. This stipulation does not apply to the operation and maintenance of production facilities unless analysis demonstrates the continued need for such mitigation and that less stringent, project-specific mitigation measures would be insufficient.
- **Controlled Surface Use (CSU)**: Use and occupancy is allowed (unless restricted by another stipulation), but identified resource values require special operational constraints that may modify the lease rights. CSU is used for operating guidance, not as a substitute for NSO or Timing stipulations.
- **Lease Notice (LN)**: Provides more detailed information concerning limitations that already exist in law, lease terms, regulations, or operational orders. A Lease Notice also addresses special items the lessee should consider when planning operations, but does not impose new or additional restrictions.
- **Standard Lease Terms (SLT)**: The terms incorporated into every oil and gas lease. Standard lease terms require compliance with all laws and regulations to ensure protection of other energy, mineral, and surface resources. Under standard lease terms, the authorized officer has limited authority to modify the siting and design of facilities and to control the rate of development and timing of activities as well as require other mitigation under standard lease terms (BLM Form 3100-11 and 43 CFR 3101.1-23).

Key Indicators

- Acres available for oil and gas leasing.
- Acre by leasing stipulation for oil and gas leasing.
- Reasonable foreseeable development for oil and gas production.

Historical Summary

In accordance with the Federal Onshore Oil and Gas Leasing Reform Act of 1987 and its implementing regulations (completed April 20, 1990), a reasonable foreseeable development (RFD) scenario was completed on the Medicine Bow National Forest. The RFD is contained in a report entitled *Oil and Gas Resources of the Medicine Bow National Forest,* dated April 10, 1995. The Reservoir Management Group of the Wyoming State Office of the Bureau of Land Management, reviewed and supplemented the 1995 RFD in a report entitled *Detailed Review of the Coalbed Gas Potential in a Portion of the Medicine Bow – Routt National Forest, Carbon County, Wyoming,* 2003.

The Sierra Madre and Snowy Range portions of the MBNF have experienced activity associated with exploration for oil and gas resources. Eleven exploratory wells, all plugged and abandoned, were drilled on the Forest between 1954 and 1983. Thirty-two exploratory wells were drilled between 1919 and 1987 adjacent to the Forest in the western Sierra Madre area and northern and eastern Snowy Range area. These wells also are all plugged and abandoned. Production has been established in fields within 5 miles of the western Sierra Madre and eastern Snowy Range areas of the Forest. However, the reservoirs which produce in these fields do not extend onto the Forest, are too shallow on the Forest to have significant potential for production or have been removed by erosion.

In 1995 when the RFD was prepared, the MBNF had 12 active oil and gas leases all of which expired without drilling activity by the year 2000. There are presently no oil and gas leases on the MBNF or any requests for leases on the Forest. The Forest has experienced limited seismic exploration, and received a proposal for seismic exploration on the eastern portion of the Snowy Range in 2002.

Oil and Gas Leasing Decisions

Most of the MBNF is on uplifts of crystalline rocks such as granites and gneisses, and consequently has no known oil and gas occurrence potential. Areas of low to medium oil and gas resource potential occur in sedimentary rocks on the flanks of these uplifts in peripheral areas of the Forest. There are no areas with high oil and gas occurrence potential in the analysis area.

The oil and gas analysis contained in this document and the decisions to be made from this EIS pertain only to those areas of the MBNF with medium and low oil and gas occurrence potential. Areas of the Forest on geologic uplifts composed of crystalline rocks at the surface and at depth, which have no known oil and gas potential, are not included in this analysis or in decisions to follow this analysis.

Title 36 CFR 228 Subpart E regulations prescribe methods by which the Forest Service will make oil and gas leasing decisions. These regulations lay out the process for determining lands administratively available for leasing, and the Forest Service process for authorizing the BLM to offer leases for sale.

The first decision [36 CFR 228.102 (d)] is whether lands in the project area are "available" or "not available" to lease (and if available, the conditions under which they are available). If lands are determined to be "not available," they are no longer considered for any type of leasing and no further decision is required concerning those lands.

If lands are determined to be "available" for leasing, then a second decision must be made regarding those lands. The second decision to be made is whether to authorize the BLM to offer oil and gas leases at this time, or to defer authorization until some future time [36 CFR 228.102 (e)].

With management responsibility and authority for the federal mineral estate, the Bureau of Land Management (BLM) also plays a role in management of oil and gas resources underlying NFS lands. The BLM is a cooperating agency in this analysis in accordance with the 1991 Interagency Agreement for Oil and Gas Leasing between the Forest Service and BLM, and the 2002 Memorandum of Understanding between the Medicine Bow National Forest and Wyoming State Office of the BLM. The oil and gas analysis addresses all federal minerals including those under non-federal surface (split estate) lands within the boundaries of the NFS units to which the analysis applies. Based on the oil and gas analysis the BLM will make decisions for leasing federal mineral estate under Forest Service administered surface and under non-federal surface (split estate lands) within Forest Service units, as appropriate.

Resource Protection Measures

The staged approach to oil and gas leasing exploration, and development allows for analysis and mitigation of effects on other resources at each stage. Leasing is the first stage in the process. A lease, by itself, does not permit ground-disturbing activities, but because it conveys certain rights to the lessee, any mitigation measure necessary to protect other resources from ground-disturbing activities need to be addressed before the lease is issued (36 CFR 228.102(c)). Consequently, the leasing stage level of analysis identifies effects on other resources from potential activities and specifies necessary restrictions, if any, beyond those imposed by standard lease terms. Stipulations attached to leases specify such restrictions, which are known to potential lessees before the lease is sold. At such time as the industry requests a lease, new information or changed circumstances might require change to the mitigation measures specified in the leasing stage analysis. These changes are disclosed in appropriate environmental analysis and decision document before the requested parcel can be leased.

At the second stage—drilling an exploratory well—the Forest Service has the responsibility and authority to approve the Surface Use Plan of Operation (SUPO), with conditions, as part of the Application for Permit to Drill (APD) (36 CFR 228.107 and 228.108). Environmental analysis of the proposed drilling project identifies potential effects on other resources from the proposed activity and

specified mitigation consistent with forest plan direction, terms of the lease, and direction in 36 CFR 228.108. Approved mitigation measures are included as Condition of Approval (COA) with the SUPO. The Forest Service must approve the SUPO as part of the APD (for which BLM provides final approval) with mitigation measures before the well can be drilled.

At the third stage, developing a discovered resource, the Forest Service has the responsibility and authority to approve the surface use part of a development plan, which could include one or more wells. Environmental analysis of the proposed development project identifies potential effects on other resources from the proposed activity and specified mitigation measures consistent with forest plan direction, terms of the lease, and direction in 36 CFR 228.108. Identified mitigation measures are included as COAs with an approved development plan and an approved SUPO and APD for each well. Development activity can proceed only after the Forest Service and BLM have approved the development plan with specified mitigation measures. Forest Service and BLM personnel must conduct periodic inspections of exploratory and development drilling operations and production activities to ensure compliance with mitigation measures (36 CFR 228.112) and other applicable regulatory authorities.

Oil and Gas Exploration

This section contains brief information on geophysical exploration, oil and gas permitting, drilling exploration, and drilling operations. More complete information on oil and gas exploration, development, leasing and reclamation can be found in the *Oil and Gas Leasing on the Thunder Basin National Grassland*, *FEIS*, 1994, and the *Oil and Gas Leasing, Northern Little Missouri National Grasslands, FEIS*, 1991, incorporated here by reference.

Geophysical activities may be conducted prior to or after leasing by the lessee or someone other than the lessee. Conducting exploratory drilling operations, however, is an exclusive right granted to a lessee on his/her lease. After a lease is issued, the lessee or lessee's assignee can conduct exploratory drilling operations, in compliance with lease terms and other conditions.

Geophysical Exploration

Geophysical methods of exploration include gravitational and magnetic surveys that are completed on the ground. Seismic surveys are the most common form of geophysical exploration for oil and gas resources. Seismic surveys analyze acoustical properties of rocks deep beneath the surface and provide geophysicists and geologists a "picture" of rock characteristics and relationships (variation in rock types, the nature of rock layers, structural characteristics such as faults and folds, and sometimes the nature of fluids or gas filling pore spaces in the rock). The "picture" of these subsurface rock relationships depends on characteristics of artificially

generated shock waves directed into the earth after they bounce off of rock layers and return to listening devices on the surface .

Generally, these surveys are conducted on foot and in trucks over large areas. In rough terrain, people on foot, supported by helicopter, may conduct such a survey. Sound sources include vibroseis trucks and dynamite. Vibroseis trucks have large metal plates that vibrate on the surface of the ground to force sound waves into the earth. Small charge explosives can be placed on sticks on the surface or in holes drilled in the ground. In either case, rock layers in the earth "bounce" the sound waves back to the surface where they are picked up by sound receivers. Sound receivers consist of a large number of small devices placed on the ground surface. The devices are evenly spaced along a wire connected to a truck that contains sophisticated computer equipment. The computer equipment collects and analyzes the subsurface sound data.

The two basic types of seismic surveys—conventional or single-line seismic and 3D or three-dimensional seismic—obtain data from the subsurface using one of the methods described above. The arrangement of and relationship between sound sources and receivers, however, differs between the two types of surveys. The design of the survey depends on the objectives of the company seeking information about the subsurface. Surveys may cover a very large area (a grid of sound source and receivers over 10s of square miles, as in some 3D surveys) or may be limited in extent (one line over a mile or two, as in some conventional surveys).

Regardless of the size of the area surveyed, if any federally owned surface is affected, the geophysical company must obtain a permit from the agency with jurisdiction for the surface. The special use permit authorizing such use includes conditional provisions for conducting seismic surveys, which by their very nature include some level of ground disturbance (generally minimal). The Forest Service imposes a fee with geophysical special use permits, except when the acquisition company or a client of the geophysical company is a leaseholder. Neither the geophysical company nor any of its clients must be a leaseholder in order to conduct a seismic survey. However, when one or more of the companies acquires data from a survey conducted on its lease, a fee is not imposed for that part of the survey on the lease.

Prior to approval or authorization, the Forest Service examines all proposals for geophysical operations on National Forest System lands, either on or off an oil and gas lease. The authorizing officer must comply with the National Environmental Policy Act implementing regulations at 40 CFR 1500-1508 and with Forest Service policy and procedures. Based on review of the environmental consequences, the proposed seismic survey may be modified to be consistent with the current approved land and resource management plan. The authorizing officer may approve the proposed survey as submitted, approve the proposed survey subject to specific conditions, or not approve the proposed survey for specific reasons.

Exploratory Drilling

Subsequent to obtaining a lease, a lessee or his/her appointed operator may drill on the lease to explore for and/or develop any hydrocarbon resources that might be present in the subsurface. Such drilling can occur only under the terms of the lease, including any special stipulations that may be attached to the lease. In addition, such drilling can occur only after the Forest Service and/or Bureau of Land Management grant additional permission. No drilling or surface occupancy associated with drilling may occur in areas covered by a No Surface Occupancy stipulation that may be attached to a lease, except under conditions as described in the stipulation.

Subsequent to obtaining a lease and prior to performing any exploration drilling or other surface disturbance on a lease, a lessee/operator must file and receive approval for an Application for Permit to Drill (APD). The APD includes a Surface Use Plan of Operations (SUPO) that itemizes certain conditions (Conditions of Approval, or COA) under which a well may be drilled. Such COAs are linked to lease terms and special stipulations, standards and guidelines in the applicable land and resource management plan, and other applicable laws and regulations. Included in requirements to conduct drilling operations for exploration or development, the lessee/operator and the federal permitting agency(ies) must comply with the National Environmental Policy Act and its implementing regulations before surface-disturbing activities can be permitted .

The Bureau of Land Management administers all APDs for all federal minerals, regardless of surface ownership. In the case of federal minerals under Forest Service surface jurisdiction, the Forest Service works with the lessee/operator on developing the SUPO. The Forest Service must approve the SUPO before any surface-disturbing activities can occur. The BLM incorporates the approved Forest Service SUPO in the APD before granting final approval to drill a well. In the case of federal minerals under private surface ownership, the BLM alone administers the APD, and the lessee/operator must work with the private landowner on provisions for surface access.

AFFECTED ENVIRONMENT

The Medicine Bow National Forest in southeastern Wyoming includes four non-contiguous parts situated on geologic uplifts composed of Precambrian crystalline rocks such as granites and gneisses. Consequently most of the Forest has no known oil and gas potential due to crystalline rocks at the surface and at depth. Sedimentary rocks on the flanks of these uplifts in peripheral areas of the Forest include documented reservoir rocks, source rocks, seals, and traps. Much of this sedimentary section on the Forest, however, is absent by erosion or is very shallow and offers only indirect evidence of the presence of oil and gas traps. In limited areas of the Forest, crystalline rocks at the surface have been thrust over a deeper

sedimentary section. The existence of traps in the subthrust sedimentary section in these areas has not been confirmed. Consequently, only small parts of the Forest have medium and low potential for oil and gas resources.

The four non-contiguous areas of the MBNF are in the Sierra Madre Range, Snowy Range, Sherman Mountains, and Laramie Range. The Forest is in a geologic region known as the Rocky Mountain foreland, which is characterized by uplifts of exposed granitic and gneissic rocks, and deep intermountain basins containing thick sequences of sedimentary rocks. Each non-contiguous area of the MBNF is situated on a foreland uplift, which is characteristically mountainous. The adjacent basins (from west to east: Washakie, Hanna, and Laramie) have been filled with sediments.

The western part of the Forest, or Sierra Madre area, is on the Sierra Madre uplift, continuation of the Park Range to the south in Colorado. The Sierra Madre area is predominantly crystalline rocks and mountainous terrain. In the extreme northern and western parts of the Sierra Madre area, on the flanks of the uplift, sedimentary rocks (mostly sandstones, siltstones, and shales) are at the surface and form locally dissected gentle hills. Crystalline rocks at the surface in the western part of the Sierra Madre area may lie over deeper sedimentary rocks. In the western portion of the Sierra Madre Mountains of the Forest, where there are sedimentary rocks or crystalline rocks overlying sedimentary rocks, the oil and gas resource potential is moderate to low.

The south-central part of the Forest, or Snowy Range area, is on the Medicine Bow Mountains, a northwest extension of the Colorado Front Range. The Snowy Range area has uplifted crystalline rocks at the surface, giving rise to mountainous terrain. Most of the Snowy Range area of the Forest is on the core of the uplift. Sedimentary rocks are present only in limited areas near the boundaries of this area of the Forest. The flanks of the uplift are highly faulted, and crystalline rocks lie over sedimentary rocks in the eastern and possibly northern parts of the Snowy Range area of the Forest. In the western portion of the Snowy Range area of the Forest, where there are sedimentary rocks or crystalline rocks overlaying sedimentary rocks, the oil and gas resource potential is moderate to low.

The Laramie Peaks and Sherman Mountains areas of the Forest lie on the Laramie Mountains trend, a northern extension of the Colorado Front Range. The Sherman Mountains area in the southern Laramie Mountains is predominantly uplifted crystalline rock. Just within the western boundary of the Sherman Mountains area, on the western flank of the uplift, is a thin section of sedimentary rocks with low oil and gas resource potential.

The Laramie Peaks area of the Forest is on the northern Laramie Mountains trend. With the exception of some thin, high-level, very localized sedimentary rocks near the boundary, this part of the Forest is entirely crystalline rocks, and has no known oil and gas resource potential.

Demand Assessment

The Medicine Bow National Forest has no history of any production of oil and gas. Eleven exploratory wells were drilled on the Forest between 1954 and 1983. Thirty-two exploratory wells were drilled between 1919 and 1987 adjacent to the Forest in the western Sierra Madre area and northern and eastern Snowy Range area. These wells were all completed as dry holes and are all plugged and abandoned. Three of those wells drilled on the Forest and three of those wells drilled adjacent to the Forest encountered non-commercial quantities of oil and gas.

Oil and gas production has been established in fields within 5 miles of the western Sierra Madre and eastern Snowy Range areas of the Forest. About three miles west of the Sierra Madre area of the Forest, Savery field (T13N, R89W) has produced over 7 billion cubic feet of gas (BCFG). About 3-5 miles east of the Snowy Range area of the Forest, a number of fields were discovered in the 1920's to 1940's. These fields (Dutton Creek, Cooper Cove, Seven Mile, Quealy Dome, and Rex Lake) have produced over 16.5 million barrels of oil and 2.5 BCFG. However, on the Forest the reservoirs rocks that produced these fields have been removed by erosion, do not extend onto the Forest, or are too shallow to have significant potential for production.

A Reasonable Foreseeable Development Scenario (RFD) projects oil and gas developments for the planning area (see previous RFD map). The RFD is contained in a report entitled *Oil and Gas Resources of the Medicine Bow National Forest,* dated April 10, 1995, which is in the planning record.

Qualitative assessments of petroleum occurrence are based on the following definitions, modified from the BLM handbook:

- **High Potential**: Demonstrated existence of source rock, thermal maturation, reservoir strata possessing permeability and porosity, and traps. Demonstrated existence is defined by physical evidence or documentation in the literature.
- **Moderate Potential**: Geophysical or geological indications that the following may be present: source rocks, thermal maturation, reservoir strata possessing permeability and porosity, and traps. Geologic indication is defined by geological inference based on indirect evidence.
- **Low Potential**: Specific indications that one or more of the following may not be present: source rocks, thermal maturation, reservoir rock, and traps.
- **No Known Potential**: Demonstrated absence of source rocks, thermal maturation, reservoir strata possessing permeability and porosity, and traps. Demonstrated absence is defined by physical evidence or documentation in the literature.

The following table shows the occurrence and development potential for the planning units and represents the full oil and gas development projection based on geology, history of exploration, economic trends, industry interest, and unlimited access.

Table 3-137. Oil and gas occurrence and development potential.

Forest Area	Occurrence Potential	# Exploratory Wells Predicted to be Drilled Next 10-15 years[1]	# Development Wells Predicted to be Drilled Next 10-15 years[2]
Sierra Madre	Low to moderate	1	0
Snowy Range	Low to moderate	1	0
Sherman Hills	Low	0	0

The scenario for this analysis considered exploration and development activities, advances in technology, and demand and price projections.

ENVIRONMENTAL CONSEQUENCES

Direct and Indirect Effects

Resource Protection Measures: Standard lease terms are incorporated into every lease and require compliance with laws and regulations to ensure protection of other energy, mineral, and surface resources, such as soil, water, vegetation, cultural, and threatened and endangered species. In addition to standard lease terms, supplemental lease stipulations may be necessary if the authority to control the activity on the lease does not already exist under laws, regulations, or orders. It is important to recognize that the authorized officer has the authority (with some limitations) to modify the location and design of facilities and control the rate of development and timing of activities, as well as require other mitigation under Sections 2 and 6 of the standard lease terms (BLM Form 3100-11 and 43 CFR 3101.1-2). Using the *Uniform Format for Oil and Gas Leasing Stipulations, March 1989*, stipulations have been developed for the following categories: 1) No Surface Occupancy (NSO), 2) Timing Limitations (TL) or seasonal restrictions, and 3) Controlled Surface Use (CSU).

Title 36 CFR 228.102(c)(2) requires a leasing analysis to identify alternatives "including that of not allowing leasing." For this analysis, the existing condition Alternative A is the no leasing alternative. Because regulations require both the availability and specific lands decisions before the BLM can issue leases on National

[1] Includes both federal and non-federal wells within the Forest boundaries.

[2] The number of development wells predicted is included within the number of exploratory wells in the previous column.

Forest System lands, and no such analysis has been conducted on the MBNF prior to this present analysis, continuation of the existing condition is equivalent to the alternative of not allowing leasing. All lands under this alternative are not administratively available for leasing.[3]

Alternative B in this analysis represents the maximum development scenario for oil and gas leasing. This alternative was developed to analyze the differences in environmental effects between leasing with the stipulations contained in the Forest Plan and leasing using standard lease terms only. All lands under this alternative are administratively available except for those legally not available (wilderness).

For the remaining Alternatives C, D DEIS, D FEIS, E, and F stipulations were developed using the standards and guidelines in the proposed land use plan. This resulted in a consistent set of stipulations being applied across all alternatives (except Alternative A and B). Alternatives C, D DEIS, D FEIS, E, and F vary by acres allocated to management areas, and in most cases, do not vary standards and guidelines except for those associated with management areas.

Determination of Effects

This section outlines the methods used to determine the magnitude of the effects. Effects from various aspects of the Revised Management Plan and associated leasing decisions are discussed in the following sections.

Stipulations to be applied to new leases were developed to implement the standards and guidelines in the Revised Management Plan. Locations of the various resources where the stipulations would apply were mapped.[4] Management areas were also mapped for each alternative. Throughout this analysis, resource inventories have been updated to include the latest available data. Because the stipulations developed for the LRMP represent the best management practices, a consistent set of stipulations was used in Alternatives C through F. Alternatives C through F vary by areas allocated to various management prescriptions. Oil and gas stipulations in Alternative A reflect the current condition with no decision about leasing and thus a no leasing alternative. Alternative B uses the standard lease terms only without supplemental lease stipulations to provide a basis for comparison of alternatives with

[3] Only lands with oil and gas resource potential (moderate and low) are carried in this analysis. Lands with no known oil and gas potential are not analyzed. Should a proposal to lease any lands with no known oil and gas resource potential be received, a site-specific NEPA analysis would be required to develop stipulations and determine consistency with the Land and Resource Management Plan.

[4] The locations of oil and gas leasing stipulations in this analysis reflect existing conditions at the time of publication of the Final Revised Land and Resource Management Plan. When an Application for Permit to Drill is filed, the location of oil and gas stipulations will be updated if necessary to reflect current on-the-ground conditions based on Forest Plan Direction.

supplemental lease stipulations. The analysis uses a consistent set of resource inventories across all alternatives.

A Reasonable Foreseeable Development Scenario (RFD), which projected the number of wells over the next 10 years, was developed for areas where leasing decisions will be made. The RFD is based on geologic potential and predicted economic factors and is not limited by Forest Service or BLM management decision. The RFD projects a number of wells that could be drilled (assuming the geologic and economic assumptions come true) if there were no BLM or Forest Service limitations on drilling.

The magnitude of the effects was determined by calculating the number of acres where oil and gas leasing is constrained by either management area direction or by leasing stipulations. Based on the amount of constrained acres, the proportionate number of wells to be eliminated or affected was determined.

Effects by Leasing Decisions

Decisions to make lands not administratively available for leasing or not to authorize lands for leasing precludes the exploration and the potential discovery of oil and gas resources and can make subsurface federal minerals unavailable for development for an indefinite period of time. If drilling and production occurs on adjacent private lands, drainage of federal reserves may occur, resulting in lost federal revenues and associated reduced returns to counties and states. The opportunity to explore and produce on adjacent leased lands may also be affected by precluding exploration and production from reservoirs under unavailable lands. Designating lands as "not administratively available" in areas where an NSO stipulation could provide the same protection may be more restrictive than necessary.

In all alternatives, wilderness is not administratively available for leasing by action of law. The Medicine Bow National Forest administers 4 wilderness areas, but only one (Huston Park) includes area within the moderate or low oil and gas resource potential area.

Table 3-138. Huston Park Wilderness mineral estate acres.

	Minerals Estate within Moderate and Low Oil and Gas Resource Potential Areas	Total Mineral Estate
Federal Minerals	7,226	30,533
Private Minerals	18	435
Total	7,244	30,968

The following table displays acres of land that would be made not available for leasing. The total acres include the entire federal mineral estate with moderate or low oil and gas resource potential, whether or not the federal government owns the

surface.[5] See the oil and gas alternative maps for spatial application of the leasing stipulations.

Table 3-139. Available acres and acres not available by alternative.

	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Total Federal [6]mineral estate	272,524	272,524	272,524	272,524	272,524	272,524	272,524
Acres not available for leasing	272,524	7,226	7,226	7,226	7,226	7,226	7,226
Acres available for leasing	0	265,298	265,298	265,298	265,298	265,298	265,298

Alternatives B through F would have the same number of acres not available for leasing. In Alternative A, all lands are not administratively available for leasing.

Effects by Type of Stipulation

Lease stipulations can restrict the placement, number, and type of wells and facilities; reduce exploration and development opportunities; and increase drilling and operational costs. A Reasonably Foreseeable Development Scenario (RFD) was used to evaluate the effects of stipulations on oil and gas resources and to identify the number of wells that would be affected. "Affected" is defined as displacement of a potential wells or having constraints imposed that increase the cost of drilling. Types of stipulations are discussed below (also, see Revised Management Plan, Appendix E- Oil and Gas Stipulations for more information).

Standard Lease Terms

All leases are subject to Standard Lease Terms (SLT). Leases with SLT and no supplemental stipulations are the least restrictive types of leases potentially available for leasing. With the exceptions noted below, SLT permit year-round occupancy of leased lands, provide full access, and have the highest potential for discovery and development of oil and gas resources .

SLT require an operator to minimize adverse impacts to air, water, land, visual, cultural, and biological resources and to other land uses or users. They require that

[5] There are areas where the federal government owns the mineral resource below ground but does not own the surface. The BLM is responisble for leasing decisions on federal minerals with non-federal surface.

[6] Total Federal Mineral Estate with moderate and low oil and gas potential changed between the DEIS (272,806 acres) and the FEIS (272,524 acres) because of land exchanges and an updated land grid used in the analysis. The most current acreages are used throughout this analysis to provide an accurate comparison of alternatives.

the lessee comply with all applicable laws, regulations, and formal orders. SLT increase the uncertainty of operating conditions because some restrictions may not be known until an application for a permit to drill is submitted and the site inspections are completed. If threatened and endangered plant and animal species or cultural resources are present, then development may not be possible for those portions of the lease. Known potential for these situations to exist are noted in Lease Notices attached to leases in potentially affected areas. Previously unknown threatened or endangered species and/or cultural resources may be identified during pre-drilling, on-site inspections. Effects to these resources can usually be mitigated but may substantially increase the operator's costs.

If potential negative effects to surface resources can be mitigated under the following SLT provisions (43 CFR 3101.1-2), then no additional stipulations are necessary:

- Drill site may be moved no more than 200 meters.
- Drilling operations may be delayed up to 60 days.

Leases issued with SLT only, have the lowest level of restrictions and meet the Forest Service mineral policy direction to encourage development of mineral resources.

Lease Stipulations

Lease stipulations are a modification of standard lease rights and are attached to and made a part of a lease. Stipulations provide greater protection for identified resources and greater mitigation of negative effects than SLT. The Rocky Mountain Regional Coordinating Committee, a joint Forest Service-BLM committee, developed guidelines for use of these stipulations in 1989. For additional information about the use of these stipulations, refer to *Uniform Format for Oil and Gas Lease Stipulations, Final Recommendations Prepared by: Rocky Mountain Regional Coordinating Committee, March 1989*. Stipulations are categorized on how the stipulation modifies lease rights, not by the resource(s) to be protected. The following are categories of lease stipulation:

No Surface Occupancy (NSO)

Use or occupancy of the land surface for fluid mineral exploration or development is prohibited to protect identified resource values.

Even though NSO stipulations prohibit surface occupation for exploration or development of oil and gas resources, the subsurface resources are legally available if they can be accessed by means other than occupying the surface specified in the NSO stipulation. Leasing an area with NSO, rather than declaring it "not administratively available" for leasing, may allow development through directional drilling, if adjacent lands are available for leasing with surface occupancy or are privately owned. Technology limits the distance a well's surface location can be placed from the downhole location, and in some areas, directional drilling is

technically impossible. Directionally drilled wells are more costly. While drilling and production may be more costly, leasing with NSO (as opposed to "no lease") does offer exploration and development opportunities on lands where surface occupancy is prohibited. Leasing with NSO can meet Forest Service minerals policy direction to encourage development of mineral resources.

Timing Limitation Stipulation (TL) (Seasonal Restriction)

Prohibits surface use during specified periods to protect identified resource values. This stipulation does not apply to the operation and maintenance of production facilities unless the analysis demonstrates the continued need for such mitigation and that less stringent, project-specific mitigation measures would be insufficient.

The TL is used, when necessary, to restrict drilling activities on leased lands for a period greater than 60 days. TLs could increase exploration costs if a well is not completed within required time limits. Shutting a drilling operation down and leaving the equipment idle or moving the equipment to another site and moving it back increases costs. TLs may push operations into the winter, where activities on frozen ground or in frigid weather can also increase operator costs.

TL provides partial accessibility for drilling operations for a portion of the year and maintains the potential for discovery and utilization of potential oil and gas resources. TL could increase exploration costs if the window available for drilling is too narrow. Use of TL meets Forest Service national mineral policy to encourage development of mineral resources.

Controlled Surface Use (CSU)

Use and occupancy is allowed (unless restricted by another stipulation), but identified resource values require special operational constraints that may modify the lease rights. CSU is used for operating guidance, not as a substitute for NSO or timing stipulations.

CSU stipulations are designed to identify standards operators must meet and to control drilling or production operating standards to mitigate potential adverse effects to surface resources. Such stipulations permit year-round occupancy and accessibility to leased lands. They maintain potential for discovery and utilization of oil and gas resources while providing mitigation of effects on other resources. Compliance with a CSU stipulation could increase the cost of oil and gas activities by requiring use of expensive technology to meet mitigation requirements. CSU stipulations meet Forest Service mineral policy direction to encourage development of mineral resources.

Lease Notices (LN)

Lease Notices are attached to leases to transmit information at the time of lease issuance, to assist the lessee in submitting acceptable plans of operation, or to assist in administration of leases. Lease notices are attached to leases in the same manner as Stipulations; however, there is an important distinction between Lease Notices and Stipulations. Lease Notices do not involve new restrictions or requirements. Any requirements contained in a Lease Notice must be fully supported in law, regulation, standard lease terms, or onshore oil and gas orders. Guidance in the use of Lease Notices is found in BLM Manual 3101 and 43 CFR 3101.1-3. Lease Notices attached to leases should not be confused with Notices to Lessees (NTL).

Notices to Lessees (NTL)

The NTL is a written notice issued by the authorized officer. NTLs implement regulations and operating orders and serve as instructions on specific items of importance within a specified area.

Effects by Alternative

The following table displays acres of land that would be made not available for leasing, available for leasing, and the area that would be affected by each type of stipulation by alternative. The total acres include the entire federal mineral estate within the moderate and low oil and gas resource potential area, whether or not the federal government owns the surface.[7] See the oil and gas alternative maps for spatial application of the leasing stipulations.

Table 3-140. Oil and gas resource potential acres by category by alternative.

	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Total Federal mineral estate	272,524	272,524	272,524	272,524	272,524	272,524	272,524
Acres not available for leasing	272,524	7,226	7,226	7,226	7,226	7,226	7,226
Acres available for leasing	0	265,298	265,298	265,298	265,298	265,298	265,298
Acres open for leasing with stipulations							
No Surface Occupancy (NSO)	NA	0	97,411	105,200	98,943	74,742	193,745
Timing Limitation (TL)	NA	0	896	529	4,276	326	1,976

[7] There are areas where the federal government owns the mineral resource below ground but does not own the surface. BLM is responsible for leasing decisions on split estate lands.

	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Controlled Surface Use (CSU) and Timing Limitation (TL)	NA	0	20,505	19,253	18,173	54,623	17,537
Controlled Surface Use (CSU)	NA	0	67,742	78,162	80,723	81,214	19,414
Standard Lease Terms (SLT)	NA	265,298	78,744	62,153	63,182	54,392	32,625
Total	NA	265,298	265,298	265,298	265,298	265,298	265,298

The following discussions primarily focus on the differences between the alternatives, or how the amount of acres available for leasing or under NSO in each alternative affects the oil and gas resource. Although acres where a CSU would be applied vary by alternative, a CSU stipulation permits year-round occupancy on leased lands, offers access, and maintains the potential for discovery and development of oil and gas resources. Similarly, timing stipulations allow drilling at certain times of the year and thus maintain the potential for discovery and development of oil and gas resources.

Table 3-141. Oil and gas resource potential acres by category as a percentage of total acres with known oil and gas potential by alternative.

	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Total Federal mineral estate	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Acres not available for leasing	100.00	2.66	2.66	2.66	2.66	2.66	2.66
Acres available for leasing	0.00	97.34	97.34	97.34	97.34	97.34	97.34
Acres open for leasing with stipulations							
No Surface Occupancy (NSO)	0.00	0.00	35.74	38.60	36.30	27.42	71.09
Timing Limitation (TL)	0.00	0.00	0.33	0.19	1.57	0.12	0.73
Controlled Surface Use (CSU) and Timing Limitation (TL)	0.00	0.00	7.52	7.06	6.67	20.04	6.43
Controlled Surface Use (CSU)	0.00	0.00	24.86	28.68	29.62	29.80	7.12

	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Standard Lease Terms (SLT)	0.00	97.34	28.89	22.81	23.18	19.96	11.97
Total	0.00	97.34	97.34	97.34	97.34	97.34	97.34

Alternative A has no acres available for oil and gas leasing with Alternatives B through F having the same amount of acres available. Alternative F has the most acres with an NSO leasing restriction, followed by Alternatives D DEIS, D FEIS, C, and E. Alternatives A and B have no acres with NSO stipulations. Alternative B has the most acres available for leasing under standard lease terms with no supplemental stipulations, followed by Alternatives C, D FEIS, D DEIS, E, and F.

In addition to the amount of acres stipulated, the shape of an area with an NSO stipulation affects the ability to access the subsurface resource from adjacent lands. The effects of these large areas of NSO are further analyzed in the Cumulative Effects section of this oil and gas leasing analysis. Refer to the oil and gas alternative maps for further information.

Projected activity levels for conventional oil and gas (2 wells drilled, none expected to be productive) will be affected by the number of acres not available for leasing or available and carrying an NSO stipulation.

Table 3-142. Effects of alternatives on the number of projected wells based on the reasonably foreseeable development scenario.

	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Wells Eliminated, Conventional	2	0	0	1	1	0	2
Total	0	2	2	1	1	2	0

Alternative A and F would have the most wells eliminated by the proposed Plan and stipulations, followed by Alternatives D DEIS and D FEIS. Alternatives B, C, and E would have the fewest wells affected or eliminated by the stipulations.

Effects from Management Areas Prescriptions

This discussion focuses on management areas that, by their own direction, place area-wide limits on oil and gas activities. Some management areas are proposed as not available for leasing, some allow oil and gas leasing but prohibit surface-disturbing activities, or have other standards and guidelines which lead to stipulations more restrictive than standard lease terms. Standard lease terms apply to all leases, whether or not they have additional special stipulations. Management areas with management direction that does not require use of an area-wide

stipulation may still include leases with special stipulations designed to protect specified resources.

Some management areas contain provisions that require NSO stipulations over large blocks of land. The effects of these large blocks of NSO are potentially greater than spatially small areas of NSO because the interiors may be essentially inaccessible. A separate analysis of the effects of NSO is located in the Cumulative Effects section of this oil and gas analysis.

Most management areas have an assigned Scenic Integrity Objective (SIO). Although the SIO often applies to the entire management area, SIOs will be treated separately under Effects from Scenery Management.

For each management area that prescribes a constraint applicable to the entire management area, and which resulted in not administratively available acreage or in an oil and gas leasing stipulation, the table below displays the acres by alternative.

Table 3-143. Acres stipulated by management area by alternative.

Management Area	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
1.13 – NAA	7,226	7,226	7,226	7,226	7,226	7,226	7,226
1.2 – NSO	0	0	0	25,065	21,505	0	72,925
1.31 – NSO	0	0	1,551	14,783	1,218	13,435	0
1.33 – NSO	0	0	24,991	15,482	5,966	565	0
1.41 – NSO	0	0	0	0	0	0	14,009
1.5 – NSO	0	0	0	0	0	395	90
2.1 – NSO	0	0	321	321	710	2,195	0
2.1 – CSU	0	0	0	3,547	0	899	899
2.2 – NSO	0	0	0	0	1,204	16,853	14,146
3.24 – NSO	0	0	0	0	0	0	57,946
3.31 – NSO	0	0	19,763	4,723	21,268	0	0
3.33 – NSO	0	0	3,290	0	0	0	2,073
3.4 – NSO	0	0	0	0	0	2,205	276
3.54 – NSO	0	0	16,816	16,862	15,293	4,874	16,862
3.58 – TL	0	0	3,537	13,412	14,490	9,961	13,825
5.41 – TL	0	0	16,126	4,408	7,654	52,049	564
8.21 – NSO	0	0	542	541	541	542	541
8.22 – NSO	0	0	908	908	910	882	882
8.6 – NSO	0	0	470	470	474	470	470

The following discussion describes area wide restrictions placed on oil and gas development based on management area direction. For effects of the stipulations on the development of oil and gas resources for the protection of other resources, such as wildlife, refer to the Effects on Oil and Gas by Type of Stipulation section.

Throughout the following discussion, it is important to remember that in Alternative A all areas are not administratively available (NAA) for leasing, and that Alternative B all areas are available for leasing with standard lease terms (SLT) only. This means that the acres that carry any management area stipulation for both Alternatives A and B will be zero, in Alternative A because there is no leasing, and in Alternative B because all acres are leased with SLT only.

MA 1.13 Wilderness, Semi-primitive – NAA

Of the four Wilderness areas on the Medicine Bow National Forest, only the Huston Park Wilderness on the Sierra Madre range has lands with any known oil and gas resource potential. As a designated wilderness Huston Park is legally not administratively available for oil and gas leasing. This means the mineral estate is not available, and activities must maintain Wilderness qualities. Motorized travel for geophysical activities is prohibited, and if geophysical activities occur, portable techniques must be used. In all alternatives, 7,226 acres of low oil and gas potential lands within Huston Park are allocated to MA 1.13.

MA 1.2 Recommended for Wilderness – NSO

Alternatives D DEIS, D FEIS, and F have areas Recommended for Wilderness, MA 1.2 that carry an NSO stipulation and fall within the moderate or low oil and gas resource potential areas. In this management area oil and gas leasing is allowed, but no surface occupancy or use is permitted. This means the mineral estate may only be accessed from adjacent areas, and activities must maintain Wilderness qualities. Motorized travel for geophysical activities is prohibited, and if geophysical activities occur, portable techniques must be used.

Protecting areas recommended for Wilderness to maintain their consideration for Wilderness designation would impact oil and gas exploration. Effects would range from increased costs of drilling, to loss of access to oil and gas resources, to the loss of some rental and royalty income. The magnitude of the loss would depend on the resources available in the particular area.

Table 3-144. Percentage of acres with known oil and gas potential and NSO due to MA 1.2 designation.

Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
0.00	0.00	0.00	9.20	7.89	0.00	26.76

Alternative F has the most acres with the NSO stipulation allocated to this management area, followed by Alternatives D DEIS, and D FEIS. Alternatives A, B, C, and E have no acres allocated to MA 1.2 with the NSO stipulation.

MA 1.31 Backcountry Recreation Year-round Nonmotorized – NSO

Alternatives C, D DEIS, D FEIS, and E have areas allocated to Backcountry Recreation Year-round Nonmotorized, MA 1.31 that carry an NSO stipulation and fall within the moderate or low oil and gas resource potential areas. In these areas oil and gas leasing is allowed, but no surface occupancy is permitted. This means the mineral estate may only be accessed from adjacent areas, and activities must maintain backcountry qualities. Motorized travel for geophysical activities is prohibited, and if geophysical activities occur, portable techniques must be used.

Protecting areas to maintain backcountry characteristics would impact oil and gas exploration. Effects would range from increased costs of drilling, to loss of access to oil and gas resources, to the loss of some rental and royalty income. The magnitude of the loss would depend on the resources available in the particular area.

Table 3-145**.** Percentage of acres with known oil and gas potential and NSO due to MA 1.31 designation.

Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
0.00	0.00	0.57	5.42	0.45	4.93	0.00

Alternative D DEIS has the most acres with the NSO stipulation allocated to this management area, followed by Alternatives E, C and D FEIS. Alternatives A, B, and F have no acres allocated to MA 1.31 with the NSO stipulation.

MA 1.33 Backcountry Recreation, Summer Nonmotorized with Winter Snowmobiling – NSO

Alternatives C, D DEIS, D FEIS, and E have areas allocated to Backcountry Recreation, Summer Nonmotorized with Winter Snowmobiling, MA 1.33, that carry an NSO stipulation and fall within the moderate or low oil and gas resource potential areas. In these areas oil and gas leasing is allowed, but no surface occupancy is permitted. This means the mineral estate may only be accessed from adjacent areas, and activities must maintain backcountry qualities. Motorized travel for geophysical activities is prohibited, and if geophysical activities occur, portable techniques must be used.

Protecting areas to maintain backcountry characteristics would impact oil and gas. Effects would range from increased costs of drilling, to loss of access to oil and gas resources, to the loss of some rental and royalty income. The magnitude of the loss would depend on the resources available in the particular area.

Table 3-146. Percentage of acres with known oil and gas potential and NSO due to MA 1.33 designation.

Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
0.00	0.00	9.17	5.68	2.19	0.21	0.00

Alternative C has the most acres with the NSO stipulation allocated to this management area, followed by Alternatives D DEIS, D FEIS, and E. Alternatives A, B, and F have no acres allocated to MA 1.33 with the NSO stipulation.

MA 1.41 Core Areas – NSO

Only Alternative F has any allocation to Core Areas, MA 1.41, which carries an NSO stipulation and falls within the moderate or low oil and gas resource potential areas. In this area oil and gas leasing is allowed, but no surface occupancy is permitted. This means the mineral estate may only be accessed from adjacent areas, and activities must maintain backcountry qualities. Motorized travel for geophysical activities is prohibited, and if geophysical activities occur, portable techniques must be used.

Protecting core reserves emphasizing maintenance of current biological diversity would impact oil and gas exploration. Effects would range from increased costs of drilling, to loss of access to oil and gas resources, to the loss of some rental and royalty income. The magnitude of the loss would depend on the resources available in the particular area.

Alternative F is the only alternative with any acres with the NSO stipulation allocated to this management area (5.14% of the area with known oil and gas potential on the Medicine Bow National Forest). Alternatives A, B, C, D DEIS, D FEIS and E have no acres allocated to MA 1.41 with the NSO stipulation.

MA 1.5 National River System, Wild Rivers Designated and Eligible – NSO

Alternatives E and F have areas allocated to National River System, Wild Rivers Designated and Eligible, MA 1.5, that carry an NSO stipulation and fall within the moderate or low oil and gas resource potential areas. In these areas oil and gas leasing is allowed, but no surface occupancy is permitted. This means the mineral estate may only be accessed from adjacent areas, and activities must maintain backcountry qualities. Motorized use is allowed on existing designated routes. Road construction or reconstruction is prohibited. If geophysical activities occur, existing designated travel routes or portable techniques must be used.

Protecting areas to perpetuate designated and eligible Wild River segments would impact oil and gas exploration. Effects would range from increased costs of drilling, to loss of access to oil and gas resources, to the loss of some rental and royalty income. The magnitude of the loss would depend on the resources available in the particular area. The magnitude of the loss is expected to be small because, for the

most part, areas considered for Wild River designation are relatively small and easily accessible from adjacent land.

Table 3-147. Percentage of acres with known oil and gas potential and NSO due to MA 1.5 designation.

Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
0.00	0.00	0.00	0.00	0.00	0.15	0.03

Alternative E has the most acres with the NSO stipulation allocated to this management area, followed by Alternatives F. Alternatives A, B, C, D DEIS and D FEIS have no acres allocated to MA 1.5 with the NSO stipulation.

MA 2.1 Special Interest Areas – NSO

Between the DEIS and the FEIS the need for increased protection for the special values of Kettle Ponds was identified, and an NSO stipulation applied rather than the CSU in the DEIS. This means the number of Special Interest Areas (SIAs) in the FEIS that have identified special values protected by NSO stipulations is increased from two to three.

Furthermore, for the preferred Alternative D FEIS, Dry Park is not included as an SIA. This means the stipulation protecting Dry Park may be found in Appendix K to this EIS, while the stipulations for resources included in the preferred Alternative D FEIS are located in plan Appendix E.

Within the areas with oil and gas resource potential proposed SIAs, Kettle Ponds, Sunken Gardens, and Dry Park, have special values that prohibit surface occupancy. For Kettle Ponds the special value is wood frog and lentic habitat, for Sunken Gardens the special value is wetland habitat, and for Dry Park, the special value is rare mountain meadow and snow glade habitat.

Alternatives C, D DEIS, D FEIS, and E have acreage allocated to Kettle Ponds, Sunken Gardens, and Dry Park SIAs that carry an NSO stipulation. This means that in Alternatives C, D DEIS, D FEIS, and E activities in these three SIAs must maintain the identified special values for which the area was established.

In alternatives designating Kettle Ponds SIAs, Sunken Gardens, and Dry Park, the mineral estate may only be accessed from adjacent areas. Motorized use is allowed on existing designated routes. Road construction and reconstruction is prohibited. If geophysical activities occur, existing designated travel routes or portable techniques must be used.

Protecting Kettle Ponds, Sunken Gardens, and Dry Park to perpetuate the identified special values would impact oil and gas exploration. Effects would range from increased costs of drilling, to loss of access to oil and gas resources, to the loss of some rental and royalty income. The magnitude of the loss would depend on the resources available in the particular area. The magnitude of the loss is expected to

be small because Kettle Ponds, Sunken Gardens and Dry Park are relatively small and easily accessible from adjacent land.

Table 3-148. Percentage of acres with known oil and gas potential and NSO due to MA 2.1 designation.

Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
0.00	0.00	0.12	0.12	0.26	0.81	0.00

Alternative E has the most acres with NSO stipulation allocated to this management area, followed by Alternative D FEIS and then by Alternatives C, and D DEIS with the same number but slightly fewer acres. Alternatives A, B, and F have no acres that require an NSO stipulation allocated to MA 2.1.

MA 2.1 Special Interest Areas – CSU

Between the DEIS and the FEIS the need for increased protection for the special values of Kettle Ponds was identified, and an NSO stipulation applied rather than the CSU in the DEIS. This means the number of Special Interest Areas (SIAs) in the FEIS that have identified special values protected by CSU stipulations is reduced from three to two. Because Big Sandstone and Many Ponds are not identified as SIAs in the preferred Alternative D FEIS, the stipulations for these SIAs may be found in Appendix K to this EIS.

Alternatives D DEIS, E, and F have acreage within the area with oil and gas resource potential allocated to Big Sandstone and Many Ponds proposed SIAs. In these proposed SIAs operations may be moved anywhere on the lease or modified to preserve identified special values. For Big Sandstone the special value is clustered lady's slipper habitat, and for Many Ponds the special value is boreal toad habitat.

In alternatives designating Big Sandstone and Many Ponds SIAs oil and gas leasing would be allowed with a Controlled Surface Use stipulation to protect identified special values. Access and other development and production related facilities would be allowed under the conditions described in the stipulation. Delays and additional costs could result if identified resources are encountered and mitigation is required. Monitoring may increase operator costs. Requirements that cause delays or increase costs for the operator could also reduce revenues for the United States Government.

Table 3-149. Percentage of acres with known oil and gas potential and CSU due to MA 2.1 designation.

Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
0.00	0.00	0.00	1.30	0.00	0.33	0.33

Alternative D DEIS has the largest amount of SIA acres requiring a CSU stipulation to preserve special values, followed by Alternative E and F. Alternatives A, B, C, and D FEIS have no acres that require an area wide CSU stipulation applied to MA 2.1.

MA 2.2 Research Natural Areas – NSO

Alternatives D FEIS, E, and F have areas allocated to Research Natural Areas (RNA), MA 2.2 that carry an NSO stipulation and fall within the moderate or low oil and gas resource potential areas. In this management area oil and gas leasing is allowed, but no surface occupancy or use is permitted. This means the mineral estate may only be accessed from adjacent areas, and activities must protect the natural condition of the ecosystem, its processes, and any species or values for which the RNA was established. Road construction or reconstruction is prohibited. If geophysical activities occur, portable techniques must be used.

Protecting recommended RNAs to maintain their consideration for designation would impact oil and gas exploration. Effects would range from increased costs of drilling, to loss of access to oil and gas resources, to the loss of some rental and royalty income. The magnitude of the loss would depend on the resources available in the particular area.

Table 3-150. Percentage of acres with known oil and gas potential and NSO due to MA 2.2 designation.

Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
0.00	0.00	0.00	0.00	0.44	6.18	5.19

Alternative E has the most acres with the NSO stipulation allocated to this management area, followed by Alternatives F and D FEIS. Alternatives A, B, C, and D DEIS have no acres allocated to MA 2.2 with the NSO stipulation.

MA 3.31 Backcountry Recreation, Year-round Motorized – NSO

Alternatives C, D DEIS, and D FEIS have areas allocated to Backcountry Recreation, Year-round Motorized, MA 3.31, that carry an NSO stipulation and fall within the moderate or low oil and gas resource potential areas. In these areas oil and gas leasing is allowed, but no surface occupancy is permitted. This means the mineral estate may only be accessed from adjacent areas, and activities must maintain backcountry qualities. Motorized travel is limited to designated routes.

Road construction or reconstruction is prohibited. Off road motorized access for geophysical activities is prohibited. If geophysical activities occur, existing designated travel routes or portable techniques must be used.

Protecting areas to maintain backcountry characteristics would impact oil and gas exploration. Effects would range from increased costs of drilling, to loss of access to oil and gas resources, to the loss of some rental and royalty income. The magnitude of the loss would depend on the resources available in the particular area.

Table 3-151. Percentage of acres with known oil and gas potential and NSO due to MA 3.31 designation.

Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
0.00	0.00	7.25	1.73	7.80	0.00	0.00

Alternative D FEIS has the most acres with the NSO stipulation allocated to this management area, followed by Alternatives C, and D DEIS. Alternatives A, B, E, and F have no acres allocated to MA 3.31 with the NSO stipulation.

MA 3.33 Backcountry Recreation, Summer Motorized with Winter Nonmotorized – NSO

Alternatives C and F have areas allocated to Backcountry Recreation, Summer Motorized with Winter Nonmotorized, MA 3.33, that carry an NSO stipulation and fall within the moderate or low oil and gas resource potential areas. In these areas oil and gas leasing is allowed, but no surface occupancy is permitted. This means the mineral estate may only be accessed from adjacent areas, and activities must maintain backcountry qualities. Motorized travel is limited to designated routes in the summer season. Road construction or reconstruction is prohibited. If geophysical activities occur, existing designated travel routes or portable techniques must be used.

Protecting areas to maintain backcountry characteristics would impact oil and gas exploration. Effects would range from increased costs of drilling, to loss of access to oil and gas resources, to the loss of some rental and royalty income. The magnitude of the loss would depend on the resources available in the particular area.

Table 3-152. Percentage of acres with known oil and gas potential and NSO due to MA 3.33 designation.

Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
0.00	0.00	1.21	0.00	0.00	0.00	0.76

Alternative C has the most acres with the NSO stipulation allocated to this management area, followed by Alternative F. Alternatives A, B, D DEIS, D FEIS, and E have no acres allocated to MA 3.33 with the NSO stipulation.

MA 3.4 National River System, Scenic Rivers Designated and Eligible – NSO

Alternatives E and F have areas allocated to National River System, Scenic Rivers Designated and Eligible, MA 3.4 that carry an NSO stipulation and fall within the moderate or low oil and gas resource potential areas. In these areas oil and gas leasing is allowed, but no surface occupancy is permitted. This means the mineral estate may only be accessed from adjacent areas, and activities must maintain scenic river qualities.

In portions of this management area with a semi-primitive nonmotorized Recreation Opportunity Spectrum (ROS) classification, all motorized travel is prohibited. In areas with a semi-primitive motorized ROS classification, motorized travel is limited to designated routes. Road construction or reconstruction is prohibited. This means if geophysical activities occur, portable techniques must be used except in areas with semi-primitive motorized classification where motorized activities could occur on designated travel routes only.

Protecting areas to perpetuate designated and eligible Scenic River segments would impact oil and gas exploration. Effects would range from increased costs of drilling, to loss of access to oil and gas resources, to the loss of some rental and royalty income. The magnitude of the loss would depend on the resources available in the particular area. The magnitude of the loss is expected to be small because, for the most part, areas considered for Scenic River designation are relatively small and easily accessible from adjacent land.

Table 3-153. Percentage of acres with known oil and gas potential and NSO due to MA 3.4 designation.

Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
0.00	0.00	0.00	0.00	0.00	0.81	0.10

Alternative E has the most acres with the NSO stipulation allocated to MA 3.4, followed by Alternative F. Alternatives A, B, C, D DEIS, and D FEIS have no acres allocated to MA 3.4 with the NSO stipulation.

MA 3.54 Special Wildlife Areas (Sheep Mountain) – NSO

Alternatives C, D DEIS, D FEIS, E, and F have areas allocated to Special Wildlife Areas (Sheep Mountain), MA 3.54, that carry an NSO stipulation and fall within the moderate or low oil and gas resource potential areas. In these areas oil and gas leasing is allowed, but no surface occupancy is permitted. This means the mineral estate may only be accessed from adjacent areas, and activities must minimize disturbance to wildlife.

The area is managed for semi-primitive nonmotorized recreation opportunities. Motorized travel is permitted on a limited, case-by-case basis to facilitate management. This means, if geophysical activities occur, motorized uses could be

authorized on a limited case-by-case basis; otherwise, portable techniques must be used.

Protecting areas to minimize disturbance to wildlife would impact oil and gas exploration. Effects would range from increased costs of drilling, to loss of access to oil and gas resources, to the loss of some rental and royalty income. The magnitude of the loss would depend on the resources available in the particular area

Table 3-154. Percentage of acres with known oil and gas potential and NSO due to MA 3.54 designation.

Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
0.00	0.00	6.17	6.19	5.61	1.79	6.19

Alternatives D DEIS, and F have the same and the most acres with the NSO stipulation allocated to MA 3.54, followed by Alternatives C, D FEIS, and E. In Alternative A no lands are administratively available for leasing; therefore, there would be no impact of wildlife refuge values on oil and gas activities because there would be no oil and gas leasing. In Alternative B the impacts of oil and gas activities on wildlife refuge values would be mitigated using standard lease terms only. SLT will not provide the same level of protection as leases with the NSO stipulation when protecting the wildlife refuge values requires moving the well location more than 200 meters or when the needed timing delay is greater than 60 days.

MA 3.57 Late Successional Forests, Limited Management - NSO

Late successional forests have management area restrictions that would lead to a no surface occupancy stipulation; however, no late successional forest management areas were identified within moderate or low oil and gas resource potential areas.

MA 3.58 Crucial Deer and Elk Winter Rangelands – TL

Alternatives C through F have areas allocated to Crucial Deer and Elk Winter Rangelands, MA 3.58, that carry a TL stipulation and fall within the moderate or low oil and gas resource potential areas. In these areas oil and gas leasing is allowed subject to limitations to protect deer and elk during critical wintering periods.

In the DEIS activities on parturition areas within Crucial Deer and Elk Winter Rangelands, MA 3.58, were prohibited from May 1 through June 30 annually. In the FEIS the limitation on deer and elk birthing (parturition) areas was moved to Forestwide Wildlife Guideline number 4. This means that birthing areas are protected anywhere they may occur on the forest, not just in MA 3.58, by a seasonal closure on motorized use of travelways. For oil and gas this limitation will be applied under standard lease terms which allow the agency to delay drilling operations up to 60 days (43 CFR 3101.1-2). Portions of MA 3.58 are known birthing areas. Although the time period (May 1 through June 30) has been removed from the Forestwide Guideline, it is used in this analysis as a reasonable estimate to

project the impact of multiple timing restrictions, which translates into a shorter oil and gas operating seasons in MA 3.58.

The entire MA 3.58 prohibits surface-disturbing activities on winter deer and elk rangelands from November 15 through April 30 annually. To protect birthing areas motorized use of travelways may also be restricted in portions of MA 3.58[8]. This means drilling activity may occur for only a limited time during the year. On winter rangelands not identified as birthing areas, access for oil and gas activities is from May 1 through November 14 each year. On rangelands with identified birthing areas, access for oil and gas activities may be limited to July 1 through November 14. During periods that are not critical to deer and elk wintering and birthing, roads can be used, constructed, or reconstructed for oil and gas activities including geophysical activities.

Protecting areas to minimize disturbance to wildlife winter range and birthing areas would impact oil and gas. Exploration costs could increase because of the short amount of time available for drilling (4.5 to 6.5 months). If a well is not completed within required time limits, shutting a drilling operation down and leaving the equipment idle or moving the equipment to another site and moving it back increases costs. Requirements that cause delays or increase costs for the operator could also reduce revenues for the United States Government.

Table 3-155. Percentage of acres with known oil and gas potential and TL due to MA 3.58 designation.

Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
0.00	0.00	1.30	4.92	5.32	3.66	5.07

Alternative D FEIS has the most acres with the TL stipulation allocated to MA 3.58, followed by Alternatives D DEIS, F, E, and C. Alternatives A, and B have no acres allocated to MA 3.58 with the TL stipulation.

MA 5.41 Deer and Elk Winter Rangelands – TL

Alternatives C through F have areas allocated to Deer and Elk Winter Rangelands, MA 5.41, that carry a TL stipulation and fall within the moderate or low oil and gas resource potential areas. In these areas oil and gas leasing is allowed subject to limitations to protect deer and elk during critical wintering periods.

The entire MA 5.41 prohibits surface-disturbing activities on winter deer and elk rangelands from November 15 through April 30 annually. This means the drilling activity may occur for only a limited time during the year. Activities must minimize disturbance to wildlife during critical periods (November 15 through April 30). During time periods that are not critical to deer and elk wintering, roads can be used,

[8] Road access restrictions in deer and elk birthing areas would be implemented by Forest Orders in accordance with site specific environmental analsyis.

constructed, or reconstructed for oil and gas activities including geophysical activities in accordance with Recreation Opportunity Spectrum (ROS) classification.

In portions of this management area with a semi-primitive nonmotorized ROS classification, all motorized travel is prohibited. In areas with a semi-primitive motorized ROS classification, motorized travel is limited to designated routes. In areas with roaded natural, roaded modified, and rural ROS classes, motorized travel is not restricted during the period when surface disturbing activities are permitted. In the semi-primitive nonmotorized and semi-primitive motorized ROS classifications road construction or reconstruction is prohibited. This means if geophysical activities occur in areas with semi-primitive nonmotorized ROS classification portable techniques must be used. If geophysical activities occur in areas with semi-primitive motorized ROS classification, motorized activities could occur on designated travel routes only, otherwise portable techniques must be used. In roaded natural, roaded modified, and rural ROS classes, motorized activities are allowed during the summer period when surface disturbing activities are permitted.

Table 3-156. ROS class acres in MA 5.41 with known oil and gas potential by alternative.

Summer ROS Description	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Semi-Primitive Nonmotorized	N/A	N/A	604	339	2,328	5,988	0
Semi-Primitive Motorized	N/A	N/A	8,404	242	0	17,948	0
Roaded Natural	N/A	N/A	3,711	1,293	2,395	10,156	235
Roaded Modified	N/A	N/A	2,568	1,683	1,425	16,688	0
Rural	N/A	N/A	839	851	1,370	1,269	330
TOTAL	N/A	N/A	**16,126**	**4,408**	**7,517**	**52,049**	**564**

The combination of short operating season due to the TL stipulation and restricted motorized travel in the semi-primitive nonmotorized and semi-primitive motorized ROS classes, limit oil and gas activities to such an extent that they are unlikely to occur. Should drilling occur, the Forest Service would rely on standard lease terms (relocation up to 200 meters) to protect the values of semi-primitive ROS classifications within MA 5.41. This means there is a small chance that semi-primitive nonmotorized and semi-primitive motorized values could be impacted in MA 5.41. If an APD was received proposing a location within one of the semi-primitive ROS classes, mitigation would include relocation up to 200 meters, allowing single purpose road construction with gated entry, reclamation restoring the natural contour of the ground, and re-vegetation with native species.

Protecting areas to minimize disturbance to wildlife winter range would impact oil and gas. Exploration costs could increase because of the short amount of time available for drilling (6.5 months). If a well is not completed within required time limits, shutting a drilling operation down and leaving the equipment idle or moving the equipment to another site and moving it back increases costs. Requirements that cause delays or increase costs for the operator could also reduce revenues for the United States Government.

Table 3-157. Percentage of acres with known oil and gas potential and TL due to MA 5.41 designation.

Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
0.00	0.00	5.92	1.62	2.81	19.10	0.21

Alternative E has the most acres with the TL stipulation allocated to MA 5.41, followed by Alternatives C, D FEIS, D DEIS, and F. Alternatives A, and B have no acres allocated to MA 5.41 with the TL stipulation.

MA 8.21 Developed Recreation – NSO

Alternatives C through F have areas allocated to Developed Recreation, MA 8.21 that carry an NSO stipulation and fall within the moderate or low oil and gas resource potential areas. In these areas oil and gas leasing is allowed, but no surface occupancy is permitted. This means the mineral estate may only be accessed from adjacent areas, and activities must minimize disturbance to the recreating public. Since the area is managed for roaded natural recreation opportunities, and motorized travel is permitted, geophysical activities can occur as authorized on a case-by-case basis.

Protecting areas to minimize impacts to the recreating public would impact oil and gas exploration. Effects would range from increased costs of drilling, to loss of access to oil and gas resources, to the loss of some rental and royalty income. The magnitude of the loss would depend on the resources available in the particular area. The magnitude of the loss is expected to be small because, for the most part, areas considered for Developed Recreation designation are relatively small and easily accessible from adjacent land.

Alternatives C through F have the same number of acres with the NSO stipulation located to MA 8.21 (0.20% of the area with known oil and gas potential on the Medicine Bow National Forest). Alternatives A, and B have no acres allocated to MA 8.21 with the NSO stipulation.

MA 8.22 Ski-based Resorts, Existing and Potential – NSO

Alternatives C through F have areas allocated to Ski-based Resorts, Existing and Potential, MA 8.22 that carry an NSO stipulation and fall within the moderate or low oil and gas resource potential areas. In these areas oil and gas leasing is allowed, but

no surface occupancy is permitted. This means the mineral estate may only be accessed from adjacent areas, and activities must minimize disturbance to the recreating public. Since the area is managed for rural recreation opportunities, and motorized travel is on the basis of an issued permit, geophysical activities can occur as authorized on a case-by-case basis.

Protecting areas to minimize impacts to the skiing and related recreating public would impact oil and gas exploration. Effects would range from increased costs of drilling, to loss of access to oil and gas resources, to the loss of some rental and royalty income. The magnitude of the loss would depend on the resources available in the particular area. The magnitude of the loss is expected to be small because, for the most part, areas considered for Ski-based Resort designation are relatively small and easily accessible from adjacent land.

Table 3-158. Percentage of acres with known oil and gas potential and NSO due to MA 8.22 designation.

Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
0.00	0.00	0.33	0.33	0.33	0.32	0.32

Alternatives C, D DEIS, and D FEIS have the same and the most acres with the NSO stipulation allocated to MA 8.22 followed by alternatives E, and F. Alternatives A, and B have no acres allocated to MA 8.22 with the NSO stipulation.

MA 8.6 Administrative Sites – NSO

Alternatives C through F have areas allocated to Administrative Sites, MA 8.6 that carry an NSO stipulation and fall within the moderate or low oil and gas resource potential areas. In these areas oil and gas leasing is allowed, but no surface occupancy is permitted. This means the mineral estate may only be accessed from adjacent areas, and activities must minimize disturbance to the recreating public. Since the area is managed for semi-primitive motorized, roaded natural, and roaded modified recreation opportunities, geophysical activities can occur as authorized on a case-by-case basis.

Protecting areas to minimize impacts to administrative sites would impact oil and gas exploration. Effects would range from increased costs of drilling, to loss of access to oil and gas resources, to the loss of some rental and royalty income. The magnitude of the loss would depend on the resources available in the particular area. The magnitude of the loss is expected to be small because, for the most part, areas considered for administrative site designation are relatively small and easily accessible from adjacent land.

Alternatives C through F have the same number of acres with the NSO stipulation allocated to MA 8.6 (0.17 % of the area with known oil and gas potential on the Medicine Bow National Forest). Alternatives A, and B have no acres allocated to MA 8.6 with the NSO stipulation.

Effects from Major Resource Programs

This section discusses how the oil and gas resource is affected by the proposed standards and guidelines developed for other resources. Stipulations are to be part of a lease only when the environmental and planning record demonstrates the necessity for the stipulations. Land use plans serve as the primary vehicle for determining the necessity for lease stipulations (BLM Manual 1624). Stipulations, which would be applied to new oil and gas leases issued during implementation of the Revised Management Plan, were developed based on standards and guidelines for other resources and activities.

In the following tables, the acres shown with the various stipulations include the entire federal mineral estate with oil and gas resource potential. There are areas where the federal government owns the mineral resource below ground but does not own the surface.

Effects from Air Management

None of the standards and guidelines developed for air quality requires oil and gas stipulations. Mineral activities do generate emissions; however, these are regulated by the states and no further standards and guidelines are required. In areas of high emissions, the states may require gases to be contained or piped. Hazardous gases such as hydrogen sulfide are produced from some oil and gas fields. Strict emission controls are enforced in these areas.

Effects from Noise Management

To implement the revised LRMP standards and guidelines, a controlled surface use stipulation is applied to limit noise in residential and recreation interface areas. The noise CSU stipulation applies to oil and gas production facilities within ¼ mile of the boundary of identified areas. Noise from oil and gas production facilities is required not to exceed 70 decibels (as measured by the A-weighted sound level [dBA] system of measurement) at the edge of identified interface areas. Identified areas include Management Area Prescriptions 7.1 (Residential/Forest Interface), 8.21 (Developed Recreation), 8.22 (Ski-based Resorts, Existing and Potential), 8.6 (Administrative Sites), lodges, and summer homes. Operators will have to provide adequate mufflers on production equipment or use electrical equipment that may increase operator costs. Requirements that increase costs for the operator could also reduce revenues for the United States Government. Because the required mitigation measures are common practices, the impacts to the operator and the government are expected to be minimal.

Alternatives C through F have same and most acres (4,921) within the moderate or low oil and gas resource potential areas with the CSU stipulation limiting noise from oil and gas production facilities. In Alternative A no lands are administratively available for leasing; therefore, there would be no impact from noise of oil and gas production facilities. In Alternative B the impacts of noise at recreation areas and

residential/forest interface areas would be mitigated using standard lease terms only. The use of standard lease provisions to move a well up to 200 meters would provide avoidance of noise impacts to residential and developed recreation interface areas in most cases; however, there is a small chance interface areas could be impacted by noise greater than 70 decibels using SLT only.

Effects from Paleontology Management

In the Rocky Mountain Region of the Forest Service, which includes the Medicine Bow National Forest, a Lease Notice for Cultural and Paleontological Resources is attached to all leases. This Lease Notice requires a predevelopment literature search and a site-specific inventory by a Forest Service Paleontologist. Oil and gas leasing is allowed subject to operational constraints to preserve vertebrate paleontological resources (see the Revised Management Plans, Chapter 1, Paleontological Resources). Access and other development and production related facilities would be allowed but may be moved or modified to preserve paleontological resources. Delays and mitigation could increase operator costs. Requirements that cause delays or increase costs for the operator could also reduce revenues for the United States Government.

Effects from Soils Management

To implement the revised LRMP standards and guidelines, four stipulations are applied to protect soil resources. An NSO stipulation is applied to high erosion, or geologic hazard soils, and to slopes over 60%. A CSU stipulation is applied to hydric soils, and to slopes from 40 to 60%.

Table 3-159. Acres stipulated to protect soil resources by alternative.

Stipulation	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
High erosion and geologic hazard (NSO)	0	0	40,921	40,921	40,921	40,921	40,921
Slopes over 60% (NSO)	0	0	1,420	1,420	1,420	1,420	1,420
Hydric soils (CSU)	0	0	12,455	12,455	12,455	12,455	12,455
Slopes 40-60% (CSU)	0	0	12,405	12,405	12,405	12,405	12,405
Total	0	0	67,201	67,201	67,201	67,201	67,201

In areas where no surface occupancy is applied, protection of steep slopes (over 60%) and high erosion and geologic hazard soils would impact oil and gas exploration. Effects would range from increased costs of drilling, to loss of access to oil and gas resources, to the loss of some rental and royalty income. The magnitude of the loss is reduced because, for the most part, steep slopes are accessible from

adjacent land, and in areas even with very steep slopes and high density of steep slopes, it is often possible to find sites to locate well pads. Additionally, the costs of development on steep slopes would be higher than on adjacent gentler slopes. However, where there is a need to relocate a well, there could be some increased costs.

Table 3-160. Acres stipulated to protect soil resources as a percentage of total acres with known oil and gas potential by alternative.

Stipulation	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
High erosion and geologic hazard (NSO)	0.00	0.00	15.02	15.02	15.02	15.02	15.02
Slopes over 60% (NSO)	0.00	0.00	0.52	0.52	0.52	0.52	0.52
Hydric soils (CSU)	0.00	0.00	4.57	4.57	4.57	4.57	4.57
Slopes 40-60% (CSU)	0.00	0.00	4.55	4.55	4.55	4.55	4.55
Total	0.00	0.00	24.66	24.66	24.66	24.66	24.66

In Alternative A, no lands are administratively available for oil and gas leasing; therefore, there would be no impacts to soil from oil and gas activities in Alternative A. In Alternative B, impacts to soils would be mitigated using standard lease terms, which require the lessee to minimize impacts to soils, and require reclamation. In addition, the use of standard lease provisions that allow for moving a well site up to 200 meters would provide avoidance of steep slopes in most cases. Alternatives C through F have the same number of acres with the NSO and CSU stipulations protecting high erosion and geologic hazard, steep slopes, and hydric soils.

Effects from Water and Aquatic

Riparian areas, woody draws, wetlands, and floodplains are protected by the hydric soils CSU stipulation discussed under Effects from Soils Management. In addition, ground disturbing activities are restricted within 300 feet or the top of the gorge (which ever is greater) of streams containing aquatic, wetland or riparian dependent TES species listed as threatened, endangered, or sensitive. Within these distance limitations, protecting aquatic, wetland or riparian dependent listed TES species would impact oil and gas exploration. Where there is a need to relocate a well, there could be some increased costs. Because the distance limitation for protection of aquatic, wetland or riparian dependent listed TES species is less than 200 meters, standard stipulations provide adequate protection.

Effects from, Livestock Grazing and Big Game Use, Forest Management, and Silviculture

Standards and guidelines for range management, livestock use, forest management and silviculture do not require any stipulations for oil and gas activities. Occupancy and use for minerals purposes are not restricted by these management activities. Certain activities, such as livestock grazing and big game grazing/browsing on mineral sites that are being reclaimed, are addressed in site-specific management requirements at the Application for Permit to Drill stage of development.

Effects from Wildlife

The effects from deer and elk winter rangelands and birthing areas on oil and gas leasing are discussed in the Effects from Management Areas section, MA 3.58 and 5.41. The effects from Sheep Mountain game refuge on oil and gas leasing are discussed in the Effects from Management Areas section, MA 3.54. The effects from threatened and endangered species are discussed under the Effects from Threatened and Endangered Species section. Standards and guidelines for bighorn sheep habitat would result in a timing limitation stipulation; however, identified bighorn sheep range is on the Laramie Range and has no known oil and gas resource potential. This section concentrates on the effects from wildlife not discussed elsewhere and which the proposed Forest Plan specifies standards and guidelines resulted in an oil and gas leasing stipulation.

Three timing limitation stipulations for wildlife are necessary to implement the proposed Forest Plan standards and guidelines. There are timing limitations for 1 mile around sharp-tailed grouse breeding complexes, for 2 miles around sage grouse breeding complexes, and for ½ mile around greater sandhill crane breeding complexes. These three TL are all for the period from March 1 through June 30. Presently, Columbian sharp-tailed grouse is the only species with inventoried breeding complex within the oil and gas resource potential area on the Medicine Bow National Forest.

Table 3-161. Acres stipulated to protect wildlife breeding complexes by alternative[9].

Stipulation	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Sharp-tailed grouse breeding complex 1 mile TL March 1 to June 30	0	0	8,755	8,755	8,755	8,755	8,755

[9] Acres stipulated for sharp-tailed grouse breeding complexes increased from 5,725 acres in the DEIS to 8,755 acres in the FEIS because of improved wildlife observation data. The most current data was used throughout this analysis to provide an accurate comparison of alternatives.

Protecting areas to minimize disturbance to wildlife breeding complexes would impact oil and gas activities. Exploration costs could increase because of the shortened amount of time available for drilling. Timing limitations may push operations into the winter, where activities on frozen ground or in frigid weather can also increase operator costs. If a well is not completed within required time limits, shutting a drilling operation down and leaving the equipment idle or moving the equipment to another site and moving it back increases costs. Requirements that cause delays or increase costs for the operator could also reduce revenues for the United States Government.

Alternatives C through F have the same acres of wildlife breeding complexes protected by leasing stipulations. In Alternative A no lands are administratively available for oil and gas leasing; therefore, there would be no impacts to wildlife breeding complexes from oil and gas activities in Alternative A. In Alternative B impacts to wildlife breeding complexes would be mitigated using standard lease terms, which require the lessee to minimize impacts to breeding complexes. SLT will not provide the same level of protection as leases with the TL stipulation when protecting the breeding complex requires moving the well location more than 200 meters or when the needed timing delay is greater than 60 days.

Effects from Threatened and Endangered Species

To implement the revised LRMP standards and guidelines, twelve stipulations are applied to protect threatened and endangered species with seventeen separate restrictions as follows:

Table 3-162. Proposed forest plan identified mitigation measures for TES species.

Species and Feature Protected	NSO Restriction	TL Restriction
Bald eagle foraging habitat	N/A	Open water and adjacent ¼ mile of land within 2.5 miles of active bald eagle nests, February 1 to August 15
Bald eagle nests	½ mile	1 mile, February 1 to August 15
Bald eagle roosts	N/A	250 yards, November 15 to March 1
Golden eagle nests	¼ mile	½ mile, February 1 to July 31
Ferruginous hawk	¼ mile	½ mile, March 1 to July 31
Northern harrier	N/A	½ mile, April 1 to August 15
Northern goshawk	N/A	½ mile, April 1 to August 30
Osprey	¼ mile	½ mile, April 1 to August 15
Peregrine falcon	¼ mile	½ mile, March 1 to August 15
Short-eared owl	N/A	¼ mile, March 1 to August 1
Swainson's hawk	¼ mile	½ mile, April 1 to August 15

Presently, peregrine falcon and northern goshawk are the only raptors with inventoried nests in the area with oil and gas resource potential on the Medicine Bow National Forest.

Table 3-163. Acres stipulated to protect threatened and endangered species by alternative.

Stipulation	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Peregrine falcon, northern goshawk ¼ mile NSO	0	0	1,359	1,359	1,359	1,359	1,359
Peregrine falcon, northern goshawk ½ mile TL March 1 to July 30	0	0	3,907	3,907	3,907	3,907	3,907
Total	0	0	5,266	5,266	5,266	5,266	5,266

Alternatives C through F have the same and most acres of threatened and endangered species nesting areas protected by leasing stipulations. In Alternative B, impacts to threatened and endangered species would be mitigated using standard lease terms, which require the lessee to minimize impacts to threatened and endangered species and to abide by all provisions of law. Under SLT threatened and endangered species would receive essentially the same level of protection as if the special stipulations, both NSO and TL, for threatened and endangered species had been applied. Therefore, threatened and endangered species receive essentially the same level of protection in all action alternatives, and impacts and costs on oil and gas from threatened and endangered species are the same in Alternatives B through F. In Alternative A, no lands are administratively available for oil and gas leasing; therefore, there would be no impacts to oil and gas activities from threatened or endangered species because there would be no oil and gas leasing.

Although revised LRMP standards and guidelines for Canada lynx habitat do not require oil and gas leasing stipulations, lynx analysis units (LAUs) are within the areas of moderate or low oil and gas leasing potential as displayed in the following table.

Table 3-164. NFS acres with oil and gas potential within LAUs.

Oil and Gas Potential	LAU Acres	Habitat Acres[10]				
		Denning	Winter Forage	Other Forage	Unsuitable	Non Habitat
Low	59,427	15,724	19,213	32,503	2,370	3,291
Medium	23,779	5,855	7,646	12,954	686	731
Total	**83,206**	**21,579**	**26,860**	**45,456**	**3,057**	**4,022**

In all alternatives allowing oil and gas leasing, lynx habitat will be preserved using standard lease terms, which require the lessee to minimize impacts to threatened and endangered species and to abide by all provisions of law. As with other threatened and endangered species, lynx habitat will receive essentially the same level of protection in all alternatives, and impacts and costs on oil and gas from preserving lynx habitat are the same in all alternatives.

Effects from aquatic, wetland or riparian dependent TES species listed as threatened, endangered, or sensitive are discussed in the Effect from Water and Aquatic section.

Effects from Fire and Fuels Treatment

Heavy equipment use during fire suppression activities could affect buried pipelines; however this is addressed in the proposed Revised Management Plans and requires consultation with appropriate resource specialists for guidance. No stipulations are required.

Effects from Insects, Disease, and Invasive and Undesirable Plant Species Management

Standards and guidelines for insects, disease, and invasive and undesirable plant species management do not require any stipulations for oil and gas activities. Occupancy and use for minerals purposes are not restricted by management activities regarding noxious and undesirable plant species. Non-native and invasive plant species, noxious weed, insect, and animal damage management requirements may add to projects and operation costs. These constraints are normally applied at the site-specific stage of development (when an Application for Permit to Drill is processed).

Effects from Heritage Resource Management

Standards and guidelines for heritage resources do not require any stipulations for oil and gas activities. Standard stipulations require the lessee to conduct operations in a

[10] Lynx analysis unit habitat classifications may overlap each other and therefore, the sum of habitat acres exceeds the LAU acres. For example many of the same acres that provide denning habitat also provide winter forage habitat.

manner that minimizes impacts to cultural resources. In the Rocky Mountain Region of the Forest Service, which includes the Medicine Bow National Forest, a Lease Notice for Cultural and Paleontological Resources is attached to all leases. This Lease Noticed requires a predevelopment literature search and a site-specific inventory by a Forest Service Archeologist. Access and other development and production related facilities would be allowed but may be moved or modified to preserve archeological resources. Delays and mitigation could increase operator costs. Requirements that cause delays or increase costs for the operator could also reduce revenues for the United States Government.

Effects from Developed Recreation

Effects from developed recreation are discussed in the Effects from Management Area Prescriptions section, MA 8.21, Developed Recreation, and MA 8.22 Ski-based Resorts, Existing and Potential.

Effects from Dispersed Recreation

Although dispersed recreation occurs almost everywhere on National Forest System lands, some management areas emphasize dispersed recreation activities. Management area prescriptions with recreation emphasis include: MA 1.13, Wilderness, Semi-primitive; MA 1.2, Recommended for Wilderness; MA 1.31, Backcountry Recreation Year-round Nonmotorized; MA 1.33, Backcountry Recreation, Summer Nonmotorized with Winter Snowmobiling; MA 1.5, National River System, Wild Rivers Designated and Eligible; MA 3.31, Backcountry Recreation, Year-round Motorized; MA 3.33, Backcountry Recreation, Summer Motorized with Winter Nonmotorized; and MA 3.4, National River System, Scenic Rivers Designated and Eligible. These areas are not administratively available or they are open to leasing with a no surface occupancy stipulation. The areas emphasizing dispersed recreation activities are displayed in the following table by alternative.

Table 3-165**.** Management area acres with dispersed recreation emphasis and leasing restriction by alternative.

Management Area	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
1.13 – NAA	7,226	7,226	7,226	7,226	7,226	7,226	7,226
1.2 – NSO	0	0	0	25,065	21,505	0	72,925
1.31 – NSO	0	0	1,551	14,783	1,218	13,435	0
1.33 – NSO	0	0	24,991	15,482	5,966	565	0
1.5 – NSO	0	0	0	0	0	395	90
3.33 – NSO	0	0	3,290	0	0	0	2,073
3.4 – NSO	0	0	0	0	0	2,205	276
Total	7,226	7,226	37,058	62,556	35,915	23,827	82,590

Management Area 1.13 is not available for oil and gas leasing. In areas with NSO stipulations, oil and gas leasing is allowed, but no surface occupancy is permitted. This means the mineral estate may only be accessed from adjacent areas, and activities must maintain the wilderness, backcountry or wild and scenic rivers qualities for which the area is designated. Road construction is prohibited. If geophysical activities occur, portable techniques must be used.

Protecting areas to maintain identified wilderness, backcountry or wild and scenic rivers qualities would impact oil and gas exploration. Effects would range from increased costs of drilling, to loss of access to oil and gas resources, to the loss of some rental and royalty income. The magnitude of the loss would depend on the resources available in the particular area. Leaving the oil and gas in place usually preserves the resource for future use (except in drainage situations).

Table 3-166. Percentage of acres with known oil and gas potential with dispersed recreation emphasis by alternative.

Management Area	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
1.13 – NAA	2.65	2.65	2.65	2.65	2.65	2.65	2.65
1.2 – NSO	0.00	0.00	0.00	9.20	7.89	0.00	26.76
1.31 – NSO	0.00	0.00	0.57	5.42	0.45	4.93	0.00
1.33 – NSO	0.00	0.00	9.17	5.68	2.19	0.21	0.00
1.5 – NSO	0.00	0.00	0.00	0.00	0.00	0.15	0.03
3.33 – NSO	0.00	0.00	1.21	0.00	0.00	0.00	0.76
3.4 – NSO	0.00	0.00	0.00	0.00	0.00	0.81	0.10
Total	2.65	2.65	13.60	22.95	13.18	8.74	30.31

Alternative F has the most acres NAA or NSO with dispersed recreation emphasis, followed by Alternatives D DEIS, C, D FEIS, and E. Alternatives A and B have the least acres NAA or NSO with dispersed recreation emphasis within the area with oil and gas resource potential.

Effects from Roadless Area Management

Within the analysis area there are portions of 17 inventoried roadless areas with oil and gas resource potential.

Table 3-167. Total federal surface acres and federal mineral oil and gas resource potential acres by roadless area.

Roadless Area Name	Total Roadless Acres, Federal Surface Estate	Roadless Acres, Federal Mineral with Oil and Gas Resource Potential
Battle Creek	5,894	5,489
Big Sandstone	7,170	7,168
Bridger Peak	6,694	2,123
Campbell Lake	7,085	1,820
Deep Creek	6,411	4,203
Huston Park Addition	8,400	378
Libby Flats	11,082	1,218
Little Sandstone	5,481	5,481
Little Snake	9,920	9,790
Middle Fork	13,232	9,504
Pennock Mountain	9,592	886
Rock Creek	18,859	18,363
Sheep Mountain	17,614	16,003
Singer Peak	10,491	10,336
Snowy Range	29,637	333
Solomon Creek	5,756	2,767
Strawberry Creek	5,876	4,172
Total	**NA**	**100,032**

Of the area with oil and gas resource potential, 36.7 percent[11] is in inventoried roadless areas. The following table displays roadless area acreage with moderate or low oil and gas resource potential by several categories.

[11] This percentage is computed using the federal minerals with moderate or low oil and gas resource potential within inventoried roadless areas divided by total federal minerals with moderate or low oil and gas resource potential.

Table 3-168. Federal mineral roadless acres with oil and gas resource potential by category by alternative.

	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Low resource potential	31,036	31,036	31,036	31,036	31,036	31,036	31,036
Moderate resource potential	68,996	68,996	68,996	68,996	68,996	68,996	68,996
Total roadless acres with resource potential	100,032	100,032	100,032	100,032	100,032	100,032	100,032
Federal mineral roadless acres open for leasing by stipulation							
No Surface Occupancy (NSO)	NA	0	71,403	77,732	69,290	45,181	98,603
Timing Limitation (TL)	NA	0	381	1	208	0	0
Controlled Surface Use (CSU) and Timing Limitation (TL)	NA	0	3,501	2,684	3,407	13,611	910
Controlled Surface Use (CSU)	NA	0	7,900	19,604	24,599	41,150	519
Standard Lease Terms (SLT)	NA	100,032	16,847	11	2,528	90	0
Total	NA	100,032	100,032	100,032	100,032	100,032	100,032

In this analysis roadless areas were allocated to various management areas by alternatives. Due to the inherent characteristics of roadless areas, many of the roadless area acres were allocated to management areas that emphasize primitive, backcountry or nonmotorized recreation opportunities. These management areas tend to preserve the roadless character through management area standards and guidelines that limit roaded activities and require NSO leasing stipulations. These effects are described by management area in the Effects by Management Area Prescription section.

As seen in the above table, Alternative F has the most roadless acres that carry a NSO stipulation and thus preserve roadless characteristics followed by Alternatives D DEIS, C, D FEIS and E. In Alternative A roadless characteristics would be preserved over the entire roadless area and oil and gas leasing prohibited. In Alternative B all areas would be available for leasing with standard lease terms and the potential impact to roadless characteristics would be greatest.

The 2001 Roadless Rule has been permanently enjoined (United States District Court for the District of Wyoming, State of Wyoming vs. USDA and Wyoming Outdoor Council, July 14, 2003). If it had gone into effect all inventoried roadless acres

would have been NSO. It is not possible to predict the effects a future resolution of the roadless issue may have.

Effects from Scenery Management

One CSU stipulation was developed to meet standards and guidelines for scenery management. This stipulation applies to areas with both high and moderate scenic integrity objectives. Surface occupancy and use is allowed subject to operational constraints to maintain the landscape character intact (see the Revised Management Plans, Appendix E, Oil and Gas Stipulations). Access and other development and production-related facilities would be allowed but may be moved or modified to preserve scenic resources. Operational constraints may include utilizing topographic and vegetative screening, matching color tones of facilities with surrounding features, orienting the well pad and facilities, redesigning production facilities to such scale that they may not be evident, or placing facilities outside the affected SIO area. Delays and mitigation could increase operator costs. Requirements that cause delays or increase costs for the operator could also reduce revenues for the United States Government. The areas affected by alternative and scenic integrity objectives are shown in the following table.

Table 3-169. Acres stipulated for scenery management by alternative.

Stipulation	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
High SIO CSU	0	0	47,916	81,392	51,438	103,879	110,340
Moderate SIO CSU	0	0	113,236	78,395	107,204	93,155	34,317
Total	0	0	161,152	159,787	158,642	197,034	144,657

Alternative E has the most acres affected by the leasing stipulation to protect scenery, followed by Alternatives C, D DEIS, D FEIS, and F. In Alternative A, no lands are administratively available for oil and gas leasing; therefore, there would be no impacts to scenery from oil and gas activities. In Alternative B impacts to scenery would be mitigated using standard lease terms, which require the lessee to minimize impacts to scenery. In addition, the use of standard lease provisions to move a well up to 200 meters would provide avoidance of sensitive scenic areas in most cases; however, there is a small chance that scenic resources could be adversely impacted using SLT only.

Effects from Wilderness

Effects from wilderness on oil and gas activities are discussed in the Effects from Management Area Prescriptions section, MA 1.13, Wilderness, Semi-primitive, and MA 1.2, Recommended for Wilderness.

Effects from Administrative Facilities

Effects from administrative facilities on oil and gas activities are discussed in the Effects from Management Area Prescriptions section, MA 8.6, Administrative Sites.

Effects from Land Adjustments

Land ownership standards and guidelines do not require any lease stipulations. Land adjustments may have implications for ownership and management of the mineral estate, which are considered at the time a specific adjustment is proposed. The Federal Land Policy and Management Act of 1976 requires an equalization of land values, which includes its mineral value, when doing adjustments (exchanges, disposal, acquisitions).

Effects from Special Use Management

No stipulations are required by standards and guidelines for special uses. However, certain mineral-related activities (roads, pipelines, gathering lines, power-lines, and lighting) require special use permits and will be affected by standards and guidelines for special uses. New standards and guidelines applied to special use activities associated with oil and gas could increase operator costs.

Cumulative Effects

Activities listed in the Cumulative Effects Table located in the Purpose and Organization portion of this FEIS Chapter 3 are considered in the cumulative effects analysis for oil and gas. Cumulative effects in this section are generally bounded in time to those reasonably foreseeable during the life of the plan (next 10 to 15 years) and bounded in space to those reasonably adjacent to the Forest (less than 50 miles from the Forest Boundary).

Effects from Oil and Gas Development on Private Lands Draft

Some who commented on the DEIS, suggested the effects of drilling adjacent private lands should be disclosed in the Cumulative Effects analysis. The Reasonable Foreseeable Development Scenario (RFD) prepared for this analysis projected two exploratory wells to be drilled on all ownerships (public and private) in the analysis area over the next 10 years. Because of the number of variables in determining if and where an exploratory well would be drilled, it is not possible to predict an exact drilling location. The prospect of a well being drilled on public lands as opposed to private lands would be approximately proportional to the amount of those lands in the analysis area (lands with oil and gas resource potential).

Table 3-170. Status of lands with oil and gas resource potential as a percentage of the total area with oil and gas resource potential.

Status	Oil and Gas Potential		Total Acres
	Low	Moderate	
Federal Surface, Federal Minerals	35.22	56.20	91.42
Federal Surface, Private Minerals	0.19	0.60	0.79
Private Surface, Federal Minerals	0.15	0.37	0.52
Private Surface, Private Minerals	2.04	5.24	7.27
Total	37.59	62.41	100.00

Within the area with oil and gas resource potential, private minerals represent 8.06 percent of the mineral estate and private surface represents 7.79 percent of the surface estate; whereas federal minerals represent 91.94 percent of the mineral estate and federal surface represents 92.21 percent of the surface estate. Based on land ownership of the area with oil and gas resource potential, it is unlikely that oil and gas activities will occur on private lands within the planning period.

Effects from Oil and Gas Development Adjacent to the Forest

On lands in proximity to the Forest but outside the Forest boundary (all ownerships) there have been several oil and gas plays. About three miles west of the Sierra Madre area of the Forest, Savery field (T13N, R89W) has produced over 7 billion cubic feet of gas (BCFG). About 3-5 miles east of the Medicine Bow area of the Forest, a number of fields were discovered in the 1920's to 1940's. These fields (Dutton Creek, Cooper Cove, Seven Mile, Quealy Dome, and Rex Lake) have produced over 16.5 million barrels of oil (MMBO) and 2.5 BCFG. However, the reservoirs from which these fields are produced do not extend onto the Forest, are too shallow on the Forest to have significant potential for production, or have been removed by erosion.

Several coalbed gas plays are currently being developed on private and Bureau of Land Management lands mostly to the west and north of the Forest. These fields include the Atlantic Rim Coalbed Methane Project approximately 6 miles west of the Forest, the Hanna Draw Coalbed Methane Exploration Project approximately 10 miles northeast of Hanna, the Seminoe Road Gas Development Project approximately 20 miles north of Rawlins, and the Desolation Flats Natural Gas Field Development Project approximately 15 miles west of Baggs, Wyoming. Of these projects the Atlantic Rim Project is the closest to the Forest, is currently undergoing exploration drilling, and has a potential development of 3,800 wells. Coalbed methane wells generally produce for 10 to 15 years.

The Reasonable Foreseeable Development Scenario (RFD) prepared for this analysis projected two exploratory wells to be drilled in the analysis area over the next 10 years. In the context of past, present and reasonably foreseeable future actions it is

unlikely there would be any identifiable cumulative effect of the projected two wells to be drilled on National Forest System lands during the next 10 years except for a small addition to the knowledge of stratigraphy.

Effects from the Proposed Forest Plan

Forest Plan standards and guidelines that require oil and gas lease stipulations may make oil and gas exploration and development more costly and limit or prevent oil and gas activities. Some have expressed concern that the number of stipulations required by the proposed plan could have a cumulative impact limiting oil and gas development. Alternatives having the most area available under standard lease terms would have the least impact from Forest Plan required lease stipulations. The issue is complex because stipulations applied to areas with moderate oil and gas resource potential would have a greater impact on potential oil and gas development than stipulations applied to areas with low oil and gas resource potential.

The following tables show the acres of restrictions or constraint on exploration and development activities for areas of moderate and low resource potential by alternative. There are no areas of high oil and gas resource potential for the Medicine Bow National Forest.

Table 3-171. Leasing restrictions by oil and gas resource potential by alternative (acres).

Stipulation	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Moderate Oil and Gas Resource Potential Areas							
NAA	167,682	0	0	0	0	0	0
NSO	0	0	73,715	80,430	68,256	56,574	120,426
TL	0	0	438	386	4,135	183	1,820
CSU&TL	0	0	16,499	15,659	13,037	46,086	11,749
CSU	0	0	43,680	43,371	53,454	41,964	12,304
SLT	0	167,682	33,350	27,835	28,800	22,874	21,383
Total Moderate	167,682	167,682	167,682	167,682	167,682	167,682	167,682
Low Oil and Gas Resource Potential Areas							
NAA	104,843	7,226	7,226	7,226	7,223	7,226	7,226
NSO	0	0	23,696	24,770	30,689	18,168	73,320
TL	0	0	459	143	141	143	156
CSU&TL	0	0	4,006	3,594	5,136	8,537	5,788
CSU	0	0	24,062	34,791	27,271	39,251	7,111
SLT	0	97,617	45,395	34,319	34,383	31,518	11,243
Total Low	104,843	104,843	104,843	104,843	104,843	104,843	104,843

NAA-Not Administratively Available for Leasing, NSO-No Surface Occupancy, TL-Timing Limitation, CSU&TL-Controlled Surface Use and Timing Limitation, CSU-Controlled Surface Use, SLT-Standard Lease Terms only

Alternative A has no acres available for leasing and no impact from lease stipulations. For areas with moderate oil and gas resource potential, the alternatives area ranked from most to least impact from lease stipulations as follows: B, C, D FEIS, D DEIS, E and F. For areas with low oil and gas resource potential the alternatives area ranked from most to least impact from lease stipulations as follows: B, C, E, D FEIS, D DEIS, and F.

Restrictions that prohibit access in areas of moderate oil and gas resource potential would have a greater effect on leasing than those same restrictions if imposed in areas with lesser potential. Such restrictions include NSO stipulations, and designation of not administratively available. The following table displays the acres not administratively available and available but with no surface occupancy permitted by oil and gas resource potential and alternative.

Table 3-172. Leasing restrictions by oil and gas resource potential by alternative (acres).

Stipulation	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Moderate Oil and Gas Resource Potential Areas							
NAA	167,682	0	0	0	0	0	0
NSO	0	0	73,715	80,430	68,256	56,574	120,426
Total Moderate	167,682	0	73,715	80,430	68,256	56,574	120,426
Low Oil and Gas Resource Potential Areas							
NAA	104,843	7,226	7,226	7,226	7,223	7,226	7,226
NSO	0	0	23,696	24,770	30,689	18,168	73,320
Total Low	104,843	7,226	30,922	31,996	37,913	25,394	80,545
Grand Total	272,525	7,226	104,637	112,426	106,169	81,968	200,971

NAA-Not Administratively Available for Leasing, NSO-No Surface Occupancy

Alternative A has the most acres not accessible due to being not administratively available for oil and gas leasing, followed by Alternatives F, D DEIS, D FEIS, C, and E not accessible due to both being not administratively available and with no surface occupancy stipulations. Alternative B has the least acres not accessible due to being not administratively available and no acres with no surface occupancy stipulations.

Effects from Large Areas of No Surface Occupancy

In the area affected by NSO stipulations, wells would be displaced to areas outside the NSO area. Impacts to oil and gas would include increased costs of development and production to directionally or horizontally drill the wells. Acknowledging that horizontal drilling may exceed two or three miles, it is economically impractical to

drill exploration wells directionally or horizontally; therefore, for purposes of this analysis lands greater than 1/8 mile inside the boundary of an NSO area are considered unavailable. This provides a reasonable expression of reality allowing for comparison of alternatives.

Inside the boundary of NSO areas beyond 1/8-mile, the oil and gas resource would be essentially inaccessible with current technology. The magnitude of the loss would depend on the resources available in the particular area. In some circumstances, leaving the oil and gas in place preserves the resource for future use. When oil and gas resources adjacent to the area of no surface occupancy are developed, drainage of the oil and gas under the no surface occupancy area could occur, resulting in a loss of resource and associated royalties to the United States government.

The following table displays the area affected and the area inaccessible due to NSO stipulations by alternative on the Medicine Bow National Forest. The area affected is defined as the area from the boundary to 1/8-mile within the NSO area. The area made not accessible is defined as the area beyond 1/8-mile inside the NSO boundary.

Table 3-173. Acres of NSO affected and not accessible due to NSO stipulations by alternative.

Stipulation	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Affected <1/8 mile	0	0	43,571	42,691	40,520	37,387	41,009
Not accessible >1/8 mile	0	0	53,839	62,510	58,425	37,355	152,736
Total NSO	0	0	97,410	105,200	98,945	74,742	193,745

NSO-No Surface Occupancy,

Alternative F has the most acres affected and not accessible due to NSO, followed by Alternatives, D DEIS, D FEIS, C, and E. Alternative A has no lands available for leasing, and Alternative B allows leasing with standard lease terms only.

Effects from Drainage

Drainage occurs when oil and gas migrates in the subsurface from areas of high pressure to areas of lower pressure, such as is found near a producing well. Production of migrated oil and gas without compensation to the owner and/or lessee from whose estate the hydrocarbons moved is called drainage. The remedy of choice is often drilling and completing a producing well on the mineral estate losing hydrocarbons.

The federal oil and gas lease obligates the lessee to protect federal minerals against drainage. Developing a well on the losing mineral estate is one method of drainage protection. Other protection may be achieved by including lands not leased in units, by agreements with adjacent mineral owners, or assessment of compensatory

royalties. However, if the federal mineral estate is not leased, the existing mineral resource may be drained and produced from adjacent non-federal mineral estates without compensation to the federal government.

Drainage can also affect overall reservoir recovery. Spacing of wells over the reservoir is crucial to maximum reservoir recovery. When a portion of the lands are not available to be drilled, oil and gas recovery from the reservoir would be diminished, secondary recovery may be inhibited, and overall recovery and revenues reduced.

When lands are leased, the lessee can be required to protect the lease from further drainage. However, when land is not leased, there is no procedure to protect from drainage. By not allowing leasing, the recoverable reserves within a particular tract may be decreased, perhaps to the point where drilling within the federal tract is not economically feasible, even if leasing is later permitted.

For the Medicine Bow National Forest, the potential loss of federal royalties caused by drainage from lands not leased is expected to be greatest in Alternative A with the greatest number of acres not administratively available for leasing, followed by Alternatives F, D DEIS, D FEIS, C, and E not accessible due to both being not administratively available and no surface occupancy stipulations. Alternative B has the least acres not accessible due to being not administratively available and no acres with no surface occupancy stipulations.

Effects from Access

Access to leases across federal lands is controlled by land and resource management plan standards and guidelines. The standards and guidelines are not specifically included in oil and gas leases but apply to the lessee, as well as any forest user. Generally, when a stipulation is applied to a lease, similar or identical restrictions will apply to the placement, construction, and use of access roads, pipelines, and power-lines.

Livestock Grazing and Big Game Use

Introduction – Suitable rangelands are lands capable of producing forage for livestock and wildlife and on which grazing by livestock has been determined to be an appropriate use. Rangelands may consist of grasslands, meadows, riparian areas, wetlands, alpine and subalpine areas, shrublands, deciduous forests, and open- or closed-canopy conifer forests. Wildlife species depend on rangelands for forage and cover throughout the year. Livestock producers, as well as outfitters, guides, and visitors, depend on forage for their commercial livestock, and riding and pack stock. State wildlife managers, as well as the hunting public, rely on rangelands to provide for big and small game needs. The general public relies on rangelands to provide habitat for a very large variety of wildlife species as well as areas for recreation, solitude, and beauty.

Legal and Administrative Framework

FSM 2200 – this manual summarizes laws and regulations governing rangeland management and forest planning.

FSM 2600 – this manual summarizes laws and regulations governing fish and wildlife management and forest planning.

R-2 Rangeland Analysis and Management Training Guide

FSH 2209.13 – Grazing Permit Administration Handbook

FSH 2609.13 – Wildlife and Fisheries Program Management Handbook

Code of Federal Regulations (CFR) 36

- 219 Planning
- 222 Range Management
- 241 Fish and Wildlife

National Forest Management Act (NFMA) of 1976 – this act identifies information 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 Service to complete site-specific National Environmental Policy Act analysis and decisions on allotments on a scheduled basis.

Key Indicators

- Acres of suitable rangelands.
- Number of active grazing allotments.
- Number of cattle and sheep permitted for grazing.
- Number of HMs of cattle grazing and sheep grazing.
- Number of AUMs of cattle grazing and sheep grazing.
- Populations of big game animals: elk, mule deer, white-tailed deer, antelope, moose, and bighorn sheep.
- Acres of privately owned rangelands lost to subdivision/development or to non-agricultural uses, by county.

Resource Protection Measures

Forest Plan standards and guidelines are designed to maintain and improve rangeland conditions. Desired rangeland vegetation conditions are specified for individual allotment areas and grazing systems are designed to achieve and maintain the desired conditions. Allowable forage utilization is stipulated on a site-specific basis and is dependent on the type and condition of vegetation present, soil and water concerns, and season and intensity of grazing. When allowable utilization meets prescribed levels, livestock are moved from the pasture or grazing area or removed from the allotment for the season.

The state of Wyoming is directly responsible for managing wildlife populations, but the Forest Service is a managing partner for population numbers, diversity, and species viability through the management of rangeland vegetation located on the National Forest. Rangeland management specialists and wildlife biologists coordinate and cooperate with state biologists to maintain big game herds at levels consistent with available habitat and desired vegetation objectives.

AFFECTED ENVIRONMENT

Livestock Grazing

Historic grazing use: Accounts indicate the occurrence of livestock grazing on the Laramie Plains and the surrounding areas as early as 1865. The area ran some 90 miles north and south from Laramie Peak to Tie Siding and some 60 miles east and west (including Pole Mountain, Elk Mountain, and the Snowy Range). With the completion of the Transcontinental Railroad in 1869, the growing cattle industry would double in the next two years. Continued falling prices, coupled with the severe losses suffered during the blizzard of 1886, made way for the rise of the sheep industry, which dominated Wyoming for the next several decades (Boglioli, Hejtmanek et al. 2002).

The short but nutritious grasses of southeastern Wyoming supported hundreds of thousands of sheep, cattle, and horses by the turn of the century. The Creighton, Sutton, and Alsop Ranch on the Big Laramie River ran 8,000 cattle and 3,000 sheep in 1870. An adjoining ranch, measuring twelve by fifteen miles, carried 5,500 cattle and 3,600 calves. Albany County alone was home to 116,000 sheep by 1884.

Riverside Livestock Company (Balch & Bacon) was running 14,400 sheep and 2,450 cattle in the valley of the Big Laramie in 1902. The Swan Land and Cattle Company was centered northeast of Laramie and contained, at its height, just over a million acres from Goshen Hole on the east to Fort Steele on the west. This operation owned 113,625 cattle in 1886. They began in the sheep business in 1904, peaking at 108,718 animals in 1911. Their total ranch operation in 1909 included 62,000 sheep, almost 28,000 cattle, and 450 horses (Burns, Gillespie et al. 1955).

Like other western areas, early use (livestock numbers and seasons of use) on the Forest was substantially greater than at present. Much of the management at the time consisted of ranchers allowing the local herds to follow the "green-up" in the spring as the winter snows melted and expecting the snow's return in the fall to help bring the animals back home. The heavy use of the rangelands became apparent over time, but was far more problematic on the private lands than on the National Forest. The Forest Service had established and was enforcing grazing policies by 1907; new practices included placing salt for more even distribution of cattle use and management and rotation of sheep bedding grounds. Cattle seasons were reduced and established for April 15th to September 30th; sheep use was staggered slightly to avoid conflicts, with established seasons from May 5th to September 30th. Additional efforts to reduce stocking and take corrective actions began in the 1920s. Additional reduction of herd sizes was the first to be implemented, followed by more reductions in the time allowed on the Forest (Boglioli, Hejtmanek et al. 2002).

Improved management of the National Forest lands began in earnest in the late 1940s. Construction of fences and water developments were initiated in order to implement rotation systems. These rotation systems were designed to control the length and timing of grazing use. Such systems were planned to allow seed set and plant recovery after grazing and to improve/increase species composition of rangelands vegetation. Twenty-five years ago, about 2/3 of the permitted cattle were still under season-long grazing systems . Today, virtually all areas of the Forest are now under some type of improved rotation or deferred grazing system designed to meet desired vegetation conditions.

The peak number of sheep permitted on all units of what would become the present-day Medicine Bow National Forest numbered well in excess of 400,000 during the first quarter of the twentieth century, in addition to nearly 200,000 cattle. Total permitted numbers have steadily decreased since that time.

Current grazing use: There are about 16,000 cattle under permit; the average season is just over three and a half months (generally mid June through September), with approximately 56,000 head-months (74,000 AUMs) of use . The number of permitted cattle has remained mostly steady over the last 20 years, but the number of grazing permittees (both cattle and sheep) has declined by 20% (down from 120 to 95). Generally, ranchers with cattle permits have sold the base property and/or the permitted livestock to another permittee, keeping the permitted cattle numbers constant over time. But the amount of head-months (and AUMs) of cattle use is down about 10% over the same 20-year period. Most of that reduction is in the form of shortened seasons of use brought about by the need to better manage riparian vegetation, improve watershed health, and avoid resource and people conflicts associated with increased recreational activities in the fall. Occasional, usually small, reductions have taken place as a result of conflicts or forage competition between livestock and big game in isolated areas.

There is no expectation of significant changes in use or demand in the immediate future, although there is a "waiting list" for cattle operators wanting to graze on the Forest. Under current and long-standing regulations, a new grazing permit can only rarely be issued to anyone who has not purchased the qualifying base property and/or permitted livestock of an existing permittee.

There are about 20,000 sheep under permit and the average grazing season is just over two months (generally early July to mid-September). This equates to approximately 42,000 head-months (12,600 AUMs) of use. The number of sheep grazed has been halved since the mid-1980s, with the amount of use also down about 40%. Much of the reduction in season of use is to meet other resource objectives, in addition to a change in off-dates in order to take advantage of better marketing opportunities. The loss of numbers is a more complicated issue and is a matter of at least the following factors: the continued low prices and high production costs faced by the sheep and wool industries, reduced ability to control expanding predator numbers and resultant herd losses, and a reduced source of individuals able and willing to work as herders, as well as the requirement to meet other resources needs. The number of ranchers with sheep permits has declined over time; some have gone out of business, while others have ceased running on Forest lands because of the expenses and economics of public land operations, resulting in vacant allotments. There is no expectation of significant changes in use or demand at this time.

Table 3-174. Change in livestock grazing use from 1980 to 2000.

Item	Number		Head Months of Use	
	1980	2000	1980	2000
Cattle	16,000	16,000	61,000	56,000
Sheep	40,000	20,000	70,000	42,000
Grazing Permittees	120	95		

About 30 horses are permitted, for a total of 100 head-months of use; these are the animals necessary for use by the ranchers to properly manage the cattle and sheep under permit (USDA Forest Service 2000b).

Outfitters and Guides: In addition to livestock permitted for vegetation and grazing management purposes, there are 20 outfitter-guides operating on the Forest. Use is authorized by Special Use Permits. Most permitted seasons generally coincide with big game hunting seasons, but permitted use periods start as early as May 15 and run as late as November 15. Total use across the Forest is estimated at 500 permitted head-months (1,814 visitor days) (USDA Forest Service 2001a).

Recreational horse use on the Forest rangelands includes frequent use by local enthusiasts as well as occasional trips by individuals and organized groups from across the country. Uses vary from weekend riders and packers to the organized annual trip down the Snowy Range trails by the Roundup Riders of the Rockies to the hundreds of resident and non-resident hunters who visit the Forest each fall during mule deer and elk hunting seasons. Total use across the Forest is estimated at 1,350 head-months (8,000 RVDs) of horse use (USDA Forest Service 2000a).

Current management: About 88% of the acres on the Forest are suitable for use by domestic livestock (see Appendix B). About 38% of the acres (410,000) are classified as prime and easily accessible rangelands with relatively high forage production – grasslands, meadows, riparian areas, wetlands, shrublands, aspen, conifers with open canopies, and alpine areas. A total of 99% of these rangeland acres that are used by domestic livestock are in satisfactory condition – they are meeting or moving toward desired vegetative conditions provided for in the 1985 Plan. For more detailed information, refer to the *Vegetation -- Rangelands* section .

There are 104 active livestock grazing allotments on the Forest. Included in these allotments are a total of 1,208,763 acres, of which 995,877 acres are NFS lands (the other 18% are private and state lands). An additional 15 allotments are currently vacant (Term Grazing Permits are not issued for livestock use); the total for these areas is 63,666 acres, of which 46,099 are NFS acres (72%). The remaining 53,162 acres of National Forest System lands are outside the boundaries of any kind of allotment, and any authorized livestock use is by recreational visitors and outfitter/guides (USDA Forest Service 1998).

Most sheep allotments practice an alternate rotation grazing system in which the pattern of grazing is "reversed" on alternating years. Sheep are herded, and move to

new bedgrounds each night. Most cattle allotments are managed under a pasture rotation system that will use most or all of the allotment 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 ranchers need to ride the allotments (if they don't have a full-time rider) several times each week to move livestock out of riparian zones and into other areas of available forage.

Site-specific NEPA analysis for rangeland management uses and activities occurs during the allotment management planning process (analysis is completed for all rangelands, whether inside or outside of active allotments). The Medicine Bow National Forest is on a 15-year schedule to update and revise allotment management plans (AMPs) as mandated by the 1995 Rescissions Act. During the first six years of that schedule (1996-2001), 40 of the 104 active and 15 vacant allotments (34 percent) have undergone updated rangeland analysis, with resultant updates and revisions of the AMPs as needed. Allotment management plans are 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 planning process to address site-specific resource issues and opportunities.

The permitted livestock grazing use across the Forest is based on available forage and utilization in accordance with forest plan standards and guidelines. Some areas experience infrequent or seasonal overuse due to poor livestock distribution across the allotment. In addition, many areas receive dual grazing and browsing pressure on the vegetation from both livestock and big game during some part of the year. Some of these areas are along the Forest boundary at lower elevations in traditional winter ranges. Solutions to these problems are dealt with in communications and coordination with Wyoming Game and Fish biologists and at the site-specific level of NEPA analysis during allotment management planning.

Summary of Existing Condition: Cattle numbers (16,000) have remained stable over the last 20 years, but use has declined by 10% (to 56,000 HMs). At the start of the twentieth century, there were 200,000 cattle and about 1,100,000 HMs. Current use amounts to about 8% of the numbers and 5% of the use that existed 100 years ago.

Permitted sheep numbers (20,000) have decreased by 50% over the last 20 years, and use has declined by about 40% as well (to 42,000 HMs). At the start of the twentieth century, there were over 400,000 sheep running on the Forest for a total of about 22,000,000 HMs. Current use amounts to about 5% of the numbers and less than 1% of the total use that existed 100 years ago.

Ninety-nine percent of the National Forest System acres on the Forest that are grazed by domestic livestock are in satisfactory condition and are meeting or moving toward desired vegetative condition specified in the 1985 Forest Plan.

Recreational livestock use on the Forest shows a steady increase, with projections for an 8-10% increase each decade (Bowker, English et al. 1997).

Livestock Grazing Permittee Operations and Resultant Open Space: There are currently 95 livestock operators with Term Grazing Permits on the Forest, down 20% in the last 20 years. Some of the reductions have occurred because ranches have combined or consolidated into larger units for economic reasons – smaller operators selling out to larger operators. Others have sold out to wealthy and/or absentee landowners interested in "retreat" acreages, hunting reserves, or scenic backdrops.

There has been an increasing tendency in recent years for some ranchers to sell off a portion of their deeded lands in an attempt to keep the remainder as some sort of viable unit and keep it in the historic family ownership and traditions.

The 95 ranchers with Term Grazing Permits on the Forest collectively own about 1,100,000 acres of private rangelands below the Forest – a cumulative total just slightly larger in size than the entire total of National Forest System lands in the Medicine Bow National Forest. In addition, they lease approximately 155,000 acres of state lands and another 80,000 acres of other private lands. The following table displays the general make-up of their privately owned lands in the six Wyoming counties surrounding the Forest.

Table 3-175. Summary of private rangelands owned by Forest grazing permittees.

Type of Land (General Use)	Acres	Percent
Native Rangeland	742,652	67
Irrigated Hay	85,794	8
Cultivated Farmland (including CRP land)	278,676	25
Total Acres	**1,107,122**	

Sources: Conservation Districts from Albany, Carbon, Converse, Laramie, Natrona, and Platte counties and the Wyoming Agricultural Statistics Service.

More than half of these ranchers also hold BLM grazing permits. Many of their private lands also contain small isolated tracts of BLM lands in the midst of their private holdings as well (Section 15 lease lands), adding to the complexity. A majority of these operators have all three types of land ownership (and may have other leased State and private land as well) intermingled in their year-round livestock operations – a change in management, land use, seasons, or numbers on any one ownership influences all the other lands.

The privately owned lands of the 95 grazing permittees contain about 750,000 acres of primary native rangelands, nearly twice the number of acres (410,000) that are found on the Forest (refer to the *Vegetation – Rangelands* section). Coupled with their state and private leased acres, that number is nearly 2 ½ times the Forest's totals.

Of the total private lands owned by grazing permittees, approximately 45% provides winter range for big game species (Coupal, Roger and Taylor 2001). The resultant 498,000 of winter range on their private lands (45% of 1,107,122 acres), including

the hay and cultivated ground, give food, cover, and shelter for the state's big game animals. As a result, the private lands of these 95 ranchers are providing over four times as many acres for winter range as the Forest provides (122,008 acres).

Permittees have a shared interest with state game managers in that their use of the Forest during the summer helps provide for increased levels of forage on their deeded lands that are used by both livestock and big game in the fall and winter. A recent study found that private lands provide 72.9% of winter range for all big game species in Albany County (76% for pronghorn, 45% for bighorn sheep, 67% for elk, 76% for mule deer, and 79% for white-tailed deer) (Coupal, Steve, Lieske et al. 2002). If these values were used, the private lands of the 95 ranchers would be providing over 800,000 acres of big game winter range – nearly 7 times that available on the Forest.

Their private lands contain about 400 miles of perennial streams – an addition of about 25% to the 1,618 miles found on the Forest. With BLM-permitted lands generally being grazed in the spring and fall, and the National Forest during the summer, these lower-elevation riparian zones provide some of the most important habitat for a wide variety of wildlife species throughout the entire year.

Over the last 15 years, an average of 9% of the land base (19% in Albany County, 8% in Converse, and 14% in Platte) has been changed to non-agricultural use, including subdivision and development (University of Wyoming 1998). Frequently, ranchers selling a part of their base ranch in order to stay in business, or selling all of it to someone no longer interested in ranching, has resulted in all or a portion of the original acreages being subdivided. The immediate and inevitable result is the loss of viability of a ranching unit and the cultural way of life associated with it. Cumulatively and irreversibly lost are Wyoming's open spaces, often-unanticipated critical wildlife escape cover or wintering habitat, and public access to these lands. Each of these ranches lost to subdivision or some other type of non-agricultural use slowly and inexorably reduces Wyoming's and the West's open spaces and wildlife habitat – detracting at least partially from the reasons why an international population prefers to visit Wyoming. Additionally, lost or reduced access can add significantly to the burden of trying to properly manage expanding big game populations, often with resultant damage claims filed against the state (Coupal, Roger and Taylor 2001). For more detail, refer to the *Communities* section.

Big Game Use

The Forest Service is directed by 36 CFR 219.19 to maintain habitat for viable populations of existing native vertebrate species; estimate the effects of changes to wildlife habitat; evaluate the effects of pest and fire management; consider problems and effects of hunting, fishing, and other uses; and coordinate and consult with biologists from other agencies. Management of all herds requires a coordinated effort if rangeland vegetation objectives are to be achieved.

Currently, big game numbers are at, or exceed, state of Wyoming population objectives throughout virtually all of the Forest (Wyoming Game and Fish Department 1976-2002).

Elk herds across the Forest (and throughout the entire state – as well as adjacent states) continue to increase. The Herd Management Objective (HMO) for the Sierra Madre herd is 4,200 animals; the population was at 3,905 in the mid-1980s but now totals 6,800.

The Snowy Range herd was at 4,700 elk in 1984, but had increased to 7,685 animals by 2000. The herd objective was at 4,000 twenty years ago and was raised to 5,000 ten years later. It was raised to 6,000 animals in 2000.

The Iron Mountain herd, including the Pole Mountain area and the southern end of Laramie Peak, has increased from 325 animals twenty years ago to 2,000 elk; the Wyoming Game and Fish Department (WG&F) raised the HMO during that time from 100 to 200; it is now 1,800.

The Laramie Peak/Muddy Mountain herd of 3,800 animals has increased from 2,595 animals twenty years ago; the HMO has increased from 2,300 to 2,550 during the same time.

Table 3-176. Elk numbers and herd management objectives from 1980 to 2000.

Herd Unit	Herd Numbers		Herd Mgmt Objectives	
	1980	2000	1980	2000
Sierra Madre	3,905	6,800	4,200	4,200
Snowy Range	4,700	7,865	4,000	6,000
Iron Mountain	325	2,000	100	1,800
Laramie Peak/Muddy Mountain	2,595	3,800	2,300	2,500

In summary, elk numbers in the four Herd Units for all Medicine Bow Forest lands have grown from 11,525 to 20,285 in the last 20 years – an increase of 76%. The herds are nearly 40% above the combined Management Objectives of 14,550 animals and 59% above the desired management numbers in 1997.

Mule deer numbers for the Baggs herd units are at 18,300 (down from a high of 23,700 in the mid-1980s) and once again nearing the population objective of 18,700. For analysis purposes, since only about half of this Herd Unit involves the National Forest, each of these numbers is reduced by 50%.

The Platte Valley herd on the west side of the Snowy Range is at 17,200 animals, down from 21,500 ten years ago and 24,400 of two decades ago. The HMO has been raised from 15,000 to 20,000 in that same period.

The Sheep Mountain herd on the east side of the Snowy Range is at 13,650, down from a high of 16,575 a decade ago but above the numbers of 10,300 of 20 years ago; the HMO during the same time has been increased from 10,000 to 15,000 animals.

The objective for the Iron Mountain herd has increased from 11,600 in 1980 to 15,000; deer numbers have increased in that time from 11,600 to an all-time high of 18,400 at present. Again, because of area, only 50% of these numbers are counted.

The Laramie Peak HMO has remained constant at 14,000 animals over the last 20 years; numbers are currently at 15,220, down from a high of 19,600 in the late-1980s and up from a low of 8,350 in the early 1990s.

The South Converse herd has more than doubled from 8,000 animals to 16,530 (with a high of 18,100 a decade ago) in the last quarter of a century. The HMO has been raised from 8,000 to 12,000 to 16,000 in that same period.

The Bates Hole/Hat Six HMO has gone from 6,200 to 12,000 since 1976. Numbers have increased from 5,800 to 8,500 at present, with a high of 11,800 in 1992.

Table 3-177. Mule deer numbers and herd management objectives from 1980 to 2000.

Herd Unit	Herd Numbers		Herd Mgmt Objectives	
	1980	2000	1980	2000
Baggs	11,850	9,150	9,350	9,350
Platte Valley	24,400	17,200	15,000	20,000
Sheep Mountain[1]	10,300	13,650	10,000	15,000
Iron Mountain	5,800	9,200	5,800	7,500
Laramie Peak[2]	19,600	15,200	14,000	14,000
South Converse[3]	8,000	16,530	8,000	16,000
Bates Hole/Hat Six[4]	5,800	8,500	6,200	12,000

[1] Population high in the 1990s was 16,575.
[2] Population high in the 1990s was 19,600.
[3] Population high in the 1990s was 18,100.
[4] Population high in the 1990s was 11,800.

In summary, mule deer numbers in the seven Herd Units for all Forest lands were estimated at 80,100 twenty years ago and currently total 89,430 – an overall 12% increase over the last two decades. Numbers fluctuated considerably over that period and reached total herd lows during that period of 76,500 with the heavy snow winters of the early 1990s. Herd numbers are slightly below (5%) the current desired HMO of 93,850 but about 40% above the 1980 objective of 68,350 individuals.

White-tailed deer – Very little specific information is known of the white-tailed deer herds in the state. In addition, populations are quite mobile, and move between WG&F regions as well as neighboring states, making it difficult to get reliable and consistent counts or manage populations in some sort of Herd Unit. White-tails are increasing their numbers and expanding their ranges. Conflicts with mule deer seem to be occurring, and the more aggressive white-tails may be one factor detrimentally influencing mule deer populations.

In summary, white-tailed deer populations in the areas on and surrounding the Forest (both Southeastern and Central Wyoming) are increasing; population estimates exceed 6,000 animals and are above the Herd Management Objectives of 5,000.

Moose numbers in the Sierra Madre and Snowy Range, transplanted into the adjacent North Park area of Colorado in the early 1970s, are increasing (in excess of 100 animals) and are above the herd objective of 100 animals.

Antelope are found across the Forest except possibly in the highest elevations of the Snowy Range. Each of the 10 Herd Units include both National Forest and BLM, and private lands below. Only 50% of the Medicine Bow herd numbers are counted for use in the following table because half of the Herd Unit is in Shirley Basin. Also, because of Herd Unit location, only 50% of the Baggs herd numbers are used.

Table 3-178. Antelope numbers and herd management objectives from 1980 to 2000.

Herd Unit	Herd Numbers		Herd Mgmt Objectives	
	1980	2000	1980	2000
LaPrele/LaBonte/Boxelder	3,350	7,625	2,000	3,500
Bates Hole/Hat Six	6,000	10,420	4,000	11,500
Dwyer	2,025	4,300	2,500	4,000
Iron Mountain	7,925	21,050	8,000	13,000
Medicine Bow	16,360	16,700	22,500	22,500
Elk Mountain/Centennial/ Big Creek	13,775	17,200	11,600	19,600
Iron Springs[1]	11,600	10,300	8,000	12,000
Baggs[2]	4,375	3,850	3,600	4,500
1 Herd numbers fluctuated by as much as 15% from 1980 to 2000. 2 Population high in the late 1980s was 5,500.				

In summary, antelope numbers have fluctuated considerably during the last twenty years, often in response to severity of the winters. Antelope numbers in the ten Herd Units for all Medicine Bow Forest lands have grown from 66,550 to 91,350 in the last 20 years – an increase of 37 percent. The herds are currently 3% above the combined Management Objectives of 88,600 animals and 14% above those of 1980.

Bighorn Sheep – Bighorn sheep numbers on the Forest have increased slightly from 400 animals in 1980 to 450 in 2000; Herd Management Objectives have remained static at 1,050 animals. Status and trend for bighorns are discussed for each of the three herds on the Forest.

Domestic sheep have been known to transmit disease, notably the Pasteurella (pneumonia-like) virus, to bighorn sheep if the two species come into nose-to-nose contact; such interaction has been known to result in die-offs of small numbers to large percentages of individual bighorn herds. In general, management efforts for bighorns consist of attempting to prevent contact between the two, largely by creating distances (buffer zones) between bighorn sheep ranges and domestic sheep grazing allotments. Habitat manipulation usually involves prescribed fire to meet forage needs on a critical part of the habitat and fire or timber harvest to create travel corridors to reach desirable summer/winter ranges.

Wyoming Game and Fish is currently finalizing a state-wide comprehensive management plan for all bighorn herds in the state. Among other things, the plan assigns a priority for management for each of the herds in the state, with Priority 1 being most important and Priority 3 being the least important Management actions for Priority 1 herds include resolving conflicts with domestic sheep, allocating funds for habitat manipulation, and transplanting additional numbers. These management approaches won't be utilized for Priority 3 herds.

There are no Priority 1 herds on the Medicine Bow (they are all in the northwest portion of the state).

The Laramie Peak herd is considered a Priority 2 herd; there are no conflicts with domestic sheep since the nearest permitted sheep allotments are quite some distance away. The herd has an established Objective of 500 animals. Populations have shown a slow, mostly-steady increase from 207 animals in the mid-1980s to over 300 at present. The state would like to see additional habitat work carried out on the Laramie Peak unit (prescribed fire efforts), and the wildfires of 2002 may have assisted, to some degree, in meeting those needs.

The Encampment River herd is considered a Priority 3 herd. No habitat work or funding will be expended, and no transplant numbers will be added. The herd, reintroduced almost a quarter of a century ago, has remained about steady at 50 animals for about 25 years, despite the fact that both the summer and winter bighorn range is surrounded by and overlapped with all or parts of 7 sheep allotments. In addition, domestic sheep operations occur on surrounding private lands as well.

The Douglas Creek herd on the west side of the Snowy Range, with an established Objective of 350 animals, has shown a slow, mostly-steady decrease from 143 animals in the mid-1980s to about 100 today. The animals were also reintroduced into the area about 25 years ago. The Douglas Creek herd is also considered a Priority 3 herd. All 8 domestic sheep allotments on the Snowy Range are currently vacant (the last ones were used in 1997). There is some domestic sheep use off the

Forest and adjacent to crucial range along the North Platte corridor. There are occasional sighting reports of individual bighorn rams on the Medicine Bow Peak area of the Snowies, but there are generally poor opportunities for animals to move to higher elevations because of dense timber stands. Wyoming Game and Fish Department reports mention that habitat improvement would entail the cutting or burning corridor routes if the bighorn sheep are to be able to move outside the current limited range; they also state additional burning is needed on winter range in the Douglas Creek and Bennett Peak areas.

Summary of Existing Condition of Big Game Use: Elk, mule deer, white-tailed deer, moose, and antelope are all increasing in numbers; all big game species on the Medicine Bow National Forest, as well as throughout all of Wyoming, have larger populations now than they did twenty years ago.

Elk and white-tailed deer are showing significant increases and are above the planned objectives in every area. Some species – elk in particular – may be higher in numbers than ever before.

About half of the herds are above HMO, and half below, for mule deer and antelope; collectively, deer are at 95% of HMO and antelope are at 103%. Had HMOs not been raised by over 40% during the last twenty years for both species, they would also show significant increases above planned levels. In most cases, HMOs have been adjusted higher over the last 20 years. Higher big game herd numbers have the potential to create a conflict with livestock management goals, which are controlled based on achieving, or not achieving, desired vegetation conditions.

Wyoming Game and Fish Objectives are numbers set based on public demands and tolerances, which can be very different from the carrying capacity of the land. Their biologists have a very difficult and complex responsibility in trying to manage big game herds. Some of the complications include:

- The general hunting population is aging, and fewer people are taking up hunting
- Demands for the type and length of hunting experience have changed, including a change in the type of equipment used
- Desire for trophy hunting has replaced a lot of subsistence hunting, with resultant increases in numbers and with changes in herd age and sex ratios
- Access – or lack of access – on both public and private lands; access fees being charged by some private landowners
- Damage payments
- Season lengths and types
- Hunter success
- Opposition to hunting in general
- Politics and coordination
- Agency funding opportunities are limited primarily (or totally) to license sales

Despite these complications, the Forest Service remains responsible for managing the rangeland vegetation to meet desired conditions, and coordination/cooperation with Wyoming Game and Fish is absolutely essential to assure that such management adheres to the capability of the land for both wild and domestic ungulates. The challenge is to maintain big game herds at desired capacities through hunting rather than through starvation or disease.

When private lands are subdivided and developed, access problems (including for hunters) almost invariably become more complicated, herd movements and corridors may be impacted, and populations may increase even more with this reduced ability to manage them.

A shift away from ranching or farming practices, including reduction or elimination of grazing on public lands, can affect wildlife grazing and migratory patterns of elk, deer, and antelope; without federal grazing permits, private rangelands would likely be used more extensively for domestic livestock operations, providing less forage and cover for wildlife, particularly during critical winter periods. Large tracts of open rangelands provide reliable wildlife habitat. Consolidation of ranching operations and creation of private hunting and fishing opportunities often result in private ranch roads being closed, eliminating historically used access to traditional hunting and fishing areas on NFS lands. Subdividing open rangelands into "ranchettes" often results in the loss of access to traditional use lands (University of Wyoming 1998) and lands being closed to all forms of public use and access, including hunting and fishing.

ENVIRONMENTAL CONSEQUENCES

Livestock Grazing

General Effects

There are 104 active grazing allotments (containing 995,877 National Forest System lands) on the Forest; an additional 15 allotments (containing 46,099 NFS acres) are currently vacant. Another 53,162 acres of NFS lands are outside the boundaries of any kind of allotment. Ninety-nine percent of the National Forest System acres on the Forest that are grazed by livestock are in satisfactory condition and are meeting or moving toward desired vegetative condition.

Permitted cattle numbers (16,000) have remained stable over the last 20 years, but use has declined by 10% to 56,000 HMs (74,000 AUMs). Permitted sheep numbers (20,000) have decreased by 50% over the last 20 years, and use has declined by about 40% to 42,000 HMs (12,600 AUMs). Livestock operators on the Forest have declined by 20% in that same time period. Recreational horse use continues to show a steady increase; projections are for it to increase by about 8 to 10% each decade.

Alternatives A, B, C, D DEIS, D FEIS, and E maintain existing conditions and livestock use levels.

Alternative F reduces livestock use by 25%. An additional seven allotments could become vacant. Average forage utilization levels across the landscape (uplands as well as riparian zones) will decrease by about 10% from current levels. Vegetation is managed to maintain a total of 70% of the vegetation in mid to late seral condition.

Implementation of each alternative, and its associated standards and guidelines, will result in approximately the above amounts of permitted use, but this is only an estimate for alternative comparison purposes. Actual permitted grazing levels are an outcome of the standards and guidelines, objectives, and management area guidance, and are not an objective or goal in their own right.

Livestock Grazing Permittee Operations and Resultant Open Space:

The following assumptions were used in discussing effects associated with management decisions on the Forest and how they may relate to open space on permittee-associated private lands:

1) If a livestock grazing permittee loses his/her grazing permit on the National Forest lands that provide the summer part of their year-round operations, the operator will first attempt to locate other summer range to replace that lost.

2) The source for replacement will likely be private lands below the Forest owned by other ranchers – most or all of whom do not hold federal grazing permits – and within a reasonable driving or trucking distance from the base ranch. Such lands are seldom available since they themselves conduct livestock operations on their owned deeded lands on a year-round basis.

If the permittee is able to locate such available lands and negotiate a long-term lease for their use, he/she will be able to continue the established operation without use of National Forest land.

3) If the permittee is unable to locate available private lands – and such is usually the case – the operator will not likely reduce the size of their operation. Such a decision amounts to voluntarily deciding to reduce available income, existing profit margin, and their desired way/quality of life – a decision that few people willingly embrace and adopt.

4) Selling a portion of the base ranch too often becomes the next logical step in order to replace the annual income lost from a reduction of operation size. If that sale happens to be to an adjoining rancher, open spaces are maintained; if circumstances require a higher level of cash flow, and the land is sold for the purpose of development, then open spaces are lost.

Based upon the actual 9% conversion of private lands to non-agricultural uses from 1982 to 1997 in the counties surrounding the Forest, and projected rates of at least the same amount over the next 10-15 years, a loss of available summer range for

some of the 95 grazing permit holders could place a similar percentage of the 1,107,000 acres owned by them in jeopardy of subdivision or development.

Maintaining current levels of grazing, as in Alternatives A, B, C, D DEIS, D FEIS, and E, will likely keep all existing permittees in business and arrest all or a part of the current land conversion rate (from those 95 operators anyway).

Alternative F projects a potential reduction of approximately 25% of livestock numbers and AUMs. If this loss would result in 25% or more of the permits being eliminated, and if these ranchers were not able to find other lands on which to run their livestock, which is likely, then they may be forced to sell part of their lands to keep their operations viable (although smaller) on the remaining acres. Accordingly, Alternative F could potentially result in an estimate of 275,000 acres of private lands being lost to development or subdivisions. Possibly as much as 100 miles of perennial riparian areas could be included in the development areas as these are generally prime sites. Between 125,000 and 200,000 acres of big game winter range could be fragmented or lost as the wide-open spaces are reduced.

Direct and Indirect Effects

Effects from Fire and Fuels Management

General fire effects depend upon the burning conditions at the time (severity) and whether it was a controlled burn or a wildfire (less predictable results from wildfire).

Livestock grazing systems are generally managed so that the pasture(s) to be burned are rested in advance for one growing season, sometimes two, to guarantee adequate fine fuels (residual grass) are left to help carry the fire. They are often rested following the burn to allow for vegetative recovery. This is an impact to the established grazing system and to the permittee's operation. Coordination is absolutely essential, and flexibility in the system is mandatory, to achieve the right conditions, especially if it requires complete removal from pastures and cooperation in the use of other or adjacent allotments. It is a substantial impact to the permittee's livestock operation, and the other pastures in the allotment, if the planned prescribed fire does not take place on schedule due to missing the burning "window," loss of necessary budgets, or failure to complete NEPA (including the appeal period) on schedule.

It has been general policy for quite some time to defer grazing use for two growing seasons following a fire to allow the vegetation to reseed and reestablish; time is flexible and can be decreased or increased depending upon the amount of moisture following the burn and when it was received. This, likewise, is an impact to the permittee's grazing operation and to the balance of the allotment, and careful coordination is required. Recent fire effects studies (Perryman and Laycock 2000) indicate that the amount of deferment should be coordinated with the post-fire vegetation condition desired; for example, if more forbs are needed in that area of the landscape (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 or eliminate the forbs from the vegetative composition).

In general, the greater the use of prescribed fire, the greater the impact on grazing operations and on the associated private lands. The use of prescribed fire for fuels treatment and vegetative management is greatest in Alternatives D DEIS and D FEIS, followed by Alternatives E, B, and C. It is only slightly less than current levels in Alternative F.

The effects of wildfire are often greater than those from prescribed burning. Entire pastures or allotments can be burned. Livestock may have to be completely removed (sometimes even to avoid being caught in the fire) and grazing deferred. This impacts all other lands in the rancher's operations—private, state, and BLM. If fences are burned, grazing systems must be modified until the they be replaced – which can be at the expense of the grazing permittee as well as the Forest Service.

Effects from Recreation Management

One of the most common effects from recreation visitors occurs when fences cross roads and trails; travelers stop to open gates and then sometimes drive on without closing them. This allows cattle to drift into pastures or allotments where they are not allowed to be and often results in unplanned vegetation use that can exceed allowed levels. It requires constant vigilance from the ranchers and a rapid, and sometimes repeated, change in plans to ride and gather up the livestock and move them back to the proper area. In some cases, cattleguards can be placed across the road, but materials and installation can exceed $3,000 for each and the cost is borne by the permittee and the Forest Service – not the public leaving the gates open.

Concentrated or frequent recreation use along roads or near popular use areas can cause cattle or sheep to scatter. Rounding livestock up, particularly if they go through fences, can be a costly and time-consuming result for the ranchers. Some people become more impatient these days when encountering livestock on a roadway, not realizing that slowly moving forward through the cattle or sheep (regardless of which direction they are being driven) gets them through fairly rapidly with virtually no impact to the animals; going rapidly can scatter or injure cattle or sheep or even damage the vehicle, and creates considerable work for the ranchers, if not a direct loss of animals. Cattle are sometimes shot during hunting seasons, resulting in a direct economic loss to the permittee.

Summer home owners sometimes become concerned with livestock in and around their cabin permit areas. In such instances, Forest employees can work with both permit holders to determine if solutions can be derived. Owners of private land inholdings occasionally likewise become concerned with livestock use in the area and will contact the Forest Service for assistance. Often these landowners are unaware that Wyoming is a fence-out state, which means that the private landowner is required to fence the livestock out—not the other way around. In some cases, it is

easier or more economical for the landowner to arrange to lease the land to the rancher for grazing privileges rather than to incur the expense of constructing long sections of fence to prevent livestock from entering upon his/her private land.

Guard dogs (like Great Pyrenees, for example) are used by some ranchers to protect the band of sheep. The dogs' duty is to protect the sheep from predators—and other intruders—and they have proven highly successful. People recreating in the area may experience encounters with the dog if they wander too close to the sheep.

Many recreationists, especially non-local and foreign visitors, like seeing a band of sheep in the distance or cattle being herded across a meadow. Other people do not like the effects of livestock grazing—the sounds, smells, excrement, and flies that are attracted to herds, etc. For more detailed information, refer to the Effects from Livestock Grazing section below.

Higher levels of summer recreation motorized use create increased levels of potential conflicts with livestock use. The levels of recreational opportunities, from highest to lowest, are Alternatives B, A, C, E, D FEIS, D DEIS, with F last.

Effects from Special Area Allocations (RNAs, SIAs, Wild and Scenic Rivers)

In some cases, but not all, creation of special areas may result in the cessation of livestock grazing in the area; some areas may require the removal of livestock, but, in many cases, prior uses are honored as a compromise or condition of achieving the designation. In addition, the use of grazing as a management tool, on an incidental or infrequent basis, may be needed to achieve rangeland vegetation management objectives over all or a part of the area. In each case, the management plan for the special area is designed to detail the level of livestock use in the area.

The alternatives with the highest allocations of Special Interest Areas present the greatest potential for change to domestic livestock uses. The alternatives, with highest to lowest numbers/acreages of Special Area Allocations are Alternatives E and F, followed by D DEIS, D FEIS, B, C, and A.

Effects from Travel Management

Forest roads and trails are used by grazing permittees to conduct their management operations, as they are by countless other Forest visitors and permit holders for a myriad of uses. Closing Forest roads to motorized access can impact permittees by requiring them to perform the activities by horse or on foot that they previously performed with four-wheelers or other vehicles. In some cases, the travel restrictions can be accommodated into the livestock grazing system with little or no problem. In others, such as maintaining water sources, major reconstruction of fences, or occasional operations such as doctoring cattle, the permittee may be provided with permission for entry into a closed area to perform the needed/required activities.

Higher levels of restrictions on motorized use create increased levels of potential conflicts with livestock use. The alternatives with travel restrictions, from highest to

lowest, are Alternatives F, D DEIS, D FEIS, C, E, B, and A. Although potential conflicts may vary by Management Area, Forest-wide Standard 1 under Infrastructure – Travelways provides for granting administrative access to the permittees under such conditions.

Effects from Facilities Maintenance

See the effects from Travel Management and Recreation above. Maintained roads provide for greater ease of access and management for livestock operators and generally decrease the costs of managing and moving livestock. Maintained roads also provide for greater access by all members of the public and can occasionally create conflicts with livestock and livestock operations. Alternatives D DEIS, D FEIS, E, and F provide for the highest percentage of roads maintained annually, followed by equal, but lower, percentages in A, B, and C.

Effects from Wilderness Management

Livestock grazing is allowed by law to continue in proclaimed wilderness areas, providing that grazing was an on-going use at the time the wilderness was designated. While some people believe that the two uses are in conflict or not compatible, the Wilderness Act of 1964 was passed with the endorsement of the livestock industry at the national level at that time, which was made possible with this concession and stipulation and agreed upon by the involved interests. This position was reaffirmed with the Congressional Grazing Guidelines referenced in Section 108 of the Colorado Wilderness Act of 1980. However, general management restrictions are applied to grazing in wilderness areas for stocking levels, number and type of improvements and their maintenance, use of motorized equipment, and emergency situations.

The higher the acreages of wilderness, the higher the number of acres on which general management restrictions for livestock use may be applied. All alternatives retain all of the existing wilderness areas. See the Roadless Area Management section immediately following for a discussion regarding proposed wilderness areas.

Effects from Roadless Area Management

The effects are very similar to those for Travel Management (see above). The higher the acreages of roadless areas and areas with non-motorized summer use allowed, the greater the potential for impacts to livestock grazing operations. Alternative E has the highest acreage of roadless areas and non-motorized summer use, followed by D DEIS, D FEIS, F, C, B, and A.

Effects from Big Game Use

Holders of grazing permits are required to adhere to all terms and conditions listed in the permit, applicable state laws, the requirements set forth in the allotment management plan (AMP), and the operating instructions annually brought forth from

the AMP in order to assure that desired vegetative conditions on the allotment are being achieved. Livestock grazing is one of the many multiple uses and values of the National Forests (where management is designed by law to conserve natural resources, and different than National Parks where management is designed to preserve natural resources). Livestock grazing is one of the tools that can be effectively and efficiently used to meet the wide range of landscape vegetative diversity. However, failure to meet all permit and management requirements can and does result in action taken against the permit – a temporary reduction in numbers and/or seasons, suspension, or even cancellation of the permit. As has been repeatedly determined by the courts, a grazing permit is a privilege, not a right, and the grazing permittees must adhere to permit requirements and work diligently to help achieve desired land use objectives in order to retain these privileges.

Big game grazing/browsing is generally compatible with livestock grazing/browsing. For a more detailed discussion, see the *Vegetation -- Rangelands* section and the discussion in the Big Game section below for *Livestock Grazing and Big Game Use*. There is a large dietary overlap (40-80%) between elk and cattle (Kufeld 1973a); there is a similar, though smaller, dietary overlap between sheep and antelope and deer (Kufeld, Wallmo et al. 1973b). Problems can arise if big game and/or livestock numbers are higher than the capability of the land to produce the annual forage required for those numbers (and leaving desired residual vegetation). Livestock numbers are the lowest they've been in over a century. Big game numbers are probably the highest now that they've been at any time during that same period, and they are continuing to increase.

While Forest-wide, rangelands are in satisfactory condition, localized impacts to rangelands, particularly shrublands and aspen stands, have been observed by Forest Service personnel. This has raised concerns about whether elk population levels are at or above the capacity of the land to meet desired conditions.

The Rock Creek big game exclosure (in place for 30 years) and the Six-Mile exclosure (since 1954) document the differences in shrub use when big game animals are excluded. Utilization cages installed in Teddy Creek Meadows six years ago display heavy shrub utilization by elk. The Crow Creek livestock exclosures on Pole Mountain show aspen hedging by big game, and heavy browsing of aspen by elk is evident on Hartt Creek and on Battle Mountain in the Sierra Madres.

There have been localized observations of elk overutilizing the winter/spring ranges in several areas on and adjacent to the Forest. Heavy utilization of willow by big game in the spring has been documented in the upper reaches of the North Fork of the Little Laramie River, Trail Creek, upper Wagonhound Creek, and upper Bow River. Similar recurring heavy willow utilization is evident in Sawmill Park, Stanley Park, Cecil Park, and East Fork Meadows. This overuse not only takes a portion of the forage allocated to livestock within those localized areas, it can and does result in a change in species composition and possibly a downward and undesirable trend in rangeland vegetation condition within those localized areas. Herd numbers may

need to be reduced in some areas, and Wyoming Game and Fish personnel are working to do so through use of such means as increased lengths and numbers of seasons, numbers of licenses issued, and expanded use of cow tags.

Elk/livestock conflicts, populations, and depredation on private lands have become major issues across the West in the last decade or more – it is not just a Wyoming or Medicine Bow National Forest concern. The Medicine Bow/Routt rangeland management cadre has discussed elk/livestock conflicts four times in the last three years, and have held fields trips during the last two years to look at examples of aspen and shrubland overutilization by elk. The Wyoming Stockgrowers have had the subjects of elk utilization and elk/livestock conflicts on their semi-annual conference agendas since June of 1995.

The Wyoming Rangeland Service Team (made up of rangeland management staff from each Forest in the state, but also having BLM, NRCS, WDA, and WG&F representatives) first began addressing the issue on May 8, 1996 and have addressed the issues and possible solutions at least annually since then. One or more members of the group have met on four separate occasions with the Director of WG&F and his Regional staff, the state and regional terrestrial biologists, employees responsible for reviewing planning documents, and once with members of the Commission to discuss the issue. Forest wildlife biologists have begun attending Wyoming Rangeland Service Team meetings to provide their expertise in developing solutions.

On June 3 and August 21 of 2003, the R-2 USFS Director for Renewable Resources, the WG&F Director, the Director of the Wyoming Department of Agriculture, and the Wyoming BLM Director, and their staffs, met to discuss this issue and develop sets of action items to work toward resolution.

Livestock numbers and use have historically and consistently been reduced when their utilization is preventing attainment of desired vegetative conditions; such reductions will no longer take place if it is determined that livestock are meeting vegetation utilization standards but big game populations exceed management objectives and desired utilization levels. There is adequate summer range across the Forest for all existing ungulate numbers; conflicts usually arise on the spring, fall, and winter ranges.

Northeastern Oregon's Bridge Creek Wildlife Management Area conclusively shows the necessity for having judicious cattle grazing as a component of a successful elk winter range. With no cattle grazing, all forage is reserved for elk; however, elk numbers then decline because forage quality is low (the elk move to other areas with higher quality forage). Elk winter ranges can become overstocked with elk in relation to the forage supply, and in this case no amount of adjustment or management in cattle grazing alone is likely to provide the feed supply required by the elk. Control of elk numbers may be required. Wildlife, like livestock, have maximum population potentials based on habitat sustainability and health (Anderson and Scherzinger 1974).

A three-year study in northwestern Wyoming found that elk preferentially selected feeding sites where forage residue was reduced by summer cattle grazing; they avoided ungrazed sites in all three seasons. In the winter and spring, elk preferentially selected feeding sites with moderate amounts of forage residue – the condition corresponding to areas which were moderately grazed by cattle the preceding summer. Cattle use increases the leaf/stem ratio of cured forage for winter use and increases elk access to new spring growth. Elk respond to forage conditions that are mediated by summer cattle grazing; moderate summer cattle grazing is a viable tool to enhance foraging opportunities for elk during critical winter and spring seasons (Crane 2002).

Based upon the general alternative direction, big game numbers can be expected to be highest in those alternatives that favor a balanced and diverse mix of values and uses. Alternative A is currently providing for very high numbers, as should Alternatives B and C. Alternatives D DEIS, D FEIS, and E should provide for moderate big game populations, while Alternative F may, over time, provide for less vegetative diversity for big game food and cover.

Effects from Mineral and Energy Development

There are generally minimal effects to overall livestock operations. Increased mineral development can create additional road systems and increased travel which can scatter livestock. Increased road construction can require installation of additional cattleguards, but these are usually paid for by the mineral company. The operations sites are frequently fenced, which reduces conflicts with livestock.

Potential for impacts, although minimal, is highest with the alternatives with the highest acreages available for oil and gas leasing: Alternative B, then C, D FEIS, D DEIS, E, and F. Alternative A currently does not provide for oil and gas leasing.

Effects from Rangeland Vegetation Management

Livestock grazing, properly conducted, creates a wide diversity of vegetative conditions across the landscape: a small amount in early seral, a greater amount in late seral, and the majority of acres in mid seral (for more detailed information, refer to the *Vegetation -- Rangelands* section). Alternatives that attempt to move large amounts of vegetation into either extreme of the range of conditions will have the greatest impact on livestock operations on the Forest and the greatest potential for negative effects on the associated owned private lands of the grazing permittees. Alternative F has the greatest impact, followed by Alternatives E, and D DEIS and D FEIS. Alternatives C, A, and B provide for more balanced mixes of vegetation.

Alternative F has the greatest potential to create subdivisions on private land below the Forest, reduce wide open spaces and big game winter range, and impact private land riparian zones because of its intent to eliminate 25% of all livestock grazing and manage increasing levels of vegetation for late seral condition. Alternative B could result in positive effects.

Effects from Forest Vegetation Management

Timber harvesting provides increased forage that can be made available for livestock and wildlife use. As timber is harvested, it often opens areas to livestock that were not available before; that sometimes requires the construction of short drift fences (at the expense of the timber program) to control cattle movements and assure they remain in permitted allotment areas. Generally, AUMs are not expected to increase because this is transitory range that is gradually reduced (over 15-25 years) as the forested cover types once again close in and eliminate under-canopy forage; however, the newly available areas can and do improve or increase grazing distribution from other areas and assist in meeting desired vegetation conditions across the landscape.

The greatest amounts of transitory range would be created in Alternative B, followed by D DEIS, C, A, D FEIS, E, and F.

Effects from Land Exchanges

Any effects are largely independent of the range of alternatives. They are usually confined to a loss of existing improvements (fences, water developments) that are on the offered lands and a gain of similar improvements, if there are any, on the acquired lands. Costs to construct needed replacements are seldom borne by the lands program, but are instead the expense of the permittee and the rangelands management program. Changes brought about in land ownership pattern require a change in allotment boundaries and often in livestock management systems as well.

Effects from Wildlife and Fisheries Management

Allowable forage utilization guidelines set forth in the standards and guidelines are specifically designed to meet desired riparian area vegetative conditions and associated fisheries habitat needs.

Management requirements to meet habitat needs for wildlife can have significant effects on livestock grazing operations, such as avoiding raptor nest sites/trees during the nesting seasons which run from before the earliest of livestock entry dates through late August. Managing to leave more residual forage for late seral habitat needs can be more of an effect or translate to fewer AUMs.

In general, managing for the needs of most fish and wildlife species is addressed through standards and guidelines and is independent of alternative selection. Following prescribed management is essential to assure desired residual grass and shrub vegetation needs are met for wildlife and fish habitat.

Effects from Threatened/Endangered/Sensitive Species Management

Management of threatened, endangered, and sensitive (TES) species will have a consistent effect on rangeland vegetation for all alternatives. In general, the habitat requirements in and around each known or discovered TES species location will be

protected, restored, or enhanced. This may require changes in management and grazing systems, some of which may be substantial; allowable forage consumption may also be affected. Conservation strategies, plans for critical habitat delineations, and biological opinions generally spell out specific management requirements. In general, habitat management needs for most listed species place additional operating restrictions upon livestock management operations (which often increase the overall expenses of conducting the operations) and often require reduced levels of grazing.

Effects from Species Viability Management Requirements

In general, management of rangeland vegetation to meet the needs of species will be consistent across all alternatives. However, managing for a mixture of seral stages across landscapes provides for the greatest diversity since plant, animal, and fish species have habitat needs in the full spectrum of seral stages. Managing for a mixture of all stages is most compatible with livestock grazing practices on the Forest and with uses of the associated private lands down below. Alternatives A, B, and C provide for the greatest diversity in seral stages; Alternatives D DEIS, D FEIS, E, and F provide for a moderate mixture of seral stages.

Effects from Soil and Watershed Management

Soil and watershed restoration or improvement projects are designed to improve condition of the land—in essence to move seral stage upward. Though not specifically related to grazing, the greatest number of soil and water improvements is planned in Alternative B, followed by C, D DEIS, D FEIS, E, and A; F plans the least. Alternatives E and F plan the greatest amount of stream or riparian restoration, then D DEIS and D FEIS, A and C; and B plans the least.

Cumulative Effects

Currently, about 54% of all vegetation is providing for a diversity of age classes – early and mid seral conditions across the Forest, and about 46% has achieved late seral status. Of the 410,000 acres of primary rangelands, about 99% of these acres are in satisfactory condition. The vast majority of the rangelands on the Forest are already in mid to late seral condition and with a steady or improving trend.

More than half of the ranchers that hold Forest Service grazing permits also hold BLM grazing permits. Many of their private lands also contain small isolated tracts of BLM lands in the midst of their private holdings as well (Section 15 lease lands), adding to the complexity of management. A majority of these operators have all three types of land ownership (and may have leased State lands and/or other leased private land as well) intermingled in their year-round livestock operations. A change in land use, livestock management, seasons, or numbers on <u>any</u> ownership influences <u>all</u> the other lands and their resultant vegetation.

There is a subtle dependency between private and public land. Residents interviewed said being able to maintain grazing activities on public lands is essential

to maintaining the "family farm" which is the cornerstone for "close-knit, stable communities" (University of Wyoming 1998). Over the 15-year period from 1992-1997, more than 3.2 million acres of rangeland across the West were converted to developed land – condos and ranchettes (USDA Natural Resources Conservation Service No date) Across Wyoming, there are 2.6 million acres of prime ranchland at risk of completely disappearing within 20 years (American Farmland Trust 2002).

Based upon the actual 9% conversion of private lands to non-agricultural uses from 1982 to 1997 in the counties surrounding the Forest, and 101,500 acres across Wyoming (USDA Natural Resources Conservation Service 1997) and anticipated and projected rates of at least the same amount over the next 10-15 years, a loss of any/all of the 95 Forest Service grazing permits places a similar percentage of the 1,107,000 acres owned by those permit holders in jeopardy of subdivision or development. Access to public lands, the ability to enjoy wide-open spaces, and a change of a preferred way of life for all residents and visitors are at risk (University of Wyoming 1998).

Subdivision of ranches into developments causes an increase in free-ranging dog and cat populations (with a resultant increased predation on small mammals and songbirds and even some larger mammals like deer fawns), vehicular traffic, illumination from yard lights, non-native plants, and numbers of people, each of which creates disturbance zones around houses and roads that can diminish wildlife populations (Mitchell, Knight et al. 2002).

As ranchers are forced to sell, the winter range for wildlife is being fragmented and lost. The net effect is lost habitat needed to maintain viable populations of native wildlife. Large ungulates are just one example. As ranches turn into ranchettes and rural subdivisions erupt across the West, many native species are declining and being replaced by species adapted to human habitation: lark buntings and bobcats by starlings and skunks, rattlesnakes and warblers by garter snakes and robins. Most Americans want to conserve native species and our western wildlife; keeping private ranchlands in ranch family hands and out of developers' plans is the single greatest environmental contribution to achieve that (Rey 2002).

Alternatives B, C, D DEIS, D FEIS, and E would maintain rangeland vegetation very similar to the present and retain existing permitted livestock use levels. Maintaining current levels of grazing, as in Alternative A, will likely keep all existing permittees in business and arrest all or a part of the current land conversion rate (from those 95 operators anyway).

Alternative F will increase the amount of late succession vegetation by 24%; livestock grazing will be reduced by approximately 25% correspondingly. It could result in 25% of the ranchers losing their permits, possibly even more. Assuming the minimum, 275,000 private rangeland acres, 125,000-200,000 winter range acres, and 100 miles of prime stream bottom could be lost to development on their private lands below the Forest.

State hunting policies and current herd management objectives can be considered constant across all alternatives; however, population levels that may vary as a result of implementing the various alternatives have cumulative effects on both the National Forest lands and the private lands below and adjacent to the Forest.

Big Game Use

General Effects

Elk, mule deer, white-tailed deer, moose, and antelope are all increasing in numbers. Big game species on the Medicine Bow National Forest, and throughout Wyoming, have larger populations now than they did 20 years ago.

Elk and white-tailed deer are showing significant increases and are above the planned objectives in every area. Elk numbers have increased by 76% in the last 20 years. The herds are nearly 40% above the combined Herd Management Objectives (HMOs)of 14,550 animals and 59% above the 1997 desired herd numbers.

As of 2000, mule deer are at 95% of HMO (slightly below) and antelope are at 103% (slightly above). Had HMOs not been raised by over 40% during the last twenty years for both species, their populations would also be significantly greater than planned levels; numbers currently are respectively 40% and 14% higher than the populations of 20 years ago.

Over the last 20 years, all big game species have increased their populations—some quite significantly. During the same time, sheep use has gone down 40% and cattle been reduced by 10%. If we can assume an inverse relationship, the best alternative for forage availability for big game populations is Alternative F, which reduces livestock use. Alternatives A, B, C, D DEIS, D FEIS, and E retain livestock grazing at current levels.

This assumption and this array of alternatives is good for big game populations, but it may not necessarily be equally beneficial for big game habitat. All big game populations, with the exception of some of the bighorn sheep herds, are at high levels. Reducing livestock numbers will not necessarily eliminate localized impacts to the habitat if big game numbers increase.

Reducing permits for livestock use on the public lands above to resolve impacts to rangelands from ungulate overutilization can reduce primary big game winter range on the private lands below through development. The Forest will continue to work with Wyoming Game and Fish personnel to find solutions where concerns about elk numbers and rangeland conditions arise. Personnel from both agencies acknowledge they need for increased cooperation and coordination to assure that the habitat and allowable numbers are at levels needed to meet desired vegetation conditions on all land ownerships.

Direct and Indirect Effects

Effects from Fire Management

General fire effects depend upon the burning conditions at the time (severity) and whether it was a controlled burn or a wildfire (less predictable results with wildfire).

Prescribed fire use on big game winter ranges is usually designed to create or improve the mosaic of vegetative conditions across the area, to retard succession, and to invigorate the existing plant species. Most shrubs are rejuvenated by fire (e.g., bitterbrush, mountain-mahogany, serviceberry and chokecherry, Gambel's oak, sumac, currant) and sprout profusely (sagebrush is the exception). Aspen likewise are affected and may sprout hundreds or even thousands of new young trees for each one present before the fire. Grasses are also rejuvenated, and many species become more palatable. Elk and other big game usually congregate on burned areas as soon as any moisture is received and green-up and resprouting begins to take place.

In general, the greater the use of prescribed fire, the greater the beneficial effects for big game habitat, particularly on winter ranges (but vegetation is set back to an earlier seral stage). The use of prescribed fire for fuels treatment and vegetative management is greatest in Alternatives D DEIS and D FEIS, followed by E, B, and C. It is only slightly less than current levels in Alternative F.

Effects from Recreation Management

In general, most big game animals will tend to move away from people to a perceived "safe" distance. Higher levels of summer recreation motorized use can create increased levels of possible conflicts with big game animals. In addition, hunters and their motorized vehicle use causes big game animals to move, often down onto private lands to avoid contact. The levels of recreational opportunities and motorized use, from highest to lowest, are Alternatives B, A, C, E, D FEIS, and D DEIS; Alternative F is last.

Contacts with humans during the winter, especially in years of deep snow on the winter ranges, can increase mortality. Animals weakened from less food and from their efforts to move through the snow can be stressed to the point of exhaustion and death from human contact or presence. The levels of winter recreation motorized use, with a possibility of increased big game contact and conflict, from highest to lowest are Alternatives A, B, C, E, D FEIS, D DEIS, and F.

Effects from Special Area Allocations (RNAs, SIAs, Wild and Scenic Rivers)

Special area designations may tend to create additional areas of cover and seclusion for big game animals, assuming that human presence in the area is maintained or reduced over time. Although the magnitude of the effect is probably quite small, the alternatives with the highest allocations of Special Interest Areas present the greatest potential for benefits to big game. With highest to lowest numbers/acreages of Special Area Allocations, the alternatives are E and F, D FEIS, D DEIS, B, C, and A.

Effects from Travel Management

Long-standing thought has been that road densities inversely affect big game populations (especially elk); the more roads, the more the animals are impacted. An equal belief, but less quoted, has been that the number of daily trips on a road, rather than the road itself, is more influential in moving big game away from human activity—the higher the use, the more the animals tend to move some distance away. The latter may tend to hold true on the Medicine Bow National Forest since road densities have increased over the last 25 years, but so have big game populations, and elk numbers have increased substantially.

Assuming that big game populations are positively influenced with a reduction in the miles of roads on the Forest, the alternatives with the highest number of miles planned for decommissioning are F and then E. All other alternatives have constant miles planned for decommissioning.

Effects from Facilities Maintenance

See the effects from Travel Management above. Assuming that big game populations are adversely affected by the number of open roads, including the activities associated with maintaining of those roads, and that reduced road maintenance discourages recreational use, Alternatives D DEIS, D FEIS, E, and F provide for the highest percentage of roads maintained annually, followed by equal, but lower, percentages in A, B, and C.

Effects from Wilderness Management

Effects are similar to those for Special Area Allocations, discussed above, except that a larger number of acres is provided for in wilderness areas versus SIAs. Alternative F has the highest amount of existing and proposed wilderness acreage combined, followed by D DEIS, D FEIS, and E. All the remaining alternatives have equal amounts – 7% of the Forest – retaining all existing wilderness areas only.

Effects from Roadless Area Management

Refer to Special Area Allocations and Wilderness Management discussions above.

Effects from Mineral and Energy Development

Additional road construction and operating facilities associated with mineral development can change patterns and timing of use by big game. If development areas are large enough, they could potentially change long-term big game use or migrational patterns in that area. Potential for impacts, although minimal, is highest with the alternatives with the highest acreages available for oil and gas leasing: Alternative B, then C, D FEIS, D DEIS, E, and F. Alternative A currently does not provide for oil and gas leasing.

Effects from Livestock Grazing

Livestock grazing/browsing is generally compatible with big game grazing/browsing, especially when the designed forage utilization levels are achieved. Livestock water developments also provide water sources for wildlife populations. Fences are constructed to standards designed to provide passage over and/or under them by big game animals. For more detail, see this topic in the Livestock Grazing section above and the *Vegetation—Rangelands* section.

Hunting seasons are the time when big game animals become the most elusive and wary. Higher human presence between September 1 and early November tends to make the animals scarce and seldom-seen. Increased and focused hunting activity has a tendency to make entire herds migrate, often in just a matter of hours or a few days, from the Forest to the "safer" private lands below. This can result in a much-reduced hunter success ratio and can also result in increased depredation payments by the state to affected landowners, particularly with elk. During a severe winter, a low number of successful hunters can result in an increased number of animals that die of stress or starvation on the winter ranges.

Since forage on summer ranges is seldom the limiting factor in determining big game populations, increasing big game populations may lead to increased monies paid out by the state for depredation damages and, potentially, to instances of herd starvation and die-offs on the winter ranges. A change in managing toward smaller herd sizes commensurate with the capacity of the winter ranges, coupled with continued expected hunter success rates, will reduce both of these effects. The Wyoming Game and Fish Department and the Forest Service will continue to cooperate on efforts to achieve appropriate population levels through herd management.

Based upon the general alternative direction, big game numbers can be expected to be highest in those alternatives that favor a balanced and diverse mix of values and uses. Alternative A is currently providing for very high numbers, as should Alternatives B and C. Alternatives D DEIS, D FEIS, and E should provide for moderate big game populations, while Alternative F may increase populations in the short run but, over time, provide for less vegetative diversity for big game food and cover. Herd sizes are often determined primarily by hunting management.

There are no changes planned for domestic sheep operations in Alternatives A, B, C, D DEIS, D FEIS, and E for at least the Laramie Peak and Sierra Madre ranges. Flexibility can be maintained for allotments on the Snowy Range, which could currently be used as forage reserves – as swing pastures, for example, in years of drought or to temporarily alleviate other allotments from the effects of wildfire or prescribed fire. Other options exist, if management ever opened up corridors in the French Creek watershed to allow expansion of existing bighorn range to the north, to avoid domestic sheep use in certain desired areas, or to allow cattle use on portions of allotments provided they were required to be herded to meet vegetation objectives.

Alternative F proposes to phase out, over time, most or all of the domestic sheep allotment use in the habitat area of the Encampment River herd as well. Such management decisions on the Forest will not necessarily eliminate or even reduce the chances of contact with domestic sheep on the adjacent private lands.

Effects from Rangeland Vegetation Management

Big game animals also tend to rely on a wide diversity of vegetative conditions and plant community types across the landscape to meet their habitat needs.

Natural effects such as wildfire and human-related effects such as prescribed fire, timber harvest, and livestock grazing tend to keep patterns of disturbance on the landscape, creating a diversity of vegetative conditions that are beneficial for big game populations. Prescribed fire and livestock grazing can be used to improve forage quality and quantity on elk winter range (Leckenby, Thomas et al. 1986). Montana Fish and Game has similarly determined that elk use on established winter ranges declines if they are not periodically rejuvenated with fire or livestock grazing every few years. Without such treatment, the elk move off-Forest to spend longer and longer periods of time on private lands, where their presence causes depredation payments to increase (Long 1989).

Alternatives that attempt to move large amounts of vegetation into late seral condition and don't provide a wide range of conditions will have the greatest effect on big game populations on the Forest and the greatest potential for adverse impacts on all private lands below the Forest. Alternative F has the greatest impact, followed by Alternatives E, and D DEIS and D FEIS. Alternatives C, A, and B provide for more balanced mixes of vegetation.

Effects from Forest Vegetation Management

Timber harvesting provides increased forage that can be made available for big game and livestock use. The benefits of food, cover, corridors, and "edge" associated with timber harvest can be highly variable, depending upon size, shape, and location of treatment units and their proximity to one another and other natural openings (Ward 1976). If harvest levels are high or units are large, edge effect can become negative, security cover and travel corridors are compromised, and increased forage in the units may not be usable for big game due to the distance from dense cover. Low harvest levels can tend to move disproportionate percentages of the Forest vegetation to late seral condition, again resulting in large acreages unusable for big game over time; however, the additional hiding cover provided might allow more elk to stay on the Forest later in the year, which could contribute to a higher harvest of animals.

Some individuals, interest groups, and state and federal agency personnel have expressed a concern that past timber harvests have reduced hiding cover on the Forest to the detriment of big game populations, notably elk. But elk numbers in the four Herd Units for all Medicine Bow Forest lands have grown from 11,525 to 20,285 in the last 20 years (an increase of 76%), and the herds are nearly 40% above

the combined Management Objectives of 14,550 animals. Since available forage and hiding cover on summer ranges is seldom the limiting factor in determining big game populations, the quantity or quality of hiding cover has apparently not resulted in any reduction in elk numbers over the last 20+ years. Hiding cover may affect the ability to harvest in a given area, but not necessarily the amount of total harvest.

The greatest amounts of timber management activity are provided for in Alternatives B and A, followed by C, D FEIS, D DEIS, and E. Alternative F provides for management on only 25% of the Forest, and does not allow for created openings (which are generally beneficial to big game) .

Effects from Land Exchanges

Any effects are largely independent of the range of alternatives. If changes brought about in the land ownership pattern are large enough, they could potentially change long-term big game use or migrational patterns in that area; potential for impacts, however, are thought to be minimal.

Effects from Wildlife and Fisheries Management

In general, managing for the needs of most fish and wildlife species is addressed through standards and guidelines and is independent of alternative selection. Following prescribed management is essential to assure desired residual grass and shrub vegetation needs are met for wildlife and fish habitat – including needs for big game species.

Effects from Threatened/Endangered/Sensitive Species Management

Management of TES species will have a consistent effect on rangeland vegetation for all alternatives. In general, the habitat requirements in and around each known or discovered TES species location will be protected, restored, or enhanced. Habitat management for specific species' needs could positively or negatively affect big game habitat. Conservation strategies, plans for critical habitat delineations, and biological opinions generally spell out specific management requirements for the species that may be either beneficial or detrimental for big game.

Effects from Species Viability Management Requirements

In general, management of rangeland vegetation to meet the needs of species will be consistent across all alternatives. However, managing for a mixture of seral stages across landscapes provides for the greatest diversity since plant, animal, and fish species have habitat needs in the full spectrum of seral stages. Managing for a mixture of all stages is most compatible with big game needs across the entire Forest landscape and with uses of the associated private lands down below. Alternatives A, B, and C provide for the greatest diversity in seral stages; Alternatives D DEIS, D FEIS, E, and F provide for a moderate mixture of seral stages.

Effects from Soil and Watershed Management

Effects are similar; see this same topic in the Livestock Grazing section above.

Cumulative Effects

Elk, mule deer, white-tailed deer, moose, and antelope are all increasing in numbers. All big game species on the Medicine Bow National Forest, and throughout the state of Wyoming, have larger populations now than they did twenty years ago.

Elk and white-tailed deer are showing significant increases and are above the planned objectives in every area. About half of the herds are above HMO, and half below, for mule deer and antelope. Collectively, deer are at 95% of HMO and antelope are at 103%.

Since forage on summer ranges is seldom the limiting factor in determining big game populations, increasing big game populations may lead to increased monies paid out by the state for depredation damages and, potentially, to instances of herd starvation and die-offs on the winter ranges. A change in managing toward smaller herd sizes commensurate with the capacity of the winter ranges, coupled with continued expected hunter success rates, will reduce both of these effects. The Wyoming Game and Fish Department and the Forest Service will continue to cooperate on efforts to achieve appropriate population levels through herd management.

Big game animals tend to rely on a wide diversity of vegetative conditions and plant community types across the landscape to meet their habitat needs. Lower timber harvest levels can tend to move disproportionate percentages of the Forest vegetation to late seral condition, resulting in larger acreages unusable for big game over time. In a recent letter to President Bush, the Ruffed Grouse Society and 31 other wildlife conservation organizations supported the use of forest management practices to maintain diverse forest habitats for most popular game species as well as non-game wildlife. The letter states, "A diverse forest landscape, supporting young and old stands of all native forest types, can help to sustain local wildlife populations. Old forests develop only through time; young forests develop only through disturbance." It concludes, "Forest management practices, including commercial timber harvest and prescribed fire, are essential tools in the maintenance of diverse, healthy forest landscapes. The removal of either of these tools from the hands of trained resource professionals on our National Forests would be a disservice to sportsmen and, more importantly, our nation's forest wildlife." (Dessecker 2002)

Based upon the general alternative direction, vegetative conditions to support big game numbers might be expected to be highest in those alternatives that favor a balanced and diverse mix of values and uses, even though populations are set by Wyoming Game and Fish population objective and public demand. Alternative A is currently providing for very high numbers, as should Alternatives B and C. Alternatives D DEIS, D FEIS, and E should provide for moderate big game

populations, while Alternative F may increase populations in the short run but, over time, provide for less vegetative diversity for big game food and cover.

While this array of alternatives is good for big game populations, it is not necessarily equally beneficial for big game habitat. All big game populations, with the exception of some of the bighorn sheep herds, are at high levels. There is adequate summer range across the Forest for all existing ungulate numbers; conflicts usually arise on the spring, fall, and winter ranges. There have been localized observations of elk overutilizing the winter/spring ranges in several areas on and adjacent to the Forest. This overuse can create competition for forage between livestock and big game on both public and private lands in those localized areas, and it can and does result in a change in species composition and a downward trend in rangeland vegetation condition. Herd numbers need to be reduced in some areas, and Wyoming Game and Fish personnel are working to do so.

Special Forest and Rangeland Products

Introduction – Special forest/rangeland products (SFPs) are mainly plant and fungi 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 medicinals, decoratives, and specialty items. Special forest/rangeland products are thought to play an important role in sustainable development and are sometimes perceived as essential links to sustaining rural economies and contributing to economic diversification. It is possible that as demand for these special products increases and new markets are created; harvest pressure on them will increase.

Legal and Administrative Framework

36 CFR 223.1: Trees, portions of trees, and other forest products on National Forest System 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.

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 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 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: 2431.31 - Minimum and 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. Personal use is provided for.

Permits are required for commercial harvest of any special forest product resource. Commercial harvest of special forest product resources is subject to the National Environmental Policy Act (NEPA). Different proposed harvest activities require different levels of NEPA analysis, including the environmental impact statement (EIS), environmental analysis (EA), and categorical exclusion (CE).

Permits are in all cases required for commercial harvest of special forest product resources, as well as for research collections directed at development of a commercial product. For commercial harvest, the permit must regulate the manner in which special forest product resources are harvested, provide information for monitoring the amount harvested, cover the government's administration cost, and to ensure the agency receives a fair market price for the sale of public resources to individuals receiving benefits beyond those received by the general public.

Research collections directed primarily at developing a commercial product also require a commercial use permit, and are subject to current national terms and conditions.

Collections that qualify as non-commercial research or educational use can be authorized through an administrative use permit or a free use permit.

Key Indicators

- Number of permits issued for special forest/rangeland products
- Quantities and locations of species harvested

Resource Protection Measures

Numerous forest-wide and management area prescription standards and guidelines exist concerning vegetation.

AFFECTED ENVIRONMENT

Aspen and lodgepole transplants, Christmas trees, firewood, posts and poles, and rock for landscaping use are examples of traditional requests for permits to acquire special forest products. Existing uses are often tied to historical knowledge and patterns of use. According to the Timber Information Manager (TIM) reports, nearly 250 transplants were taken under permit on the Forest in fiscal year 2001, nearly doubling from the previous two years. About 1,750 Christmas trees were sold in that same time. Demand for posts and poles has increased steadily during the last two years, with permits totaling 312 hundred cubic feet (CCF). Firewood permits are showing the same steady increase, with nearly 3,000 cords sold last year.

In recent years, however, requests from the general public and scientific community have also been increasing rapidly for the use of additional and diverse special forest and rangeland plants for specific purposes. Examples are digging lupine, larkspur, penstemon, and shrubs for transplanting and landscaping purposes; harvesting berries, mushrooms, and bracken ferns as specialty food items; collecting willow stems for making furniture; pine cones, conks, and burls for crafts or decorative items; and harvesting purple coneflower (Echinacea) and St. John's wort for medicinal purposes. Interest from Native Americans is increasing to collect traditional use plants. Scientific organizations are requesting permission to collect specimens for research efforts.

Existing quantities of nearly all types of desired products are dependent upon ecological conditions and existing distributions of potential habitat as expressed by forest and/or non-forest cover types (for more detailed information, refer to the *Biodiversity* section).

Since many of these uses require complete removal of the plant and all plant parts, permits for collection and use 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.

Summary of Existing Condition: Unlike timber products and fish and wildlife products where harvest is largely regulated and quantified, special products harvest is largely unregulated and not quantified at this time. This is largely due to special forest/rangeland products use moving from personal use at small scales to multi-million dollar international businesses in the last 10 years. As markets expand and demands increase, regulations will be necessary to sustain the resources and manage the people using them.

In many cases, little is known about the distribution and abundance of specialty plants. This makes it difficult to determine that management, including permitting of some level of harvest, is providing for the long-term health and sustainability. Increasing emphasis on inventory and evaluation of life histories will become increasingly important as demand for these species increases.

Uses of, and requests for, Medicine Bow special forest and rangeland products are increasing at a rapid rate – both traditional and non-traditional types. Charge permits have long been required for such items as firewood, tree transplants, and Christmas trees; permits (charge or free) for removal of all types of products will likely be required in the future. Permit amounts and/or locations may have to be regulated in order to assure sustainability of some of the non-traditional plant species.

ENVIRONMENTAL CONSEQUENCES

Direct and Indirect Effects

The requests for Special Forest/Rangeland Products will continue to increase regardless of the alternative, and the number of permits issued for their use will be independent of the alternative selected.

Fire increases the potential availability of some special products – especially mushrooms. The use of prescribed fire for fuels treatment and vegetative management is highest in Alternatives D DEIS, D FEIS, and E, then in B and C. The greatest acres affected by wildfire would be in Alternatives F and E, as they provide for the greatest levels of natural disturbances.

Alternatives D DEIS, D FEIS, E, and F, with higher levels of wilderness, roadless, and special area allocations, will reduce the areas across the Forest where products would be available for collecting.

Alternatives A, B, C, and D DEIS and D FEIS, with higher levels of open and maintained roads, will maintain or increase opportunities for the general public to access and harvest these products. There are 176,863 acres within 100 yards of Level 2, 3, 4, and 5 roads -- or roughly 15% of the Forest – that would likely be the most accessible for harvesting of special forest/rangeland products.

The affect of larger numbers of visitors on the forest is discussed in the recreation section of this chapter.

Cumulative Effects

The cumulative effects of vegetation composition are discussed in Biodiversity and Vegetation – Rangeland sections of this chapter.

Timber Resources

Introduction – The Medicine Bow National Forest contains valuable timber resources. They are important for providing habitat for plants and animals, and important to the people who use or are employed because of wood products. These products include construction lumber, fuelwood, transplants and Christmas trees, posts and poles, and wood for carving. Primary species include lodgepole pine in the lower elevations, cottonwoods found along riparian zones, mixed conifer stands and aspen stands at middle elevations, and stands of spruce and fir that dominate the higher elevations of the forest.

Changes Between Draft and Final

- Descriptions of age and size class were changed to utilize Habitat Structural Stages rather than size class. This allows more consistency for comparison with other chapters in the FEIS.
- The Supply and Demand section was updated to reflect recent changes in the local timber industry.
- A summary of growing stock by alternative was added.
- Timber suitability was updated for Alternative D FEIS to reflect new wetland information from the Fish and Wildlife Service and to correct riparian buffer distances which were inadvertently left out in the DEIS. These changes are summarized in Appendix B of the FEIS.
- The SPECTRUM model was reviewed and updated by an expert independent analyst. Several errors in constraints and tracking variables were identified and corrected. Key changes are summarized in Appendix B of the FEIS.

Legal and Administrative Framework

The National Forest Management Act of 1976 – this act sets 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.

The 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 therefrom…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

Key Indicators

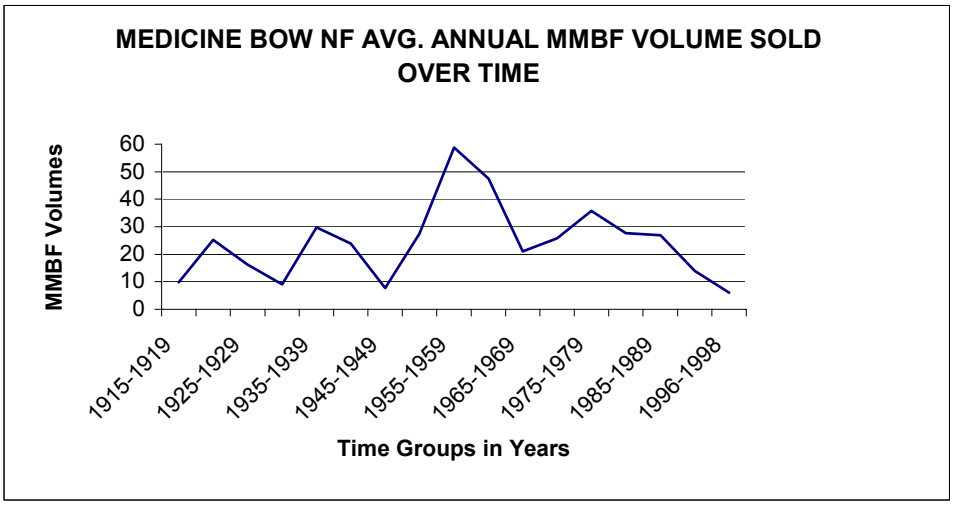
- Acres suitable for timber production
- Timber production (ASQ and TSPQ)
- Acres by harvest type
- Age class distribution (Habitat Structural Stage)

AFFECTED ENVIRONMENT

Timber Production

Historical documentation shows that specific areas of the forest were used for harvesting wood products. The history of cutting on the Medicine Bow National Forest dates back to before the turn of the century. One of the earliest documented uses of what would become the Medicine Bow National Forest was for the building of the transcontinental telegraph in 1861. One of the earliest government uses of the forests were for timber reserves. These wooded areas were set aside by the federal government to provide fuel and building materials for government installations. The most extensive early lumbering operations within the present forest occurred during the construction of the transcontinental railroad across Wyoming. At least three companies contracted with the Union Pacific Railroad in 1867 to cut ties in the Laramie Mountains. According to Mullison, three million ties were cut from the Medicine Bow from 1867-1870 (Mullison 1909). As late as 1938, the Wyoming Timber Company drove 300,000 ties down Douglas Creek to Ft. Steele. Records from reports from 1915 to 2000 indicate approximately 24 Million Board Feet (MMBF) was removed annually from the Forest (USDA Forest Service 2001b). Annual harvest volumes from 1861 to 2002 ranged from less than 1 MMBF to 127 MMBF.

Figure 3-6. Historic timber harvest volume.



The highest volumes occurred during the 1950s and early 1960s. Many National Forests across the West experienced the same increase in harvesting after World War II to meet the demands of a rapidly growing economy.

In 1986, the 1985 Land and Resource Management Plan for the forest was implemented. This Plan established an Allowable Sale Quantity (ASQ) of 28.4 MMBF/yr. Actual harvest since the late 1980s has decreased steadily. This reduction is due to a variety of factors including the need to meet other ecological and social needs on the forest.

The following table shows the volume sold from 1986 through 2001. These figures are for conifer sawtimber or ASQ. The average volume sold during that period was 12.5 million board feet (MMBF).

Table 3-179. Sawtimber volume sold since 1985.

Year	Million Board Feet (MMBF)
1986	7.5
1987	33.8
1988	34.7
1989	21.4
1990	18.4
1991	18.4
1992	6.8
1993	18.4
1994	7.4

Year	Million Board Feet (MMBF)
1995	0.08
1996	5.6
1997	7.5
1998	4.7
1999	1.2
2000	2.0
2001	3.7

Timber Suitability

The total acres treated by timber harvest from 1986 to 2001 include 4% of forested lands or approximately 47,000 acres. The 1985 plan identified 636,048 acres of tentatively suitable for timber production. From that tentatively suitable land base, 447,555 acres of the Forest were determined to be suitable and scheduled for timber harvest. A complete description of timber suitability is found in Appendix B of the FEIS. On the ground suitable acres may vary over time as new inventory data is obtained, stand boundaries are remapped and use of computerized geographic information systems occurs. At this time, the 1985 Forest Plan shows 474,828 acres of suitable timberlands.

Harvest Methods

Spruce-fir forests are harvested by single tree and group selection silvicultural treatments under the uneven-aged regeneration system, and two or three-step shelterwood systems under the even-aged regeneration system. Pre-commercial thinning is used primarily to reduce stocking of subalpine fir or lodgepole pine regeneration in the openings created by selection harvests or in the understory following shelterwood harvest. Pre-commercial thinning reduces competition for moisture and nutrients concentrating growth on the more desirable individuals in the regenerating patches or stands, providing healthier, more vigorous trees, and maintaining spruce as a significant component of the regenerated stands. Relatively little pre-commercial thinning is done in spruce-fir on the Medicine Bow National Forest. Commercial thinning or stocking control is used to remove trees recently dead or at risk of dying due to competition, insects and disease or to maintain overall stand vigor.

Lodgepole pine forests are usually managed under the even-aged regeneration method using clearcutting. Occasionally seed tree or shelterwood systems are used. Lodgepole pine regenerates very well with these methods due to its ecological niche as a seral species that is a prolific seed producer that germinates and grows best in full sunlight. Seedling stocking rates often are over 1000 seedlings per acre and can range over 100,000 seedlings per acre (Lotan and Perry 1983). Pre-commercial

thinning is a cost-effective method of insuring a commercial product from heavily stocked lodgepole pine stands. Pre-commercial thinning also provides the opportunity to retain other species in the thinned stand and maintain the trees' ability to respond to future thinning with increased growth (Johnstone 1985). The majority of pre-commercial thinning on the Medicine Bow National Forest is done in lodgepole pine. Commercial thinning helps maintain healthy, vigorous trees which increases resistance to mountain pine beetle infestations in larger diameter stands as well as to provide openings for additional regeneration.

The following table shows the acres treated by silvicultural cutting method. The total treatment acreage shown in this table is 127,855 acres, or approximately 12% of forest. The actual acres receiving treatment is slightly smaller because some areas have been entered more than once to complete a multiple stage silvicultural treatment.

Table 3-180. Acres of past harvest treatments by decade since the 1950s.

Period	Clear Cut	Other Regeneration Harvests	Shelterwood Harvests	Intermediate Harvests	Salvage	Total
1950-1959	15,710	37	0	1,211	1,386	18,344
1960-1969	19,350	0	1,820	449	953	22,572
1970-1979	16,810	58	5,524	1,663	2,286	26,341
1980-1989	15,641	308	16,195	1,260	3,783	37,187
1990-1999	8,731	1,801	11,372	586	921	23,411
Totals	76,242	2,204	34,911	5,169	9,329	127,855

The National Forest Management Act of 1976 directs the Forest Service to use the clearcut harvest system only when "…it is determined to be the optimum method to meet the objectives and requirements of the relevant land management plan". Congress enacted NFMA in part to ensure that careful consideration and systematic analyses would be performed prior to harvest activities being implemented on a forested site.

Clearcutting is an effective method for managing lodgepole pine ecosystems in a variety of conditions. These may include control of pathogens such as dwarf mistletoe, regeneration of shade intolerant plant species, and providing openings which are useful to some species of wildlife. Determination of harvest methods must be analyzed in a site-specific manner to identify the characteristics which define the optimum harvest method to achieve the desired management objectives.

Clearcutting on the Medicine Bow has been reduced from 64% of total harvest acres during the 1950s through 1980s, to 37% for the 1990s.

The following table displays the acres by silvicultural harvest system on the Medicine Bow National Forest since the 1985 Forest Plan was implemented.

Table 3-181. Comparison of planned and actual timber harvest by silvicultural harvest system 1986-2001.

Silvicultural System	10 year projection from 1985 Plan	Actual Acres 1986-2001
Clearcut	21,255	17,705
Shelterwoods		
Preparation cut	10,892	15,983
Seed cut	6,750	2,045
Removal cut	2,282	3,803
Selection		
Individual	5,249	488
Group	11,637	546
Sanitation/Salvage	0	1,515
Total	58,065	42,085

Source: Rocky Mountain Resource Information System (RMRIS) database

This table indicates that 72% of the planned decadal harvest treatment level was accomplished during a 15-year period. This reduced rate of accomplishment is a result of appeals and litigation (12 of 13 timber sales were appealed from 1998 through 2000), updated inventories and site specific conditions resulting in on-the-ground situations that differed from the conditions modeled in the 1985 Plan, and changes in public values since the 1985 Plan was approved. In addition, new Forest Service handbook direction such as the updated Watershed Conservation Practices Handbook (FSH 2509.25) has provided additional resource protection measures that were not incorporated into the 1985 Forest Plan.

Reforestation

The Forest Service is required by regulation 36 CFR 219.27(c)(3), " When trees are cut to achieve timber production objectives, the cuttings shall be made is such a way as to assure that the technology and knowledge exists to adequately restock the lands within five years after final harvest".

This requirement allows for exceptions when harvesting occurs for other than timber production objectives.

Reforestation is the process of reestablishing forest cover on disturbed areas. Reforestation can occur naturally from existing seed sources in the disturbed area or

from adjacent live trees. Reforestation can also occur artificially from planting or seeding of disturbed areas. These methods generally ensure the reestablishment of trees within five years.

Regeneration harvest treatments on the Medicine Bow National Forest are restocked predominantly by natural methods. A review of the last 15 years of monitoring reports indicates that 95% of all regeneration harvests have been restocked within 5 years. Where regeneration is not expected to occur naturally, hand seeding has been the preferred method for reforestation. Since 1985, the Forest has seeded 1,274 acres or an average of 84 acres a year. Less prevalent because of its high cost is hand planting of live seedlings. Since 1985, the Forest has hand planted 169 acres.

Elevation, soils, cover type, post harvest treatments, and climate all play a role in successful regeneration. Naturally harsh environments such as those that occur above 10,000 feet in elevation, combined with unexpected climatic conditions such as drought, can result in regeneration failures. For this reason, spruce fir stands above 10,000 feet are not considered suitable lands for timber production. A site-specific silvicultural review is conducted prior to a final harvest and the harvest will not proceed unless there is a strong indication that the area to be harvested will regenerate within the 5-year period after harvest.

Timber Supply and Demand

Timber markets have changed dramatically in recent years, and especially since the Forest Plan was first approved. This is true at all scales -- international, national, regional, and local. Recent assessments of timber markets in Wyoming have been prepared. *Wyoming Timber Market Analysis: The New Western Timber Economy* was prepared by Dr. Douglas Rideout and Dr. Hayley Hesseln in 2000. Because of more recent significant changes in the local timber industry, an assessment by Charles Keegan, Todd Morgan, and Timothy Spoelma was obtained in 2003. These assessments, along with public comment on the DEIS and discussions with local timber industry provide the basis for this section.

In decades past, each national forest typically had timber purchasers that were locally situated. Timber was rarely sold to purchasers located beyond a few hours drive from the forest. These mills were very dependent upon timber coming from one or two national forests. Competition was limited to a few firms within this circle.

Like other industries throughout the U.S., timber processors have consolidated and repositioned themselves to better compete in today's markets. Several years ago lumber prices were significantly higher than they are today. When prices were high, firms could reach out hundreds of miles for timber from a variety of sources. In response to international competition and changing supplies with generally smaller logs, corporations made large investments to achieve very efficient mills using modern technologies. Today prices are about 70% of their high six years ago.

From 1997 to mid-2003, eleven firms have purchased timber from the Medicine Bow National Forest. Louisiana-Pacific Corporation, with a mill in Saratoga, WY, purchased 50% of all sold timber; Big Horn Lumber, with a mill in Laramie, WY purchased 38% of all sold timber; and 44 Lumber, with a mill in Encampment, WY purchased 4%. The remaining eight firms bought a single timber sale each for a combined total of about 8%.

The Louisiana-Pacific mill in Saratoga has a 1-shift capacity of about 25 million board feet (log scale). In recent years, the mill processed about 35 million board feet annually by running 6 10-hour days per week. It can process a variety of log sizes and species to produce primarily 2x4 and 2x6 lumber products. At one time, the mill had an operating circle of about 100 miles – one that was common within the industry. This would limit timber supplied to mostly the Routt and Medicine Bow National Forests. Under better market conditions and weaker national forest timber supplies in the 1990s, logs were hauled from almost anywhere in Wyoming and Colorado. LP also purchased and hauled logs from Utah, Idaho, and New Mexico. While the composition of timber supplies can vary widely, state, private, Bureau of Land Management, and reservation ownerships have accounted for up to 50 percent of total volume in recent years.

The Big Horn mill in Laramie has a 1-shift capacity of about 15 million board feet (log scale), which has been their typical operation in recent years. This mill focuses on high quality 1x4, 1x6, and 1x8 lumber products. Compared with LP, Big Horn Lumber has retained a more traditional operating circle and has a greater reliance upon national forests – about 65% of its log supplies come from national forests in Wyoming and Colorado.

44 Lumber, incorporated in 2003, is operating the former Hammer mill in Encampment. The firm has plans to process small diameter logs with a annual 1-shift capacity of 8 million board feet (log scale), but can move to two shifts if markets and timber supplies permit. 44 Lumber desires to be very diversified by offering a wide variety of lumber products, including 1x4 and 1x6 boards, door stock, rough lumber, and houselogs. The Medicine Bow National Forest has been the primary source of timber supplies to date.

Changes in the industry now come more quickly than in years past. Despite recent investments in several technological upgrades, LP announced the permanent closure of its Saratoga mill in late 2002. Citing a very poor lumber market, low timber supplies from national forests, and high operational costs, the mill went up for sale. The future of the mill is uncertain. While there has been serious interest in acquiring the mill, at the time of this writing no agreement to purchase has been made. Even if the mill is acquired by another firm, there are no guarantees that the mill will remain in Saratoga or operate as it has historically.

In recent years, the Medicine Bow National Forest has provided local mills with less and less timber. Offer volumes have been low and the size of logs has been shrinking. As shown in the following table, the history of sawtimber sold and

harvested on the Forest since the original plan was signed has shown a dramatic reduction. Budgets, appeals, litigation, market conditions, natural disasters, and changes in national policies (such as roadless) all have combined historically to reduce the harvest and processing of timber from MBNF lands. All of this has occurred while the allowable sale quantity (ASQ) of the original plan remained at 28.4 million board feet.

While national forest timber has been a relatively low share of total timber harvest in the market area, the balance of timber supplies has been provided by state, private, and other ownerships. It is generally recognized that recent volumes from state and private ownerships are not sustainable in the long run. Consequently, the future demand for and supply of timber from the Medicine Bow National Forest cannot be characterized by a simple projection of historic trends. Anticipated harvest and processing levels are discussed later in the Environmental Consequences portion of this section.

Table 3-182. Sawtimber volume sold and harvested, 1986-2002 (million board feet).

Year	Sold	Harvested	Offered and Not Sold
1986	7.5	23.8	*
1987	33.8	39.5	*
1988	34.7	44.6	*
1989	21.4	37.0	*
1990	18.4	28.2	*
1991	18.4	35.8	*
1992	6.8	29.6	*
1993	18.4	15.7	*
1994	7.4	13.2	*
1995	0.1	4.8	0.1
1996	5.6	3.1	0.1
1997	7.5	2.1	6.8
1998	4.7	9.7	0.3
1999	1.2	3.5	0.9
2000	2	2.5	1.2
2001	3.7	1.9	0
2002	0.0	5.5	0
Average	11.3	17.7	*

*Source: TSPIRS, *Complete data not available*

The Forest Service strives to prepare sales that will be economical to both the purchaser and the Forest Service, but not every sale offered is sold. This situation can be due to a variety of factors including haul distances, product mix, or current market conditions. Because this situation is impossible to predict, this analysis assumes all sales offered will be harvested. Based on available data from the last eight years, 14 sales totaling 9.4 million board feet have been offered and not sold on the Medicine Bow NF since 1995. With one exception (White Swan Timber Sale in 1997), these sales consisted mostly of small trees designed to meet silvicultural objectives related to the management of small diameter trees.

Age Class Distribution

Age class information based on stand exam information is not available for the entire forest. Habitat structural stages can generally be correlated to age, although this will vary based on site conditions, and species. The following table displays the age and habitat structural distribution for the primary commercial timber species on tentatively suitable lands.

Table 3-183. Acres of age and habitat structural stage distribution of commercial tree species on tentatively suitable lands.

Species	HSS 1	HSS 2	HSS 3	HSS 4	HSS 5
Douglas-fir 6,119	0-5 yrs 95	6-30 yrs 0	31-80 yrs 864	81-200 yrs 4322	200+ yrs 838
Lodgepole Pine 434,634	0-5 yrs 13,005	6-30 yrs 40,833	31-110 yrs 180,020	110-150 yrs 163,894	150+ yrs 36,882
Ponderosa Pine 95,064	0-5 yrs 4,262	6-20 yrs 391	21-70 yrs 6,631	71-200 yrs 81,704	200+ yrs 2,076
Spruce-fir 139,881	0-5 yrs 3,665	6-20 yrs 8,324	21-70 yrs 23,895	71-200 yrs 65,832	200+ yrs 38,165
Total 675,698	**3% 21,027**	**8% 49,548**	**31% 211,410**	**51% 315,752**	**13% 77,961**

Source: RIS Database

ENVIRONMENTAL CONSEQUENCES

General Effects

Timber Suitability

Identification of lands suitable for timber production is one of the key decisions made in a forest plan. The process to determine timber suitability is found in 36 CFR 219.14, and FSH 2409.13. It is described in detail in Appendix B of the FEIS.

Table 3-184. Timber suitability.

	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Tentatively Suitable and Common to all Alternatives*	663,557	663,557	663,557	663,557	662,756	663,557	663,557
Suitable Acres	474,828	407,803	370,662	330,561	320,754	290,157	172,455

**Alternative D FEIS is different due to land status updates applied only to D FEIS. These were minor changes not affecting the ranking of alternative effects.*

Source: GIS Data layers.

Lands identified as tentatively suitable and common to all alternatives are based on physical characteristics of the land as identified using current inventory and data layers in a GIS format. These factors include various physical and administrative factors such as slopes, soil characteristics, site productivity. Lands identified as suitable for timber production vary by alternative and are based on management area prescriptions. Alternative A has the highest level of suitable acres followed by Alternatives B through F respectively.

Only selected management area prescriptions are appropriate for timber production. The following table displays management areas that schedule timber harvest and contribute to the ASQ.

Table 3-185. Suitable acres by management area prescription contributing to ASQ.

MA	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
3.32	14,741						
4.22	34,680						
4.31	35,232						
5.11		14,380	10,836	12,017		10,815	
5.13	230,695	329,031	193,342	91,431	102,259	74,610	
5.15		64,392	165,894	227,112	218,494	204,731	
5.21	24,453						
5.4	24,453						271,780
Total	474,828	407,803	370,072	330,560	320,753	290,157	271,780

Source: GIS Data

Acres identified as suitable for timber production are processed through the SPECTRUM timber modeling program. Based on land management constraints and growth and yield information, the model schedules acres that are suitable for harvest and combines them with yield tables to estimate harvest levels. As a result of resource protection and budget constraints, the acres scheduled for harvest in SPECTRUM are less than the initial suitable acres input into the model.

The following table displays the acres of suitable and scheduled for each alternative over a 200-year period. Alternatives A, B, and C have the highest levels of suitable and scheduled timber. It should be noted that Alternatives D and E include a large

percentage of the suitable timberland in Management Area 5.15, which includes a variety of ecologically oriented standards and guidelines. Harvesting in these areas will include practices such as leaving large, unharvested islands within clearcuts to emulate uneven burn patterns, similar to those resulting from wildfires. The SPECTRUM model was programmed to account for these islands by reducing available acres by 20% to account for these management practices. Portions of these unharvested areas may blow down; however their utility is expected to continue by providing sources of downed wood in the forest. In addition, some of these inclusions may include mistletoe, which could potentially spread to the regenerated stand. Sale layout will be key in ensuring that these areas are located in areas less prone to windthrow and with reduced levels of mistletoe.

Table 3-186. Suitable and scheduled timberlands for 200-year period. (Acres)

Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
339,873	332,786	318,295	300,520	286,120	266,346	147,469

Source: SPECTRUM Model

Map 3-19. Areas tentatively suitable for timber production on the Medicine Bow National Forest.

Map 3-20. Areas suitable for timber production on the Medicine Bow National Forest under Alternative A.

Map 3-21. Areas suitable for timber production on the Medicine Bow National Forest under Alternative B.

Map 3-22. Areas suitable for timber production on the Medicine Bow National Forest under Alternative C.

Map 3-23. Areas suitable for timber production on the Medicine Bow National Forest under Alternative D DEIS.

Map 3-24. Areas suitable for timber production on the Medicine Bow National Forest under Alternative D FEIS

Map 3-25. Areas suitable for timber production on the Medicine Bow National Forest under Alternative E.

Map 3-26. Areas suitable for timber production on the Medicine Bow National Forest under Alternative F.

Timber Production (ASQ and TSPQ)

The Allowable Sale Quantity of Sawtimber (ASQ) for each alternative was formulated by considering the tentatively suitable timberland, multiple-use objectives, and the management requirements in the NFMA regulations. A discussion of the analysis process and use of model constraints is found in Appendix B of the FEIS.

The ASQ is the quantity of timber that may be sold from the area of suitable land covered by the forest plan for a time period specified by the plan. This quantity is usually expressed on an annual basis as the "average annual allowable sale quantity" (36 CFR 219.3). This quantity may be expressed as an annual figure, but over a 10-year period, the annual volume sold from suitable timberlands shall not exceed the annual amount times ten. Application of forestwide, management area or geographic area standards and guidelines may limit the volume actually available during site-specific project implementation. Examples of resource protection measures that may factor into the actual amount of ASQ sold are water quality, wildlife, and heritage measures. Where possible, the effect of these standards and guidelines has been taken into account in the calculation of the ASQ. See Appendix B for details of modeling constraints. In addition, changes in budget levels or other outside factors such as wildfires could cause actual timber offer levels to be less than the ASQ.

The following figure displays the average annual ASQ for each alternative at the desired condition level and at the experienced budget level. Alternative A, B and C provide the highest ASQ.

Table 3-187. Annual allowable sale quantity (ASQ) by alternative.

	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Desired Condition Level (MMBF)	28.9	27.2	25.8	24.2	22.8	20.7	3.0
Desired Condition Level (MMCF)	6.2	5.9	5.6	5.2	4.9	4.5	0.6
Experienced Budget Level (MMBF)	10.6	12.5	10.6	10.4	10.4	7.8	3.0

In Alternatives B-F, only management area prescriptions 5.11, 5.13, 5.4 and 5.15 contribute toward the ASQ. Timber harvest may be allowed in other management area prescriptions, but only to meet other resource objectives compatible with the management area. Harvest in these areas would not contribute towards the ASQ but would contribute toward the total timber sale program level.

Alternative A has a variety of additional management area prescriptions that contribute to ASQ. These include 3.32, 4.22, 4.31, 4.31 and 5.21. These prescriptions

are used only because they reflect current management under Alternative A. The Category 3 and 4 management area prescriptions are generally incompatible with active timber management. Subsequently, Alternative A has a higher ASQ even though the theme of Alternative B was to increase current timber production.

Alternative F uses only MA 5.4 for contributing to ASQ. This prescription has the same modeling constraints as all other MA's except for MA 5.15. The Management Area prescriptions for this alternative were selected by the original proponent of the alternative and carried forward by the Forest Service.

Sawtimber production is directly related to the number of acres classified as suitable for timber production and acres within management area prescriptions that contribute to ASQ. Management area prescriptions 5.13 and 5.21 have a more intensive timber management emphasis and an increased level of timber production than other timber production management areas. Management area prescriptions 5.11 and 5.15 have less intensive timber management emphasis, with a greater emphasis on biological processes.

Because the SPECTRUM model is not a spatial model, it is impossible to present a solution that displays which areas of the forest scheduled for harvest. These are site-specific project decisions. The model is a tool used to estimate the volume that can be produced at a non-declining sustained level.

Anticipated Harvest and Processing

As a ceiling on timber sold from suitable timber lands, allowable sale quantity (ASQ) has not been a reliable predictor of actual harvest levels. Annual budgets, project appeals, litigation, market conditions, natural disasters, and changes in national policies affecting resource management all have combined historically to reduce timber harvest on the Medicine Bow National Forest. Some factors tend to reduce harvest levels, while others increase the levels. ASQ volumes include only sawtimber harvested from suitable timber lands.

Estimating sawtimber volume harvested and processed locally during the first decade of the plan must consider a variety of factors – some that influence timber supply and others that influence mill capacities. Among the more critical uncertainties are operations of the Saratoga mill and timber program budget levels for the Medicine Bow National Forest. To account for these and other variables, several scenarios were developed. The following table shows three processing capacity scenarios. High I and High II in the table represent different mixes of mill operations, but result in nearly the same aggregate capacity.

Table 3-188. Timber industry processing capacity scenarios

Capacity Scenario	Number of Shifts at All Local Mills	Status of Saratoga Mill	Estimated Annual Volume (MMBF, log scale)
Maximum	2	Operating	97
High I	1	Operating	48
High II	2	Closed/Removed	47
Low	1	Closed/Removed	23

The following table shows two sawtimber supply scenarios. All sawtimber sources have been considered. Supplies from state, private, and other sources were held at 20 percent of the industry 1-shift capacity with the Saratoga mill in operation. Sawtimber supplies from the Routt National Forest were held at the average annual volume anticipated for 2004 through 2007. Sawtimber from the Medicine Bow National Forest was examined at two levels: 1) volumes that can be supported by experienced budget levels and 2) desired budget levels. Historic deviations from ASQ since 1986 were examined to see what the combined effect of all historic factors had been in not achieving ASQ harvest levels. It was discovered that experienced budget levels provided a more limiting constraint on future timber program volume than all historic factors combined. Consequently, only budget limitations were used in developing anticipated harvest volumes in 2010. In the absence of budgetary and other limitations, desired budget level volumes could be harvested. National forests other than the Routt and Medicine Bow have typically provided some, but not significant volumes to Wyoming sawmills in the past. In this analysis, no volumes are assumed to be provided from these other national forests. The total of sawtimber supplies from all sources is shown in the following table.

Table 3-189. Total timbershed sawtimber supply in 2010 by source scenario (MMBF).

	Anticipated Harvest		Anticipated Harvest		Desired Budget Level Harvest	
Alternative	Routt NF	State/Private/ Other	Medicine Bow NF	All Sources	Medicine Bow NF	All Sources
A	18	10	10.7	38.7	29.0	57.0
B	18	10	12.6	40.6	27.3	55.3
C	18	10	10.7	38.7	25.9	53.9
D DEIS	18	10	10.5	38.5	24.3	52.3
D FEIS	18	10	10.5	38.5	22.9	50.9
E	18	10	7.9	35.9	20.8	48.8
F	18	10	1.9	29.9	3.0	31.0

To estimate volumes processed in local mills, both the supply and processing capacity scenarios are combined. The most limiting factor – either sawtimber supplies or industry capacity – determines the total volume that would be processed under each alternative. The results are shown in the following table.

Table 3-190. Estimated total sawtimber volume (all sources) in 2010 processed within the Medicine Bow area (MMBF).

Scenario		Alternative						
Med Bow Volume	Processing Capacity	A	B	C	D DEIS	D FEIS	E	F
None	Low 23 MMBF	23	23	23	23	23	23	23
Anticipated	Low 23 MMBF	23	23	23	23	23	23	23
Anticipated	**High 48 MMBF**	**39**	**41**	**39**	**39**	**39**	**36**	**30**
Desired Budget Level	Low 23 MMBF	23	23	23	23	23	23	23
Desired Budget Level	High 48 MMBF	48	48	48	48	48	48	32
Desired Budget Level	Maximum 97 MMBF	57	55	54	52	51	49	31

Several observations can be made from the table above. At low processing capacity, sawtimber supplies from the Routt NF and other ownerships are sufficient to keep all mills other than Saratoga operating with one shift. Anticipated sawtimber volumes from the Medicine Bow NF, if experienced budget levels continue throughout the first decade, may add sufficient supplies to satisfy modest industry processing capacity – either 1-shift operations at most mills, including the one at Saratoga, or greater than 1-shift operations at most mills excluding the mill at Saratoga. Because total timbershed volume would fall short of fully utilizing all local industry one-shift capacity, not all mills may be equally viable. Since Alternatives A, C, D DEIS, and D FEIS fall short by 9 MMBF of a combined 1-shift production at all mills, it is uncertain whether all mills would continue operation, some choosing to operate at less than 1-shift, or whether one mill would close. Should budgets and other factors not limit sawtimber volume, then slightly more than half of the maximum industry capacity would be utilized. This last observation does not apply to Alternative F, where the highest supply levels do not exceed a high industry capacity. Anticipated volume from the Medicine Bow combined with a high industry capacity appears to

provide the most likely scenario of timber harvest and processing within the local area. This row is bolded in the above table.

Sawtimber is not the only timber product that is harvested from forest lands. Products-other-than logs (POL), which include posts and poles, generally have low processing requirements. POL is typically generated with sawtimber volume, and therefore varies according to the supply scenarios discussed above. Additional POL volume can be generated from fuel and other resource treatments. All POL would be processed by firms with the Medicine Bow NF area. Anticipated POL volumes are displayed in the following table.

Table 3-191. Products-other-than-logs harvested in 2010 (MMBF)

Alt	A	B	C	D DEIS	D FEIS	E	F
Experienced Budget Level	3.1	3.5	3.1	3.1	3.1	2.6	1.4
Desired Budget Level	6.8	6.4	6.2	5.8	5.6	5.1	1.6

Timber products other than live sawtimber and salvage of dead timber can be harvested from both suitable and unsuitable timber lands. Fuel treatment in the wildland urban interface is a good example of an activity yielding timber products that generally do not come from suited timber lands. While these products are not counted toward allowable sale quantity, they nonetheless count toward total harvest volumes. The sum of volume from these products, live sawtimber, and firewood for personal use is called Total Sale Program Quantity (TSPQ). For a detailed discussion of TSPQ, see Appendix B.

Table 3-192. Average annual total sale program quantity for first decade (MMBF).

Harvest	A	B	C	D DEIS	D FEIS	E	F
Experienced Budget Level	15.3	17.6	15.3	15.1	15.1	12.0	4.8
Desired Budget Level	37.2	35.2	33.5	31.6	30.0	27.4	6.1

Harvest Methods

A variety of harvest methods is available as silvicultural tools in the management of forest resources. The SPECTRUM model produces an acreage estimate of treatment types used in each alternative. The following table displays estimated treatment types by alternative. It should be noted that these are modeled estimates only. Site-specific project analyses will determine actual silvicultural prescriptions based on detailed,

on the ground conditions and project objectives. Clearcutting is an available silvicultural tool in all alternatives except alternative F.

Based on modeling, Alternative B would have the highest levels of clearcutting, followed by C, A, D DEIS, D FEIS and E.

Table 3-193 Average annual harvest acres by treatment types contributing to ASQ averaged from first 50 years.

Treatment Type	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Even Aged Harvest Regeneration	2,067	2,103	1,988	1,810	1,687	1600	8
Uneven Aged	586	408	342	379	459	431	113
Even Aged Non-Regeneration	592	613	646	626	590	532	54
Total Acres	3,245	3,124	2,976	2,835	2,736	2,562	175

Source: SPECTRUM Timber Model

**This table includes only harvest acres directly contributing to ASQ. Harvest figures in the S-2 tables include harvest acres for other resource objectives such as fuel treatments.*

As described in the preceding table, even-aged regeneration methods include clearcutting, seed tree and shelterwood seed cut systems. Even-aged non-regeneration treatment methods include shelterwood preparatory cuts and overstory removal cuts. Uneven-aged regeneration methods include group selection and single tree selection treatments. While traditional uneven-aged management is a silvicultural tool available to the Forest, use of the term here indicates multiple age classes within a stand, which results from group or single tree selection treatments. At the stand level, these harvests are small pockets of even aged trees. Over the landscape, this results in multiple age classes that mimic small-scale natural processes where there are historically small areas of insect infestations, blowdown, or other mortality. True uneven-aged harvest methods, where all ages are represented on all acres, is not a practical silvicultural system for lodgepole pine.

Alternatives D DEIS, D FEIS and E include a large percentage of the suitable base in Management Area 5.15. This management area includes a variety of ecologically oriented standards designed to reduce adverse visual impacts associated with clearcutting. Implementation of this prescription will generally treat fewer acres during some site-specific projects based on local conditions. Actual treatment plans will be based on site-specific goals and objectives and other site-specific project level information.

The acres in the above table only include harvest activities directly contributing to ASQ. As described in the previous section, the fire and fuels section, and presented

in the S-2 tables, total harvest will also include over 1,000 acres of fuel treatment harvest. The S-2 tables include harvest acres combined to include harvest that contributes to ASQ and harvest for other objectives which may occur on lands not classified as suitable.. These harvests will primarily be even aged non-regeneration treatments designed to reduce fire hazards. Where these harvests occur on lands suitable for timber harvest they will contribute to the ASQ. Where these treatments occur on lands not suitable for timber production they will not contribute to the ASQ.

Growing Stock and Growth

Growth occurs across the forest at different rates. The rate of growth is dependent on the age of the trees. Young trees grow at a very rapid rate compared to older trees whose growth slows over time. Growth alone cannot be assumed to equal a level of harvest which could occur, since much of the growth occurs in smaller diameter trees.

The effects of the alternatives on growth for commercial species Forest-wide are displayed in the following table. Because growth is directly related to age, generally, alternatives that harvest more timber result in higher levels of growth. There is currently, approximately 5,811,000 CMBF standing volume (growing stock) of commercial species. While harvesting that does not contribute to ASQ will be occurring to meet other objectives we did not model that in SPECTRUM, so it is not displayed below.

Table 3-194. Forestwide growth of commercial species as modeled by SPECTRUM.

CMBF	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Decade 1	407,221	403,953	401,994	401,853	403,464	402,654	404,089
Decade 5	241,537	253,684	245,091	244,538	250,258	243,076	194,659

Removals counting toward ASQ do not exceed forestwide growth over a 50-year period. Over that same period, there is a reduction in forestwide growth.

Age Class Distribution (HSS)

The age class distribution of commercial timber species on the forest is a critical concern for maintaining a sustainable supply of forest products, maintaining healthy vigorous stands of trees, and maintaining ecosystem diversity. A condition with more timber in overmature age classes results in a reduction of future potential harvest volumes due to slower growth rates, increasing decay, tree mortality, and risk of insect and disease infestations, and wildfire.

The following table summarizes the current distribution of habitat structural stages on suitable lands for each alternative. As previously discussed, habitat structural stages do not reflect a direct correlation to age, however it is considered to be a reasonable approximation when detailed age data is not available.

Table 3-195. Acres of habitat structure stages for commercial species on suitable lands.

Habitat Structural Stage	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
HSS 1	14,541	14,176	13,534	13,492	12,834	12,427	9,134
HSS 2	46,545	45,059	44,280	42,066	43,340	38,862	21,339
HSS 3	150,949	127,226	110,089	106,675	103,442	91,884	59,310
HSS 4	201,385	170,651	152,059	127,491	119,805	108,440	66,420
HSS 5	60,741	50,036	49,527	40,444	41,331	38,241	16,501

There are approximately 78,000 acres of HSS or old aged tentatively suitable acres of commercial species. Alternatives A, B, and C include the highest number of older or HSS 5 suitable timberlands allocated to timber production management areas. Alternatives D DEIS, D FEIS, E and F respectively have the least. As a result, alternatives A, B, and C would have the potential to have the greatest effect on creating a more balanced distribution of age classes on lands suitable for timber production.

As part of the development of the Sale Schedule or ASQ, planning regulations at 36 CFR 219.16(a)(iii) direct the Forest Service to:

> "Assure all even-aged stands scheduled to be harvested during the planning period will generally have reached the Culmination of Mean Annual Increment of growth (CMAI)."

CMAI is the point at which the average annual growth is greatest for a stand of trees. CMAI varies by site conditions and species. For lodgepole pine on the Medicine Bow National Forest, CMAI is generally achieved at approximately 120 years of age. Silvicultural review of all stands is conducted during site-specific project analysis to determine the actual CMAI for a specific stand.

The Medicine Bow currently has a preponderance of lodgepole pine in the 80 to 120 year age class on suitable lands. To address this situation, a guideline has been added to Management Area 5.15 such that special emphasis is given to treating lodgepole pine in the 80 to 120 age class where acres of this age class are outside the historic range of variability. This direction is consistent with the above planning regulation that also states that:

> "Alternatives which incorporate exceptions to these standards shall be evaluated if it is reasonable to expect that overall multiple use objectives would be better attained. Alternatives which incorporate exceptions to these standards are permitted for the use of sound silvicultural practices, such as thinning or other stand improvement measures."

All alternatives are bound by this planning regulation, however Alternatives A and F do not include Management Area 5.15 which places a specific emphasis on considering the treatment of stands prior to meeting CMAI under certain conditions.

Direct and Indirect Effects

Effects from Fire and Fuels Management

Under Alternatives E and F, natural processes are emphasized and there is increased potential for wildfire under normal climatic conditions. This could result in fire damaging or killing trees on very limited acres or across many acres, depending largely on climatic and fuel conditions. Because of the large areas that would not be actively managed, it would be difficult to prevent or suppress fires within the areas managed for timber. The increased potential for wildfire could decrease, or through salvage operations, momentarily increase the amount of timber that could be harvested under these alternatives. Timber stands destroyed by wildfire, would also reduce that amount of timber available for future wood products needs.

Under Alternatives A, B, C, D DEIS and D FEIS, there is a lower potential for wildfire due to active timber management. In particular, Alternatives D DEIS, D FEIS and E plan for the highest level of fuel treatments that should mitigate or reduce adverse wildfire effects to suitable timberlands. Reduced fuel loading and developed road systems will allow easier fire suppression access and should result in smaller wildfires. Under extreme climatic condition years, the probability for wildfires is generally similar for all alternatives.

Effects from Insect and Disease Management

Insects and disease can affect the production of timber by killing and damaging trees. Under all alternatives, there exists potential for salvage/sanitation harvests to remove dead and damaged timber and to attempt to slow or impede infestations from spreading. The degree to which these harvests are undertaken will largely depend upon the risks associated with wildfire potential, infestation spread into healthy

stands, public safety, the presence of high value resources, the resource emphasis of the infected or adjoining area, as well as site-specific analyses.

Under Alternatives E and F, where natural processes are emphasized, there is a greater potential for infestations from insects and disease. As with wildfire, there is a higher potential of mortality on large acreages of timber. A large infestation could momentarily increase timber supplies.

Effects from Roadless Area Allocations

Suitable timber lands include portions of inventoried roadless areas within management areas which contribute to ASQ. The acres of inventoried roadless areas that are allocated to management area prescriptions that contribute to ASQ varies by alternative and is summarized in the following table.

Table 3-196. Acres of inventoried roadless areas allocated to timber management prescriptions.

Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
232,157	100,835	57,875	10,484	16,986	3,901	4,864

Not all of the acres allocated to Management Area prescriptions, which contribute to ASQ are suitable timberlands. This situation occurs as the result of small areas of lands not tentatively suited for timber production, which are impractical to separate into different management prescriptions because of size or location. Only the suitable portions of these management area allocations are modeled in SPECTRUM for ASQ calculations.

The table below shows suitable timberlands within inventoried roadless acres that are allocated to management areas that contribute to ASQ and the estimated volume predicted to be removed in these areas. If the 2001 Roadless Area Conservation Rule is implemented, it would preclude timber harvest and road building on these acres.

Table 3-197. Acres of inventoried roadless areas allocated to timber management prescriptions and occurring on suitable lands and estimated volume contributing to ASQ/decade.

Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
123,746	70,106	38,432	8,469	12,159	3,027	2,472
7.5mmbf	4.7mmbf	2.7mmbf	0.6mmbf	0.8mmbf	0.2mmbf	0.03mmbf

Timber harvest in these areas would incur higher road building costs than already roaded areas, which are accounted for in the SPECTRUM model. In addition, during project planning, it is anticipated that continued public controversy of timber harvesting in roadless areas, even if allocated to suitable management area

prescriptions in the Forest Plan, would continue. This could result in actual harvest levels less than planned as a result of social concerns encountered during project development. Based on this, it is expected that Alternatives E, F, D DEIS and D FEIS would have higher probability of achieving timber production levels identified in the SPECTRUM model.

Effects from Old Growth Management

Forest-wide standards and guidelines for old growth will have some effect on the amount of timber available for harvest during site-specific project implementation. Because old growth must be well distributed over the forest, it may be necessary that some portion of these areas be included on suitable lands. In all alternatives, there are tentatively suitable lands that are also potential old growth lands that are not allocated to management areas for timber production.

A review of existing old growth on the forest indicates that potential old growth occurs on lands both suitable and not suitable for timber production. The SPECTRUM model included a constraint to maintain the minimum amounts of old growth to ensure that these standards and guidelines are accounted for in estimates of ASQ. Identifying and managing these lands as old growth is not a management area allocation nor a timber suitability requirement.

Effects from Lynx Amendment Standards and Guidelines

The Forest Service is in the process of amending Land and Resource Management Plans (LRMPs) for 7 national forests in Colorado and Wyoming to provide conservation and recovery of the Canada lynx, a threatened species through a separate NEPA process conducted at the Regional level. The amendment was expected to be completed in 2003 and include the Medicine Bow National Forest, but it is now expected that the Medicine Bow Revision will be completed prior to that amendment.

Therefore, we have included conservation measures from the Lynx Conservation Assessment Strategy in the Revision and through this direction will conserve lynx habitat and provide conditions favorable to the recovery of lynx. Those measures are part of Chapter 1 of the Revised Plan and are listed below. A summary of potential impacts of these standards and guidelines to the timber resource follows.

Lynx Amendment Vegetation Standards and Guidelines

Standards 1. Unless a broad scale assessment has been completed that substantiates different historical levels of suitable habitat, limit disturbance within each LAU as follows: if more than 30 percent of lynx habitat within a LAU is currently in unsuitable condition, no further reduction of suitable conditions shall occur as a result of vegetation management project proposals. Fire use activities that restore ecological processes and maintain or improve lynx habitat are not limited by the 30 percent standard.

2. Timber management practices, such as timber harvest and salvage sales, shall not change more than 15 percent of lynx habitat within a LAU to an unsuitable condition within a 10 year period.

3. Maintain denning habitat within a LAU in patches generally larger than 5 acres, comprising at least 10 percent of the lynx habitat. Where less than 10 percent denning habitat is present within a LAU, defer management activities and practices that alter vegetation in stands that have the highest potential for developing denning-habitat structure in the future. Wildland fire Use activities that restore ecological processes and maintain or improve lynx habitat are not limited by the 10 percent standard.

Standards 4. Following a disturbance, such as blowdown, fires, insects, or pathogens mortality that could contribute to lynx denning habitat, do not salvage harvest when the affected area is smaller than 5 acres. Exceptions to this include

   a. Developed recreation sites, administrative sites, or authorized special use structures or improvements;

   b. Road and Trail corridors where public safety or access has been or may be compromised; and

   c. LAUs where denning habitat has been mapped and field validated, provided that at least 10 percent denning habitat is retained and is well distributed.

5. Pre-commercial thinning may be allowed only when stands no longer provide snowshoe hare habitat (e.g., self-pruning processes have eliminated snowshoe hare cover and forage availability during winter conditions with average snow pack).

Guidelines
1. Where little or no habitat for snowshoe hares is currently available, vegetation management practices in lynx habitat should be planned to recruit a high density of conifers, hardwoods, and shrubs preferred by snowshoe hares. Provide for continuing availability of foraging habitat in proximity to denning habitat.
2. Where recruitment of additional denning habitat is desired, or to extend the production of snowshoe hare foraging habitat where forage quality and quantity is declining due to plant succession, vegetation management practices should retain sufficient vertical diversity, standing dead trees and coarse woody debris. The juxtaposition of denning and foraging habitat should be maintained or improved.

Lynx vegetation standard #1 is not expected to reduce timber harvest activities on the Forest. Currently the highest level of unsuitable lynx habitat on any LAU on the Forest is 4%.

Effects of lynx vegetation standard #2 are not expected to have a significant impact on the timber program on the Forest. Currently no lynx analysis unit exceeds 4% of unsuitable lynx habitat.

Table 3-198. Unsuitable lynx habitat by lynx analysis unit.

Lynx Analysis Unit Name	Total Acres	Acres of Non Habitat	Acres of Currently Unsuitable Habitat	%Unsuitable Habitat
Battle Creek	44,500	3,836	64	0.14
Bow River/Pass Creek	55,155	7,286	2,350	4.26
Cedar/Brush	45,100	3,459	1,825	4.05
Encampment River	1,399	158	0	0.00
French/Upper Douglas	57,677	6,571	2,396	4.15
Green Mountain	32,854	1,845	744	2.27
Little Snake River	2,764	211	0	0.00
Northeast Snowy Range	54,717	8,503	1,042	1.90
Upper Sierra Madre	45,053	952	1,955	4.34
Total	**339,220**	**32,820**	**10,376**	**3.06**

The following table displays the acreages and percentages of lands suitable for timber harvest in each LAU by alternative. The Alternatives with the most potential to be impacted are Alternatives A, B and C with 47-57% of the LAUs suitable for timber production. Alternatives D DEIS, D FEIS and E have 38-41% and Alternative F 24%.

Table 3-199. Acres and percent of suitable timber within lynx analysis units in timber production management areas.

Lynx Analysis Unit Name	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
Battle Creek	10,416 23%	7,420 17%	4,253 10%	1,580 4%	929 2%	1,371 3%	115 0%
Bow River/Pass Creek	33,627 61%	25,548 46%	27,051 49%	25,554 46%	25,503 46%	25,503 46%	21,941 40%
Cedar/Brush	30,754 68%	27,258 60%	27,792 62%	27,471 61%	26,219 58%	23,581 52%	13,906 31%
Encampment River	1,005 72%	805 58%	1,005 72%	668 48%	668 48%	668 48%	516 37%
French/Upper Douglas	41,068 71%	36,994 64%	37,092 64%	34,275 59%	34,299 60%	30,694 53%	18,419 32%
Green Mountain	15,078 46%	13,229 40%	12,445 38%	11,037 34%	11,801 36%	7,762 24%	6,356 19%
Little Snake River	1,350 49%	1,337 48%	1,337 48%	1,028 37%	1,022 37%	1,028 37%	0 0%
Northeast Snowy Range	30,746 56%	22,588 41%	19,294 35%	16,529 30%	17,825 33%	17,000 31%	6,975 13%
Upper Sierra Madre	29,899 66%	29,146 65%	28,010 62%	21,250 47%	19,214 43%	19,615 44%	11,987 27%
Total Acres	**193,943**	**164,325**	**158,279**	**139,392**	**137,479**	**127,222**	**80,215**
Total Percent	**57%**	**48%**	**47%**	**41%**	**41%**	**38%**	**24%**

Timber activities affecting lynx habitat suitability are limited to regeneration harvests such as clearcutting and seed tree cuts. These would be most prevalent in lodgepole pine rather than spruce fir habitat types. The majority of these LAUs are higher elevation forests with a spruce fir component of approximately 50%. Consequently, it is expected that this standard will have minimal potential impacts on the overall timber resource on the forest.

In addition, snowshoe hare seem to prefer stands that have large components of relatively dense, small-diameter trees with crowns extending above the snow and available for the hare to browse during winter months (LCAS, 2000). This generally translates to trees over 5 feet tall and with crown basal heights of 10 feet or less. This means that a relatively short time frame is required for regeneration cuts to achieve suitable habitat levels. As such, long term impacts to timber production will be minimal; however, short-term delays could result during the recovery period of regeneration harvests if LAUs were to reach the 15% unsuitable habitat level within a decade at the same time.

Effects from lynx vegetation standard #3 are expected to be minimal on the Medicine Bow National Forest. As indicated in the following table, the majority of LAUs on

the Forest are well above the 10% denning habitat requirement. Harvest in the Encampment River and Little Snake River LAU could be limited in all Alternatives due to their relatively small size and limited denning habitat.

Table 3-200. Current denning habitat.

Lynx Analysis Unit Name	Total Acres	Acres of Denning Habitat	% Denning Habitat
Battle Creek	44,500	13,792	30%
Bow River/Pass Creek	55,155	15,137	27%
Cedar/Brush	45,100	11,623	26%
Encampment River	1,399	142	10%
French/Upper Douglas	57,677	12,657	22%
Green Mountain	32,854	10,112	31%
Little Snake River	2,764	186	7%
Northeast Snowy Range	54,717	17,119	31%
Upper Sierra Madre	45,053	8,849	20%
Total	**339,220**	**89,617**	**26%**

Effects from lynx vegetation standard #4 could substantially increase the size of insect infestations resulting from blowdown and small infestations, resulting in significant loss of trees and increases in fuel loads.

Effects from lynx vegetation standard #5 would result in essentially no pre-commercial thinning within lynx habitat for an indefinite period. For those management areas where commercial timber production is a goal, reduced production of sawlog-sized material would occur. Lodgepole pine would be affected to the greatest degree.

Shaw states that delaying thinning to age 50 will result in significant fuel loading and post-harvest wind/snow damage (Shaw 2002). In his research, live crown ratios on codominant crown classes at age 50 drop from an average of 76 percent on thinned stands to 50% on unthinned. Elimination of thinning at a young age will likely deter stand progression to large stand structure, probably not moving beyond a 3C Habitat Structural Stage.

Effects from lynx vegetation guideline #1 has the potential for allowing better regulation of LAUs within the bounds of lynx vegetation standards 1-3, thereby providing habitat over time.

Effects from lynx vegetation guideline #2 are expected to be relatively minor due to the current levels of denning habitat on the Forest.

Effects from Other Standards and Guidelines

Many standards and guidelines have the potential to effect timber harvest at the project level depending on site-specific conditions. The effects of standards not specifically modeled in SPECTRUM, or discussed in this section, are expected to have only minor effect on harvest levels when considered at the forest-wide scale.

In addition, some of these standards and guidelines are difficult to accurately model at the Forest-wide scale due to overlapping guidelines. For example, Forest-wide Wildlife Guideline #2 for maintaining or increasing security areas, has the potential to effect harvest levels, however it is expected that many of these areas will overlap with stands being managed for other objectives such as old growth, or occur in management areas with other resource emphases.

Effects from Travel Management

Most of the management area allocations for timber management occur in previously roaded areas. As a result, there will be more road reconstruction than construction needed to harvest timber. Based on past road construction and reconstruction data on the Forest, it is estimated that future harvest on the Medicine Bow will require on average 0.0019 mile/1 acre harvested of road construction and 0.0042 mile/1 acre harvested of reconstruction. Future road decommissioning on the forest is not expected to have a significant impact on the timber management program since most decommissioning will take place on unclassified roads.

Cumulative Effects

The cumulative effects on timber management activities are generally limited to within the Forest boundary. For purposes of this analysis, the duration of effects are limited to 50 years. This is due to modeling limitations which can not be expected to accurately predict effects in the future due to the many unpredictable variables such as climatic changes and timber markets.

Cumulative activities identified as having potential to effect timber outputs include the beetle epidemics on the Routt National Forest, roadless area management, State and private forest activities, and the Timber Working Circle or timbershed.

About 303,000 acres of private and state owned land are scattered within the boundaries of the Medicine Bow National Forest. While portions of these lands have been harvested and will be harvested in the future, their contribution to timber supply as a whole is expected to be small since most private ownerships are held for recreational purposes rather than timber production. State ownerships could provide a higher level of wood fiber. National forests other than the Routt and Medicine Bow have typically provided some, but not significant volumes to Wyoming sawmills in the past.

The potential effects of beetle epidemics on the timber resource could result in a short-term increase in harvest based on salvage operations. Long-term impacts could result in a decrease in supply depending on the amount of area impacted. Based on normal climatic conditions, ranking of potential risk by alternative from highest to lowest is F, E, D DEIS, D FEIS, C, B and A. Under severe climate conditions such as extended drought, alternative impacts are not expected to be significantly different.

Impacts from Roadless Area management are discussed in the general effects section. Long-term impacts to timber management if the Roadless Area Conservation Rule is implemented would preclude future timber management options and would be the same for all alternatives.

The SPECTRUM timber model generates an estimate of habitat structural stages by decade based on harvest activities. These estimates do not include any potential changes to structural stages from insects, diseases or fire. The following table displays acres of habitat structural stages estimated to occur for commercial timber species on suitable lands at the end of the first decade and at the end of the fifth decade.

These estimates indicate that all alternatives result in a generally regulated distribution of habitat structural stages on suitable lands when expressed as a percentage of suitable lands within that alternative. Because Alternative F does not include clearcutting, acres of habitat structural stages 1 are zero by the 5th decade and at negligible levels for structure stage 2.

All alternatives demonstrate an increase in structure stage 5 from present conditions. This is due primarily to modeling constraints, and specific analysis unit conditions. In addition, the current levels of structure stage 5 was an added component to the RIS database and has not been entirely updated.

Table 3-201. Acres and percent of habitat structural stages of timber species on suitable lands for end of 1st decade over end of 5th decade.

Size Class	Alt A	Alt B	Alt C	Alt D DEIS	Alt D FEIS	Alt E	Alt F
1 Grass/ Forb	27,527 (6%)	29,002 (7%)	28,101 (7%)	26,822 (8%)	27,330 (8%)	25,453 (9%)	15,458 (9%)
	39,521 (9%)	44,561 (11%)	39,903 (10%)	38,127 (11%)	32,400 (10%)	31,948 (11%)	0 (0%)
2 Seedling/ Sapling	35,681 (8%)	35,920 (9%)	34,849 (9%)	33,854 (10%)	33,933 (10%)	30,628 (10%)	18,227 (11%)
	23,489 (5%)	26,635 (6%)	24,852 (6%)	23,032 (7%)	22,453 (7%)	21,115 (7%)	376 (.2%)
3 Pole	144,398 (31%)	123,068 (30%)	106,209 (28%)	102,523 (31%)	100,772 (31%)	87,487 (30%)	55,393 (32%)
	124,692 (27%)	113,067 (27%)	105,689 (27%)	104,784 (30%)	102,952 (31%)	95,255 (32%)	52,419 (30%)
4 Late Succes-sional	227,662 (49%)	202,324 (49%)	181,834 (48%)	147,313 (44%)	139,376 (43%)	127,352 (43%)	73,536 (43%)
	113,059 (34%)	105,316 (25%)	95,207 (25%)	86,807 (25%)	80,912 (25%)	70,201 (24%)	62,380 (36%)
5 Old growth	27,560 (6%)	26,612 (6%)	26,665 (7%)	25,608 (8%)	25,562 (8%)	24,071 (8%)	9,884 (6%)
	157,704 (34%)	134,805 (32%)	119,331 (31%)	91,750 (27%)	91,495 (28%)	78,494 (26%)	58,491 (34%)

Source: SPECTRUM model.

Communities

Introduction – The human environment includes the natural and physical environment and people's relationship to it. The relationship between the Medicine Bow National Forest and the local lifestyles and economies is interdependent and complex. Year-round, residents and nonresidents utilize Forest resources to make a living, find solace, and experience a good deal of their social life. Each relationship is unique, yet the attachment is always the same. Some communities have a more direct relationship than others. This section will cover all affected and neighboring counties. Affected counties include: Albany, Carbon, Converse, and Jackson (CO). These are included in the economic modeling, and the neighboring counties, Laramie, Natrona, Platte, and Larimer (CO) are included based on their influence on or from Forest uses. The Map (County Locations) shows the counties discussed in this section.

The social and economic assessments for the forest plan are detailed descriptions of the relationships between and among the counties and the Forest. These documents are on file in the Supervisor's Office of the Medicine Bow National Forest.

This portion of the FEIS is separated into two sections: the first section, **Communities of Place**, includes the subsections *Demographics, Economics,* and *Local Governments*. *Demographics* includes such topics as population, environmental justice, and attitudes and values. The last section, **Financial and Economic Efficiency,** examines consequences of alternatives from the perspectives of taxpayers and society as a whole.

Changes between Draft and Final

In response to comments on the Draft EIS, the Communities section has been modified for the Final EIS. Some of the more substantial changes include:

- Revising the timber supply, mill capacity and resulting impacts
- Revising estimated snowmobile use and resulting impacts
- Streamlining the history narratives of communities
- Dropping the Community of Interest section because of minimal comment or interest
- Adding a Tribal component throughout the demographics subsection
- Revision of tax consequences to local governments
- Adjustment of the key indicators

Legal and Administrative Framework

The **National Environmental Policy Act (NEPA)** requires that consequences to the human environment be analyzed and disclosed. The extent to which these environmental factors are analyzed and discussed is related to the nature of public comments received during the public involvement process, from scoping through preparation of the FEIS.

The **National Forest Management Act** requires the examination of local community impacts as well as economic cost-efficiency considerations when preparing or revising a forest plan.

Executive Order 12898 requires that planning alternatives be assessed to determine whether they would disproportionately affect minority and low-income populations. The concept is called "environmental justice."

The **Secure Rural Schools and Community Self-determination Act of 2000** specifies how states and counties will be compensated for impacts associated with visitors to National Forest System lands.

The **Payments in Lieu of Taxes Act of 1976** authorizes compensation to counties in lieu of property taxes that cannot be levied against federal lands within their jurisdiction.

The **National Historic Preservation Act** (NHPA) protects historic and archaeological values during the planning and implementation of federal projects (CFR 36 800 and CFR 36 60). The law requires the location and identification of cultural resources during the planning phase of a project, a determination of "significance" for potentially affected resources, and provisions for mitigation of any adverse effects to significant sites that may be affected. Consultation with associated Tribal members is required to determine if cultural resources that might be affected by a project are of significant cultural value to the Tribe.

The **American Indian Religious Freedom Act** (AIRFA) protects American Indian rights to exercise traditional religions, including access to sites and freedom to worship through ceremonial and traditional rites.

Native American Grave Protection and Repatriation Act 0f 1990 (NAGPRA) – American Indian burials and sacred items are protected by this act. If human remains or objects of cultural patrimony are discovered, this law requires that the Indian Tribe most closely related to the individual will be consulted and they will determine the appropriate treatment of the remains.

Executive Order 13007 (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.

Key Indicators

- Change to resident or Native American life-styles
- Employment
- Income
- Local government fiscal impacts
- Present net value

Communities of Place

Demographics

AFFECTED ENVIRONMENT

Geographic Location

The following map shows the location of each of the counties surrounding the Forest, for which this analysis will consider. The Medicine Bow National Forest is located among the centers of commerce in southeast Wyoming, and approximately 150 miles north of the Denver Metropolitan area.

Map 3-27. County locations.

Human History, Customs, and Culture

Knowing the history and culture of an area can often provide valuable context for understanding communities and how current or future events may shape their lives. No two communities in the planning area are alike, though many of them share a common history. What follows are brief historical and cultural profiles of the communities in the planning area.

Native American Tribes

The Medicine Bow National Forest lies on the western edge of the area inhabited by multiple Great Plains Indian Tribes. It is also located on the northeast edge of lands inhabited by multiple Great Basin Tribes from Idaho and Utah.

Roughly, that historic home range stretched from the area around Red Lodge, Montana south to New Mexico, east along the Arkansas River into present day Kansas, then north to the Black Hills and Devils Tower. Their residence and culture are important to understanding the history of the planning area. This area was a crossroads that sustained traditional life. This makes the Medicine Bow National Forest an area of traditional use by many Tribes.

Modern Tribes associated with the Great Plains Tradition include the Northern and Southern Arapaho, Northern and Southern Cheyenne, and the Sioux Nations of the Ogalala, Brule, Cheyenne River, and Standing Rock. The modern Tribes associated with the Great Basin Culture include the Eastern Shoshone and Northern Ute.

The Tribes are concerned over any plan to foreclose on future potential uses by their members, and they want access when in the area. Tribal people consider their uses part of multiple use, "part of the public in public lands"**,** but make a distinction between their uses and others. The difference is the spiritual dimension they assign to all they may do on National Forest land.

The area that is now the Medicine Bow provided medicinal and edible plants and lodgepole pine for teepee poles. Native Americans used these resources when they were in the area. Plants that remain important to Wind River people at this time include:

Artemesia ludoviciana (Cutweed sage wort, also called white sage or sweet sage) is still used in ceremonies. The supply on the reservation is gone, so Tribal members now gather what they need from the Tongue River area of Montana. The species is found widely throughout Wyoming between elevations of 3,500-8,500 feet: it is therefore likely *Artemesia ludoviciana* occurs on the Medicine Bow.

Juniper trees are used for smudges. Many junipers on the reservation are diseased, so their numbers there are declining**.**

Cattails are used to cushion the ground during worship ceremonies. They are declining in number due to drought and pressure from use.

Lodgepole pine is harvested for teepee poles. In recent years, Tribal members have traveled to the Estes Park, Colorado area to harvest young lodgepole, because this is a traditional use area. The Arapaho-Roosevelt National Forest has supplied pole permits.

Berries, such as chokecherries, currants, and buffalo berries are still valued, though they are declining.

Tribal members still use certain mineral deposits in some soils to produce a dye, ochre, which has traditional use value.

Treaties, Congressional and Executive actions have lead to the removal of these people from traditional lands and resources within the Medicine Bow National Forest.

The Sioux, Gros-Ventre, Assinaboines, Arrivckaras, Mandan, Blackfoot, Crow, Cheyenne and Arapaho signed the Fort Laramie Treaty of 1851. In this treaty each of the Tribes acknowledged their territories. The Cheyenne and Arapaho defined their territory as "Commencing at the place where the road leaves the North Fork of the Platte River: thence up the Platte River to its source; thence along the main range of the Rocky Mountains to the head waters of the Arkansas River; thence down the Arkansas River to the crossing of the Santa Fe Road; thence in a northwesterly direction to the forks of the Platte River, and thence up the Platte River to the place of the beginning" (Kappler, 1904). This places portions of the Medicine Bow National Forest in the area claimed by the Cheyenne and Arapaho.

Several members of the Cheyenne and Arapaho tribes signed the Treaty of Fort Wise in 1861. This treaty set aside a reservation in the Arkansas River Valley for the exclusive use of the Tribes. At this time the Arapaho and Cheyenne agreed to "cede and relinquish to the United States all lands now owned, possessed, or claimed by them, wherever situated, except for a tract to be reserved" (Kapplers, 1904) as a reservation.

The Eastern Shoshone and the Bannock Tribe of Idaho signed the Treaty of Fort Bridger in 1868. This treaty set the boundaries for two reservations, one for the Bannock in Idaho (Fort Hall), and one in the Wind River Mountains of Wyoming, the Wind River Reservation.

In 1868 the Tabaquache, Muache, Capote, Weeminuche, Grand River, and Uintah bands of the Ute Indians signed a treaty with the United States which set the boundaries of the Ute Reservation in Colorado and established two Indian Agencies, The White River Agency near Meeker, Colorado and the Los Pinos Agency on the Rio De los Pinos. The Ute bands relinquished all claim and rights to the lands in Colorado and Wyoming not contained in the reservation.

Carbon County:

Rawlins is named for General John A. Rawlins. While scouting the route for the Union Pacific Railroad in 1867, Rawlins expressed the desire for a drink of cool water and said if ever something were named for him, he hoped it would be a spring of water. When the survey party discovered a spring flowing fresh, cool water, they immediately called it Rawlins Spring. The community which grew up around the spring bore the same name. The name was later shortened to Raawlins. In 1886, the town was incorporated and designated the Carbon County seat.

Encampment: Early in 1897 Ed Haggarty, a discovery of a rich copper source near the Encampment River gave rise to the town of Grand Encampment, Wyoming. Grand Encampment was later changed to Encampment upon request from the Postal Service to shorten the name. The town was originally incorporated in January 1898.

The discovery of copper made mining the chief economic endeavor for the citizens of Encampment. No fewer than 63 copper mining companies, along with numerous independent mining engineers and consultants opened their offices in Encampment (Patera 1991). Large-scale mining ended, however, when legal matters forced the closing of the Rudefeha mine in 1907.

For decades after the mining boom, Encampment survived as the center for ranches established in the area, with some employment available from small timber and mining operations. Since WWII, there has been a growing tourist trade that has helped the town survive the ensuing decades.

Riverside was established in 1901, but it was originally called Dogget from May of 1900 until January of 1901 (Moulton 1982). Located adjacent to the town of Encampment, Riverside's fortunes were directly tied to the copper industry. The Boston-Wyoming smelter (which was actually within the town limits of Encampment) was the catalyst of both economic and social life for Riverside. Between 1906 and 1908 three fires at the Boston-Wyoming smelter drove the company into financial ruin. "The smelter never reopened, and Riverside was left stranded, ready for the wedding that never occurred"(Patera 1991). Postal service to Riverside was discontinued in 1910.

Saratoga: The town of Saratoga, Wyoming has long been a crossroads and a destination for American Indians and European-American settlers. American Indians reportedly used the natural hot springs of Saratoga for medicinal purposes (Moulton 1995). The State of Wyoming commandeered the hot springs from their traditional American Indian users and constructed a mineral pool at the current site of Saratoga. The community that built up around the springs was named "Warm Springs" but was changed to Saratoga in 1884, after the resort town of Saratoga Springs, New York (Moulton 1995).

Saratoga's early history was rooted in the mining industry. Much of the area surrounding Saratoga was also used for livestock grazing. During the 1940's, a

Civilian Conservation Corps camp was established in Saratoga, and workers spent five winters there, their duties including the construction of the Barrett Ridge winter recreation area (Thybony 2001). Recreation and the hot springs, continue to be the primary attractions of present-day Saratoga.

Elk Mountain owes its location to the development of early transportation in the area. The site proved to be an ideal spot for crossing the Medicine Bow River, and also a place to stop and camp. In approximately 1860, the formation of the Overland Stage Line solidified this Medicine Bow crossing by making it a stage stop. The old stage station served as a central location around which to build, and in 1877 a post office was built to provide service for the growing area.

Proximity to the Union Pacific Railroad and the rich rangelands surrounding Elk Mountain encouraged cattle and sheep grazing. Mining also played an important role in the growth of Elk Mountain in the second half of the 19th century. 1897, copper was found on the west side of Elk Mountain. The Town of Elk Mountain was nicely located as an entrance point into the mountain range.

Elk Mountain became accessible to automobile travel when the dirt road between Laramie and Rawlins was improved to let cars through. The town promoted itself as a 'must see' sight for tourists and it remained a popular destination point through the mid 1990's.

Hanna: Mark Hanna, a Union Pacific Coal Company employee, founded the town of Hanna in 1889. He reportedly said that the mines of Hanna "could supply the nation with coal for a century" (Anderson 1941). Despite such grand intentions, Hanna started out as a small tent town.

As the coal industry grew, so did the town of Hanna. The town's population grew to 1,500 by 1893, and remained in that range for several decades to follow (De Haan 1972). The Union Pacific gave the town of Hanna water rights and land in December, and Hanna began to survive on its own. Ranching and other occupations aided in its survival. The energy boom of the early 1970's prompted a renewed interest in coal. Hanna grew into a mining town again, as seven major mines were reopened.

Sinclair was initially set up as a pump station in 1868, to provide a reliable source of water for the railhead station in Rawlins. The pump station was named Grenville, after the railroad's chief engineer. The area was not used much in the years that followed except for sheep and cattle grazing.

In 1922, the Grenville pumping station was chosen for a new oil refinery. The Producers and Refiners Corporation used the first letters in their name to name the new town, Parco. Initially, living conditions in Parco were primitive with no plans for improvement. To address the poor living conditions, the corporation contracted with a Denver firm in 1923, and blueprints were drawn up for the master planned community. Parco rapidly became a model for all other company towns. The first

general election was also held in 1924. The formal opening of Parco was August 6-8, 1925. The cost of building Parco and the refinery was said to be $10 million.

In 1934, the community and refinery were sold to Sinclair Refinery. The community did well with the change of ownership and was given its new name of Sinclair in 1942.

The Little Snake River Valley includes Baggs, Savery, and Dixon: Human use of the Little Snake Basin is estimated from 6,000 to 8,000 years ago. By 1800 five Indian tribes including Shoshone, Sioux, Utes, Arapaho, and Cheyenne tribes used the Little Snake River Basin. Many tribes hunted the area due to the abundance of game. While many parties of early trappers traversed the northern sections of Carbon County and the lower Platte Valley the first recorded instance of an organized party in the Little Snake Basin was the party of three men in May of 1839.

The first cattle entered the Little Snake Basin in 1871. From 1975 to 1885, cattle numbers increased dramatically in the Little Snake basin. Ranching was directly responsible for the earliest permanent settlement of the Little Snake Basin. It has been the mainstay of the local economy since the 1870's and the dominant use of the land. Many ranches in the basin have territorial water rights for irrigating lands (prior to Wyoming becoming a state). Consequently, the customs and culture of the ranching industry dominate the sociology in the basin. Ranching is the Little Snake Basin is heavily dependent on federal lands for a significant portion of the year. Every ranch in the valley has either a BLM and/or USFS grazing permit.

Miners were attracted to the valley in the late 1860's when gold was discovered in the Hahn's Peak region in the Routt NF. By the late 1890's hard rock mining was well underway in the Sierra Madre Mountain Range. Copper was the primary mineral being mined. Several towns sprang up at the headwaters of the Little Snake basin including Old Battle, Rambler, and others.

The periods from 1954-1964 and 1977-1982 were primarily associated with oil. The first discovery and production of oil in the basin occurred in 1954. Oil and Gas exploration, development, and production have become an increasingly important component of the local economy and tax base in the Little Snake Basin. From the mid 1990's to the present, natural gas has been the hydrocarbon most prevalent in development and production. Much of the Little Snake River Basin is underlain with coal and substantial coalbed methane reserves, bringing new exploration to the area; over 200 exploratory wells have been drilled in the last two years. The BLM is currently working on an EIS for coalbed methane in the area, with a maximum potential of 3,880 exploratory wells. In the late 1960's and 70's low grade uranium was mined west of Baggs.

The oil and gas exploratory phase created a boom and bust economy. Oil and gas exploration, development, and production have had little direct effects on the Forest. However, the majority of the workers employed in this area spend a substantial

amount of their time on the Forest in the forms of hunting, fishing, camping, horseback riding and snowmobiling.

Personal and commercial timber harvest have occurred in the Little Snake River basin on the MBNF since the early 1800s. Today commercial and personal use of timber products on MBNF lands play a key role in the customs, culture, and economy of the communities in the Little Snake River Basin as well as Carbon county as a whole.

Hunting is the single largest recreational activity in the Little Snake Basin and the Little Snake River Basin. Historically, the abundance of game attracted Indian tribes and trappers. As early as 1839, easterners were coming to the area soley to hunt. With the establishment of 1860s, market hunting became a prevalent industry in the area. By the 1890s, hunting had decimated game populations in the region. The state regulating hunting at the turn of the century, and game populations continue to increase through the 1990s, with peak high populations of elk, deer, and antelope occurring in the 1990s. Sport or recreational hunting has again become a viable industry in the Sierra Madre Mountain range.

Albany County:

Laramie: The location of the Laramie townsite came about by chance when the Chief Engineer of the Union Pacific Railroad convinced the railroad to change their route to cross over the smaller Laramie Mountains instead of the Rocky Mountains. Union Pacific officials surveyed the proposed route, and the result was the initial townsite of Laramie, consisting of one hundred blocks, neatly laid out. The city of Laramie was officially established in May of 1868.

Business grew rapidly in Laramie an dby 1870, available professional services included a public notary, county clerk and justice of the peace, several attorneys, two physicians, and a dentist (Homsher 1965). Union Pacific wages provided the chief source of income for Laramie citizens in the 1870s. By 1872, the Union Pacific Railroad had built an extensive plant in Laramie.

The livestock business had an early start around Laramie. Cattle and sheep ranching began in earnest almost as soon as the railroad track was laid. Another important industry of the time was lumbering. In 1872, the Union Pacific spent over $150,000 in Laramie for railroad ties, many used to repair the line east of Laramie (Homsher 1965). Laramie's natural resources encouraged further economic growth into the 1890s and pat the turn of the century.

Laramie was chosen in 1869 to be a location for a Federal Penitentiary. A location was selected west of town near a water supply and where there was also stone for the building. Prisoners worked in the brickyard, stone quarry, prison garden and, in the winter, put up ice from the river.

It was March 4, 1886, the bill creating the University of Wyoming was signed into law. The cornerstone was laid September 27, 1886. Throughout its history, the University of Wyoming has been a center of activity for Laramie and Wyoming as a whole. For many years, the University has been the major ecnomic stimulus for Laramie and continues in that role today (Mason 1987).

Centennial: In 1875, some hunters reportedly happened upon a gold vein near the base of Centennial Mountain (Thybony 2001). This first tiny settlement was named Centennial in honor of the coming year's 100-year celebration festivities, and was actually located one mile southwest of the present town of Centennial.

While Centennial can largely be characterized by its long history of logging, mining, and grazing ventures, tourism and recreation have contributed to the growth of the area both historically and presently. Centennial and the surrounding area were used recreationally as early as 1914. Centennial and its nearby mountains continue to be frequented by skiers, campers, and hikers, making it a year-round source of recreational opportunities.

Albany: The community at Albany arose in response to construction of the Laramie, Hahn's Peak and Pacific Railway. The railhead at Albany (or New Albany) provided a convenient, central location where local miners and logging companies could take advantage of the more efficient transportation system to get their products to markets in Laramie and beyond.

By 1911, a post office, two boarding houses, a freighting company, restaurant and a general store had been established at Albany, and the community boasted a population numbering eleven.

The 1920s and 1930s witnessed an increase in recreational use in the area. During this period, a summer home tract was established at Albany on Forest Service owned land. Many existing structures were permitted for use as summer homes. Over the years, most of these residences have either been remodeled and modernized or completely replaced with modern structures.

Jelm, Wyoming was ideally situated to be the gateway into the Medicine Bow Mountains, which had become a primary source for ties and railroad timbers. The first recorded mining in the ara was in April 1874 and in March 1875, the first recorded homestead in the Jelm area was established.

Quiet mining continued until the spring of 1880 when three men arrived in Laramie with a sack of ore they claimed to have found in the Jelm area. They stopped off at the Laramie Daily Sentinel and the result was a story titled "GOLD! GOLD!! GOLD!!!" The release of the story created a rush to Jelm. Claims were bought with great speed.

However, by some of the men knew they had been fooled. The ore that had precipitated the gold rush had been very rich, however it was not from the Jelm area. By June there was a lawsuit, but not in time to stop the boom. The summer of 1881

produced very little from the mines. The Boom was over, after only one year, and by the end of 1881 most of the miners had left. A number of determined people stayed on and the town was never completely deserted until the 1930s.

Rock River came into existence when the Union Pacific Railroad was rerouted in 1898, the town was incorporated in 1910. In 1919, oil was discovered 14 miles west of town in what is now called McFadden. The economy flourished and hopes ran high that a refinery would be established, but instead the oil was piped to a refinery in Laramie. With this change, the "lively cow town" of Rock Creek was abandoned as a railroad stop. The nearest new station to Rock Creek was named Rock River by the Union Pacific Railroad and many of the business operators of Rock Creek moved to Rock River.

Douglas: The first residents of Douglas initially settled along the Platte River near the mouth Antelope Creek. This settlement was generally referred to as the town of Antelope and soon became a center of commerce for area ranchers.

After the townsite of Douglas was officially mapped and lots were put up for sale in September 1886, the town of Antelope was packed up and moved to present-day Douglas. Douglas was incorporated in 1887, its population was down to 805; by 1907 the population was nearly 2000.

In the beginning and for many years to come, Douglas was primarily an agricultural town. The general character of Douglas changed, however, with the development of the fossil fuel industry. Though still a relatively small town by American standards, it is no longer a town where 'everybody knows everybody'. Douglas' population was only 3,000 in 1970, and it now stands at about 5,700.

Glenrock: In its formative years Glenrock was referred to as Deer Creek, due to its location at the mouth of Deer Creek on the North Platte River. Deer Creek would become a favored Platte River crossing point of nineteenth-century explorers and pioneers and played a key role in many episodes of American frontier history. For example, as Eugene Potter points out in Pages from Converse County's Past, Glenrock "...has the distinction of setting astride three of America's most famous pioneer trails"(Potter: 1986: 68) These would be the Oregon, California and Mormon trails. It wasn't until 1886 that the town was named Glen Rock; the first evidence of the name Glenrock dates to December of 1887 (Potter 1986).

During the early years, Glenrock grew into a small agricultural community. After the Fremont, Elkhorn and Missouri Valley Railroad was extended to Glenrock in 1887, coal mining became established as a lucrative business opportunity. In the early twentieth-century, in the midst of a coal boom, the population of Glenrock was about 500. Between 1906 and 1915, however, the population decreased to about 200 as the demand for the soft coal came to a halt (Potter 1986; (Glenrock Independent 1984).

In 1915 and 1916, Glenrock experienced an oil boom and the population ballooned to about 5,000 virtually overnight (Glenrock Independent 1984); Potter 1986). Although the boom would eventually slow down by about 1918, the oil industry continued to develop in Glenrock. with the establishment of several major refineries such as Standard Oil, Continental Oil and others (Bonar 1984).

By the 1950s, the oil industry was waning in Glenrock. Once again, however, there was an answer to Glenrock's industrial needs - the Dave Johnston Power Plant. Completed in 1964, it is still the top employer in town. More recently, since the 1970's, uranium mining has become a lucrative industry for Glenrock as well. The population of Glenrock presently stands at about 2,400.

Population

Population figures from the 2000 Census indicate modest growth since 1990 in some communities (Laramie), declines in some communities in Carbon County, and relatively large growth in others (Baggs, Rock River, Rolling Hills, Evansville, and Mills). Actual population increases and decreases are relative to the community.

Table 3-202. 1990 and 2000 census population of communities around the Forest.

Town	County	April 1990	April 2000	Change 1990- 2000	Percent change 1990-2000
Laramie	Albany	26,687	27,204	517	1.90%
Baggs	Carbon	272	348	76	27.9%
Dixon	Carbon	70	79	9	12.9%
Encampment	Carbon	490	443	-47	-9.6%
Hanna	Carbon	1,076	873	-203	-18.9%
Medicine Bow	Carbon	389	274	-115	-29.6%
Rawlins	Carbon	9,380	8,538	-842	-9.0%
Riverside	Carbon	85	59	-26	-30.6%
Saratoga	Carbon	1,969	1,726	-243	-12.3%
Sinclair	Carbon	500	423	-77	-15.4%
Walden	Jackson (CO)	890	734	-156	-17.5%
Douglas	Converse	5,076	5,288	212	4.2%
Glenrock	Converse	2,153	2,231	78	3.6%
Cheyenne	Laramie	50,008	53,011	3,003	6.0%
Bar Nunn	Natrona	835	936	101	12.1%
Casper	Natrona	46,742	49,644	2,902	6.2%
Evansville	Natrona	1,403	2,255	852	60.7%
Mills	Natrona	1,574	2,591	1,017	64.6%

Town	County	April 1990	April 2000	Change 1990- 2000	Percent change 1990-2000
Guernsey	Platte	1,155	1,147	-8	-0.7%
Wheatland	Platte	3,271	3,548	277	8.5%

Source: U.S. Department of Commerce. U.S. Census Bureau, 2000.

Population Patterns – Trends in Population

Population projections indicate an upward trend in population estimated through 2020. As these estimates are based on previous years' population growth and declines, sudden increases due to economic forces aren't evident here. It's expected that Carbon County, while indicating a slight decline over the next two decades, can expect some increases due to a new 'boom' in gas production in the little Savery, Dixon, and Baggs area. Larimer County, Colorado is expected to nearly double its 1990 population by 2020 (Woods and Poole 2002); (Colorado Department of Local Affairs).

Age Classes

The age distribution of Wyoming's population approximates that of the U.S. The age distribution of population in Carbon, Natrona, and Laramie Counties' populations are almost a mirror of Wyoming's. Carbon County has a high concentration of young parents, and children; the population of the county is projected to age substantially by the year 2020. Platte and Converse Counties' age structure is similar to Carbon County, with the exception of the 20 to 34 year old age group, which accounts for a lower percent of total than the other counties. Albany County's young population is driven by enrollments at the University of Wyoming and Wyoming Technical Institute.

Environmental Justice

As required by Executive Order 12898, all federal actions must consider potentially disproportionate effects on minority and low-income populations. The following tables provide demographic statistics for identifying potential populations of concern. The first displays race and ethnicity, the second displays poverty.

Table 3-203. Racial component of the population of counties around the Medicine Bow, and neighboring counties, 2000.

County	Total Population	Hispanic Race	Black/ African American	American Indian /Alaska Native	Asian Pacific Islander	Some Other Race
Albany	32,014	7.5%	1.4%	1.9%	2.2%	3.4%
Carbon	15,639	13.8%	0.8%	1.9%	1.0%	6.4%
Converse	12,052	5.5%	0.3%	1.8%	0.4%	2.9%
Platte	8,807	5.3%	0.2%	1.2%	0.4%	2.1%
Laramie	81,607	10.9%	3.2%	1.7%	1.7%	4.9%
Natrona	66,533	4.9%	1.1%	1.8%	0.7%	2.5%
Wyoming	493,782	6.4%	0.1%	3.0%	0.9%	3.2%

Source: U.S. Department of Commerce. U.S. Census Bureau, 2000.

Families and persons are classified as below poverty if their total family income or unrelated individual income was less than the poverty threshold specified for the applicable family size, age of householder, and number of related children under 18 present. If the total income of a person's family is less than the threshold appropriate for that family, then the person is considered poor, together with every member of his or her family. If a person is not living with anyone related by birth, marriage, or adoption, then the person's own income is compared with his other poverty threshold.

The poverty thresholds are updated every year to reflect changes in the Consumer Price Index. The poverty thresholds are the same for all parts of the country – they are not adjusted for regional, state or local variations in the cost of living. Poverty status was not determined for institutionalized people, people in military group quarters, people in college dormitories, and unrelated individuals under 15 years old.

In both 1989 and 1999, Albany County had the highest poverty level among the selected counties. This is most likely associated with the large student population at the University of Wyoming. Carbon County and Jackson County were the only ones to experience a population decreased. Unfortunately, these same counties experienced the highest rate of poverty increases over the last decade. Natrona County had the largest increased in the number of individuals below the poverty level (749). Converse County had a modest population growth rate in the last decade, accompanied by a slower growth in residents below the poverty level. Both Laramie and Platte Counties had actual reductions in both the number and percent of individuals living below the poverty level.

Table 3-204. Percent of population below poverty level as compared with population changes.

	Percent Below Poverty Level			Population		
County	1990	2000	Percent Change	1990	2000	Percent Change
Albany	19.8%	21.0%	8.2%	28,867	29,439	2.0%
Carbon	10.0%	12.9%	16.0%	14,405	12,955	-10.1%
Converse	11.9%	11.6%	2.7%	7,563	7,969	5.4%
Platte	15.7%	11.6%	-20.8%	4,891	5,244	7.2%

Source: U.S. Department of Commerce. U.S. Census Bureau, 2000.

Tribal Communities

All of the Indian communities that rely on Forest products to maintain their traditional way of life are located on reservations that are so far from the Forest that they often are not considered to be locally affected communities. However each of the communities from these reservations is a minority community and has low to extremely low-income averages.

Northern Arapaho and Eastern Shoshone: The Wind River Reservation, located in Fremont, Hot Springs and Sublette Counties, is the closest reservation to the Medicine Bow National Forest. Home to the Northern Arapaho and Eastern Shoshone its exterior boundary encompasses 2.68 million acres. Agriculture and working directly for the Tribal government are the main sources of employment for Tribal members.

Tribal/Agency Headquarters	Ft. Washakie/Ethete, WY
Number of enrolled members (Arapaho and Shoshone)	5703
Reservation Service Population	4297
Unemployment rates	65%
Language	English, Arapaho, Shoshone

(Mni Sose Intertribal Water Rights Coalition, 2003)

Northern Cheyenne: The Northern Cheyenne Reservation was established by Executive Order in November of 1884. The exterior boundary of the reservation encompasses 444,775 acres of which 440,824 are Tribal owned or allotted. The major sources of employment on the reservation are in agriculture and working for the Tribal government. External sources of employment are in energy and mining operations.

Tribal/Agency Headquarters	Lame Deer, MT
Number of enrolled members	6,591
Reservation Population	4,371
Unemployment rates	46%
Language	English, Cheyenne

(Mni Sose Intertribal Water Rights Coalition, 2003)

Cheyenne River Sioux: The Cheyenne River Sioux Tribe Reservation was established by Congressional Act on March 2, 1889. This Congressional Act, known as the Great Sioux Settlement, identified all of the boundaries of the present day Lakota/Dakota reservations. The exterior boundary of the reservation encompasses 2,850,000 acres of which 1,615,500 are Tribal owned. The Cheyenne River Reservation is home to the Cheyenne River, Minnecoujou, Itazapco, and Two Kettle bands. Agriculture and working for the Tribal government are the main sources of employment.

Tribal/Agency Headquarters	Eagle Butte, SD
Number of enrolled members	12,000
Reservation Population	14,000
Unemployment rates	no data
Language	English, Lakota

(Mni Sose Intertribal Water Rights Coalition, 2003)

Crow Creek Sioux: The Crow Creek Sioux Tribe Reservation was established by Congressional Act on March 2, 1889. This Congressional Act, known as the Great Sioux Settlement, identified all of the boundaries of the present day Lakota/Dakota reservations. The exterior boundary of the reservation encompasses 225,000 acres of which 123,483 are Tribal owned. The Crow Creek Reservation is home to the Dakota and Yankton bands. Agriculture and working for the Tribal government are the main sources of employment. The Tribe also owns the Lode Star Casino, which is an additional source of employment.

Tribal/Agency Headquarters	Ft. Thompson, SD
Number of enrolled members	3,000
Reservation Population	2.816
Unemployment rates	no data
Language	English, Lakota/Dakota

(Mni Sose Intertribal Water Rights Coalition, 2003)

Lower Brule Sioux: The Lower Brule Sioux Reservation was established on March 2, 1889. The Great Sioux Settlement of March 2, 1889, identified all of the boundaries of the present day Lakota/Dakota reservations. The exterior boundary of the reservation encompasses 225,970 acres of which 109,943 are Tribal owned. Agriculture and working for the Tribal Government are the main sources of employment. The Tribe also owns and operates the Golden Buffalo Casino, which is an additional source of employment.

Tribal/Agency Headquarters	Ft. Thompson, SD
Number of enrolled members	2,502
Reservation Population	1,362
Unemployment rates	no data
Language	English, Lakota/Dakota

(Mni Sose Intertribal Water Rights Coalition, 2003)

Rosebud Sioux: The Rosebud Sioux Tribe Reservation was established by Congressional Act on March 2, 1889. This Congressional Act, known as the Great Sioux Settlement, identified all of the boundaries of the present day Lakota/Dakota reservations. The exterior boundary of the reservation encompasses 2,850,000 acres of which 1,615,500 are Tribal owned. Agriculture and working for the Tribal government are the main sources of employment. The Tribe owns and operates the Rosebud Casino, which is a source of employment.

Tribal/Agency Headquarters	Rosebud, SD
Number of enrolled members	15,438
Reservation Service Population	12,763
Unemployment rates	45%
Language	English, Lakota

(Mni Sose Intertribal Water Rights Coalition, 2003)

Santee Sioux: The Santee Sioux Tribe Reservation was established by Congressional Act on March 2, 1889. This Congressional Act, known as the Great Sioux Settlement, identified all of the boundaries of the present day Lakota/Dakota reservations. The exterior boundary of the reservation encompasses 9,449 acres of which 9,449 are Tribal owned or allotted. Agriculture and working for the Tribal Government are the main sources of employment.

Tribal/Agency Headquarters	Santee, NB
Number of enrolled members	2,500
Reservation Service Population	603
Unemployment rates	no data
Language	English, Dakota

(Mni Sose Intertribal Water Rights Coalition, 2003)

Sisseton-Wahpeton Sioux: The Sisseton-Wahpeton Reservation was established by Congressional Act on March 2, 1889. This Congressional Act, known as the Great Sioux Settlement, identified all of the boundaries of the present day Lakota/Dakota reservations. The exterior boundary of the reservation encompasses 2,850,000 acres of which 1,615,500 are Tribal owned. Agriculture and working for the Tribal Government are the main sources of employment. The Tribe owns and operates the Dakota Sioux Casino and Agency Bingo, and a plastic bag manufacturing company, which are sources of employment.

Tribal/Agency Headquarters	Old Agency Village, SD
Number of enrolled members	10,174
Reservation Service Population	4,730
Unemployment rates	59%
Language	English, Dakota

(Mni Sose Intertribal Water Rights Coalition, 2003)

Ute Indian Tribe (Northern Ute): The Uintah Reservation was established in 1861 by Executive Order of President Abraham Lincoln. The Ouray addition to the reservation was established in 1882 after the Yaparika and Uncompaghre bands were moved out of Colorado. The exterior boundary of the reservation encompasses nearly one million acres in the Uintah Basin of Utah. Agriculture and working for the Tribal government are the main sources of employment on the Uintah and Ouray Reservation. The Tribe owns and operates several businesses, which are sources of employment. The median income for Ute families is $14,500.

Tribal/Agency Headquarters	Ft. Duschesne, UT
Number of enrolled members	3120
Reservation Population	2650
Unemployment rates	no data
Language	English, Nooche

(Utah Division of Indian Affairs, 2003)

Attitudes and Values

In order to estimate potential affects to residents, it is important to identify and consider their values and lifestyles. Three studies were done to help with this part of the analysis: The County Land Management Study (University of Wyoming 1998), a Public Opinion Survey by the Wyoming Department of Agriculture (University of Wyoming 2002), and a study done by the University of Wyoming for this plan revision (Blevins and Jensen 2002). The County Land Management Study is a 1998 survey of residents that was developed by a group of representatives from each county (planners and commissioners), the Forest Service, and the University of Wyoming.

The Wyoming Department of Agriculture Public Opinion Survey was meant to study how Wyoming citizens perceive the state's agriculture. The survey instrument was based on one developed by three professors at the Colorado State University, College of Natural Resources. The 2001 questionnaire was a fine-tuned instrument as a result of testing an original in 1996. The survey is a random sample of Wyoming households with telephones, rather than focusing on nearby residents. Ninety one percent of those interviewed did not currently live or work on a farm or ranch, 51 percent had never worked or lived on a farm.

The study done by Blevins and Jensen was adapted from a study done on the Chequamegon National Forest. These documents are on file in the Medicine Bow National Forest Supervisor's office. Interviewers asked residents about their interpretation of changes, preferences, and values in the communities. They were asked to provide value statements regarding the forest and its management. Some of the information is included in this Section of the DEIS.

As part of the County Land Management Study, respondents were asked about nine possible missions that the Forest Service could undertake in terms of their importance to them. Each mission activity was rated on a scale of 1 to 9, with 1 being most important and 9 being least important to the respondent. All residents ranked 'provide and protect water' as the highest priority, followed by wildlife habitat, and preserving the Forest for future uses.

Ensuring forest resources for future use, and providing water quality and quantity are clearly important to residents around the Forest. Some individuals believe that

setting aside more land for preservation is the way to make sure the forest is available for future use, while others believe logging and preventing catastrophic fire is the most reasonable insurance policy. This dichotomy is reflective of the interviews with residents, and with national studies (see the *Communities of Interest* section).

Table 3-205. Median rankings of public benefits from use of the National Forest by county and rural/town (1 = most important, 9 = least important).

Possible Responses…	Albany	Carbon	Converse
To make sure… forests are available for future use.	1.6	1.7	1.8
Provide and protect sources of water for human use.	1.7	1.6	1.6
To provide a healthy home for wildlife.	2.3	2.2	2.5
Provide a place where people can feel free to relax	4.3	4.3	4.2
To provide recreational opportunities.	4.6	4.5	4.4
To support traditional ways of life for future use and enjoyment.	5.1	4.9	4.8
To provide grazing land for livestock	6.3	6.9	6.5
To provide timber for private and commercial use.	6.5	6.0	6.5
To provide minerals.	7.4	7.6	7.0

Source: University of Wyoming 1998

Tourism

Amenities are important for both tourism development and for resident lifestyles. The counties around the Forest have an optional lodging tax, with which they promote their areas for tourism purposes. Carbon County and Albany County have an extensive advertising campaign for snowmobile riding in the Snowy Range and Sierra Madre. This tourism activity has replaced an otherwise slow economy during the winter. This promotion is not without controversy, and comments received on the Draft plan indicate both support and concern over this effort.

Crowding was among the concerns over managing the Forest for tourism. Newcomers into the area bring crowding into local recreation areas. They also bring with them different attitudes, and technologies contrary to the local environment. Area residents are most affected by visitors who have little regard for area standards, environmental ethics and respect for the resource.

According to tourism research, sustainable tourism development and use must respect the culture and environment of the host area. Planners have to find the balance between development and other benefits to a community, and the point at which development starts to feed on rather than sustain the resource (USDA Forest Service 1995). Citizens must help set goals and priorities to ensure responsible tourism-related planning and development are supported by them, because decisions made regarding tourism development will affect lifestyle and the economic opportunity of residents in the tourism destination area for years (ibid).

Residents in all three counties place a very strong emphasis on the conservation of natural resources on public lands in the 21st Century (83 percent in Albany County, 79 percent in Carbon, and 75 percent in Converse). The *Aquatics* section of this Chapter outlines the amounts and quality of water produced on the Forest.

Residents were asked to rank order 12 possible reasons why they chose their place of residence. Most were brought up in the area. Many agreed that wide-open spaces, and avoidance of an urban lifestyle were two of their primary reasons. With the exception of "I was raised here," CLM respondents indicated they were attracted to the area's landscape. Among other local tourism developments in areas around the forest, Carbon County is experiencing recreational development in the Sierra Madre side of Forest, including a major water development, and a potential ski area. Many noted that the solitude and beauty of the Forest were good reasons to stay in the community.

The most frequently cited thing/event that made and individual's last visit to the Forest satisfying was viewing wildlife, followed by escaping the routine, reducing mental anxiety, clearing one's thoughts, and enjoying the western charm of the countryside.

Native American Uses

Although the Medicine Bow is some distance from the Wind River Reservation (and the Shoshone National Forest is actually adjacent), Tribal members want access for traditional uses when they are in an area. They do not wish to single out an area; rather, they wish to keep options open for the future, whether they currently use an area or not. That includes the Medicine Bow National Forest. Sometimes the uses may be extractive, such as gathering teepee poles or ceremonial plants. Other times uses are of a purely spiritual nature and may involve sites for prayer and fasting. (Only the individual knows such sites; locations for prayer and fasting are confidential.)

Livestock Grazing and Ranching

There is a subtle dependency between private land uses and public land management. Residents interviewed indicated that being able to maintain grazing activities on public lands is essential to maintaining "the family farm" which is the cornerstone for "close-knit, stable communities." Most residents are less likely to see the connection to their own lifestyle. Most (60-70 percent) said reductions on grazing would have little or no effect on their lives (University of Wyoming 1998). In a later study, 81 percent of Wyoming residents said it was very important to maintain land and water in agricultural production, saying ranching is important to Wyoming's quality of life (University of Wyoming 2002). Their most important reasons to keep land and water in agriculture were to keep jobs and business related to agriculture, provide wildlife habitat, produce food and fiber, provide open space, and preserving the state's western heritage (ibid).

Ranch Conversions

Residents and county representatives expressed concern over recent changes in land uses on private lands inside and adjacent to the Forest.

Many population changes are a result of conversions from agricultural use, generally the effects of no longer having a viable ranching way of life. Agricultural land is converted to some other development, typically subdivisions. The rate of conversion from agricultural to non-agricultural uses increased dramatically between 1992 and 1997 (USDA Natural Resources Conservation Service 1997). The rate of conversion of land in Albany County had increased 19 percent by 1997 (see table below), 13.5 percent in Platte County, and nearly eight percent in Converse County. Only Carbon County had no conversions during this time period, but rather ranch consolidations. Commissioners say there are now more applications for subdivision development.

Table 3-206. Acres developed by county, and population, 1982 and 1997.

County	Developed Area, 1982 (Acres)	Developed Area, 1997 (Acres)	Percent Change	Population 1982	Population 1997	Percent Change
Albany	10,176	12,096	18.9%	30,608	29,672	-3.1%
Carbon	13,312	13,312	0.0%	22,374	15,722	-29.7%
Converse	21,504	23,168	7.7%	15,036	12,332	-18.0%
Platte	10,432	11,840	13.5%	10,337	8,548	-17.3%
Total	55,424	60,416	9.0%	78,355	66,274	-15.4%

Source: USDA Natural Resources Conservation Service 1997.

Ranchers point out that a shift away from ranching or farming practices, including grazing on public lands, would affect wildlife grazing and migratory patterns of elk and deer. Without Federal grazing permits, their forage would be used more intensively for domestic cattle operations with little left over for wildlife, particularly in the winter. Wildlife access is provided for on large tracts of open range. Of the total private lands owned by grazing permittees on the Forest, nearly 45 percent provides winter range.

Ranch consolidations are not represented in this table, which may explain the zero percent conversion in Carbon County over this same time period. A number of consolidations are occurring near Esterbrook and adjacent to the Forest boundary in the Laramie Peak unit. Consolidation of ranching operations to create one enterprise often results in private ranch roads being closed to the public; this automatically locks people out of traditional lands by creating private hunting and fishing opportunities. Converse County officials have noted this trend has been occurring more frequently during the last decade.

Consolidation of family ranches into large corporate ranches has resulted in absentee landowners making rules for local managers to enforce. Some new ranchers allow

free access, others charge a gate fee, and some don't allow any public access across their land. In many cases, historic access is now closed because of gates left open and other acts of disrespect for private property.

Second Homes

Wyoming is experiencing growth in the number of second homes. Some counties do not require natural resource-related standards for development of parcels, but new, part-time residents expect county services, such as fire fighting, water, and in some cases, snow plowing. Platte County is undergoing development of 35-acre parcels near the Forest boundary. (Laramie Peak Ranch and Oregon Trail Ranch). These homes are for seasonal, recreational, or occasional use. Between 1990 and 2000, second homes accounted for almost, 3,000 new housing units in the state, or 14 percent of all new housing (Taylor and Lieske 2002).

The increase in second homes changes the landscape and culture of Wyoming communities. They do not serve as the primary residence, so people living in them are not considered in the total population calculations. According to the 2000 Census, Wyoming's percentage of second homes was nearly 1.8 times the national average (3.1)

Subdivisions are occurring in high visibility areas along highways, and near the base of the mountains. Albany County is experiencing development directly adjacent to the Pole Mountain area. The concern with this development is the effect of concentrated human uses on the aquifer that waters Cheyenne. The headwaters of Crow Creek occur on the east side of Pole Mountain, which is also part of the aquifer recharge area for 60 wells in the Cheyenne area.

Other types of land developments are occurring in Natrona, Platte, and Carbon Counties. Officials in Natrona County expect private development to impact the Forest, especially relative to recreation, private and public access. Table 7 illustrates the percentage of housing units in each of the counties around the Forest.

Table 3-207. Percentage of housing as second homes, 2000.

County	Percent Second Homes	Percent Change 1990-2000
Albany	7.2	16.7
Carbon	12.6	51.5
Converse	5.6	18.6
Laramie	0.7	33.0
Natrona	3.1	1.7
Platte	6.6	17.3
Wyoming	5.5	30.9

Source: U.S. Department of Commerce. U.S. Census Bureau. 2000.

Wildland Urban Interface (WUI)

The interagency implementation of the National Fire Plan in Wyoming resulted from national and local concerns over continued growth in wildland-urban interface throughout the state, which places more citizens and property at risk for substantial losses from wildland fire. This effort is the result of increasing forest health problems due to fuels accumulations from past suppression success and changes in land use activities, such as subdivisions inside and adjacent to the National Forest. In Laramie and Albany Counties, homes are being developed on a weekly basis around the Laramie Mountains (Pole Mountain) and on the prairie adjoining them.

The 10-year Comprehensive Strategy was developed by the State's task force (made up of local citizens and state and federal employees), which outlines four goals for implementation: 1) Improve fire prevention and suppression, 2) Reduce hazardous fuels, 3) Reduce fire adapted ecosystems, 4) Promote community assistance. The team identified communities at risk, and high-priority watersheds at risk. Communities at risk on and around the Forest are listed in the *Fire and Fuels* section of this Chapter.

Although many people want to live in a wildland area, many do not know how to protect themselves from the increased risk of wildfire until they have lived there for some time. A cooperative study between Michigan State University and the Forest Service about homeowners' attitudes about wildland fires suggested that potential wildland-urban interface homebuyers know very little about potential risks and resource management efforts (USDA-Forest Service 2003).

Timber Industry

The timber industry, in part because of its long history on the Forest, is viewed much like ranching, as part of the local way of life. Timber people see themselves as part of the solution in maintaining a healthy forest. The shift in forest management practices over the last decade is indicative of the level of involvement from local interests. There is little support among the public or the Tribes for the level and type of clearcutting of the 1950s and early 60s. Arguments for logging include improved habitat, particularly for elk and deer, as well as reducing the danger of wildfires. The downside of additional logging for many people is the economic and environmental cost of constructing the roads needed for timber harvesting.

ENVIRONMENTAL CONSEQUENCES

Direct and Indirect Effects

The potential effect to residents is discussed throughout the *Communities* sections. All alternatives are a continuation of multiple uses; however each would have a different relative effect on residents' lifestyles, to varying degrees.

Population

Population is effected by ranchland conversions, and by economic activity in communities within driving distance of home. Many residents in Laramie actually work in Cheyenne, Encampment residents work in Saratoga, and Saratoga residents work in Rawlins or Sinclair. This movement makes it difficult to determine a one-to-one relationship between population adjustments and economic activity. Population changes relative to the University of Wyoming, Albany County Campus of Laramie County Community College, and the Wyoming Technical Institution are more affected by national economics than local economic activities, unless students are forced to choose something other than their education due to the inherent poverty of students.

Alternatives most likely to affect populations are those that require a longer adjustment period for existing economic activity. Since the economies of these communities is embedded in tradition, it can be expected that Alternative F would require more of an adjustment than the other alternatives, followed by Alternative E, D FEIS, D DEIS, C, A, and B.

Environmental Justice

The presence of minority groups in the study area is documented in the *Affected Environment* portion of this section.

Continuing interactions with communities having lower income households will occur during Forest Plan implementation. The National Survey of Recreation and the Environment (Cordell 1997) provided the Forest Service with a profile of the individuals participating in various recreational activities on the national forests in the Rocky Mountain Region (Montana, North Dakota, South Dakota, Nebraska, Kansas, Idaho, Utah, Nevada, Arizona, New Mexico, and Colorado). The survey revealed that the rates of participation in recreational activities available on National Forest System lands are very similar between minority groups and Caucasians. Therefore, impacts resulting from changes in recreation opportunities under any alternative would not be expected to have a disproportionate impact on any minority group. Impacts resulting from changes in recreation opportunities under any alternative would not be expected to have a disproportionate impact on any low income group.

Attitudes and Values

Rural lifestyles are dependent on all sectors of the economy, especially support services which make it easier to live, work, and spend money in the area. The changes in expenditures by National Forest management activities illustrate the shift in management direction from current activities. See the discussion on Medicine Bow National Forest program expenditures in the *Economic* analysis in this section. Expenditures would decrease as commodity support decreases by alternative. Alternatives F and E would show a decrease, while the other action alternatives

would indicate an increase, the lowest of which would be in Alternative D FEIS, D DEIS, C, and A.

In order to estimate potential effects to Indian people, it is important to identify and consider their values and traditional uses of forest products. Two studies were done to help with this part of the analysis: *An Ethnobotany of Medicine Bow National Forest* (Byrnes, 2002), and an ethnographic study. The ethnography is a small part of a historic overview of the Forest, *Historical Overview of Land Use in the Medicine Bow National Fore*st, completed in 2003 (Boglioli et al, 2003). It consists of a series of interviews with traditional tribal leaders, elders, and tribal employees of the Tribes listed above. These interviews consisted of formal meetings attended by Forest Service representatives, the interviewer, and tribal informants, and private interviews between the interviewer and tribal members. The interview consisted of a series of questions focusing on the traditional uses of lands administered by the Medicine Bow National Forest, and the traditional names of prominent geographic features of the Forest. The ethnographic study had limited results. The majority of Tribes contacted for this interview process indicated that they were interested in participating, and considered the Medicine Bow to be a portion of their ancestral lands, but had reservations about divulging information that might be considered sacred, or might be used in a fashion that the other members of their Tribe would consider to be inappropriate. Many of the comments received indicate that the preferred time for consultation is at the time of project environmental planning.

Tourism Planning and Development

Commenters were concerned over maintaining current recreation opportunities on the Forest. They also wanted to ensure a steady flow of tourism. Concerns included:

1. Losing tourism, as a result of new restrictions on motorized use, specifically snowmobile riding
2. The potential influx of new users wanting to use the areas recommended for wilderness
3. Crowding due to increased use on fewer roads due to decommissioning, and
4. The possibility of ruining the scenery due to wildfire.

Recreation will increase in all alternatives, but use types will shift in some alternatives from the current trends. Snowmobile riding would potentially decrease in all alternatives, due to increases in special designations that restrict snowmobile riding. Alternative F would compel more snowmobile riders to ride elsewhere, because of the requirement that all snowmobiles stay on roads and trails. Alternatives F, E, D DEIS, and D FEIS would have the highest effect on snowmobile numbers, while at the same time, cross-country skiing numbers would increase as a result

Wilderness use levels will increase, slightly, as adventure seekers begin to use new areas recommended for wilderness. This may result in an opportunity for the communities of Arlington and Encampment to facilitate these users with tourism support services. If there is no response to an increased need, however, other nearby communities would receive the benefits of this addition or shift in users.

As many individuals pointed out, roads will be closed, forestwide, which will result in crowding when tourism increases. This will occur, regardless of the alternative (see the *Travel Management* section of Chapter 3 of the EIS for more discussion on roads maintenance and management), but moreso under Alternatives F and E.

Increasing tourism will most likely force an adjustment by "local" users. This is one of the effects of increasing tourism in an area, as discussed in the Affected Environment. This is also an example of the need for County tourism boards, the State Division of Tourism, and the Forest Service to work together to ensure residents are included in tourism planning, regardless of the alternative in this plan. The econmic effects of tourism are discussed in the *Economics* section.

Livestock Grazing and Ranching

Shifts in the populations of Carbon and Converse Counties are more directly attributed to global market forces than they are to Forest Service management. Agriculture and the trend toward consolidation and conversion is largely an economic debate; many ranchers find that as they get older and their children don't want to carry on the ranching operation because of other livelihood opportunities, selling the ranch is a retirement account. Other economic factors make it less attractive to sell in one lump sum, so it's easier to subdivide or consolidate with another ranch. This kind of trend would be most apt to occur if these ranchers didn't have the value of a federal grazing lease. Grazing allotments and animal unit months permitted would be the same as current in all alternatives, with the exception of Alternative F.

Timber Harvest

Lowering the amount of timber harvested to levels in Alternative F would affect the continued operation of mill operations. The effects would be less from Alternative E, followed by Alternatives D FEIS, D DEIS, C, A, and B. See the *Economics* section of this Chapter for discussion on the Plan's effects on jobs and income.

Wildland Urban Interface (WUI)

Wildfire is a concern of all residents, most importantly those who have homes in or near the forest. In accordance with the National Fire Plan, Wyoming's task force identified Communities at Risk through implementation of the National Fire Plan. Clearing activities are occurring around these areas, and will continue, regardless of the Alternative. The effects to these areas from the revised plan are discussed in the *Fire and Fuels* analysis section of this chapter.

Cumulative Effects

Green Mountain Ski Area proposed

The Green Mountain resort is a proposed ski area, located inside the Forest boundary, on private land west of Encampment. Access to the Green Mountain section is through the Forest. The Hog Park Road is not currently plowed for vehicular use in the winter. Plowing this road would affect snowmobile use in the area, which would be forced to use an alternate route south.

The Trend to Convert Ranch Lands

Leisure time is becoming as important as work time. The American dream is no longer just to have a house, but it's to have a house in the middle of a landscape where your neighbors are beyond a grove of trees, and your back door opens to acres of open space. Approximately 97,000 acres of land became unavailable for agricultural uses from 1982 to 1997 (USDA Natural Resources Conservation Service 1997). From 1992 to 1997, approximately 37,800 acres of land became unavailable for agricultural uses. The healthy economy from 1992 to 1997 and the associated increase in development of urban areas, transportation systems, mineral extraction, and other non-agricultural uses has contributed to this rate of conversion. The trend toward conversion from a ranching way of life is dramatic. This would be more likely to occur in Alternative F than in the other alternatives.

Economics

AFFECTED ENVIRONMENT

The economic consequences of the Medicine Bow National Forest stretch across many parts of Wyoming and Colorado, but two areas were recognized as most affected by the Forest. The Southern Medicine Bow is most connected to a local economy that is defined by Albany and Carbon Counties in Wyoming and Jackson County in Colorado. The Northern Medicine Bow (Laramie Peak area) touches many Wyoming counties, but is most connected economically to Converse County. These two areas are the focus of the economics discussion, which examines employment and income relationships between the Medicine Bow National Forest and surrounding areas.

Several counties and town that interact with the Forest are not a major part of this analysis. Platte and Natrona Counties are home to about a half-dozen grazing permittees each. While the economic relationship with the Forest is highly important to those permittees, the overall influence to the local economy of these counties is relatively small. The residents of Laramie County (Cheyenne) and Larimer County, Colorado (Ft. Collins) are important centers of recreation demand for the Forest.

However, the tourism impact of these residents is primarily experienced in the towns near the Forest. There is an economic impact in Cheyenne and Ft. Collins, but the overall influence to the local economy of these counties is very small. The four counties just mentioned are analyzed in other portions of the Communities section, and in other parts of this EIS.

Employment

The current distribution of employment, the trends in employment, and average earnings per job are important measures of a county's economic health. The following table indicates that employment in the counties is concentrated in the government, services, and trade sectors, with the exception of Jackson County, Colorado, where Agriculture employs more than any other sector. The government sector includes all levels of government, federal, state, and local.

Table 3-208. Employment by major industry and county, 2001 (jobs).

Industry	Southern Med Bow			Northern Med Bow	Total
	Albany	*Carbon*	*Jackson*	*Converse*	
Agriculture	664	845	324	631	2,464
Mining	47	314	12	750	1,123
Construction	1,128	689	108	495	2,421
Manufacturing	830	616	55	198	1,700
Transportation, communication & utilities	391	607	56	704	1,757
Trade	4,072	1,911	158	1,244	7,384
Finance, insurance, & real estate	1,652	567	18	350	2,587
Services	5,705	2,112	189	1,361	9,367
Government	6,718	2,009	199	1,304	10,230
Total	21,206	9,670	1,119	7,038	39,033

Source: U.S. Department of Commerce, Bureau of Economic Analysis 2003 and Fletcher and Taylor 2000.

Albany County: Fifty three percent of employment in Albany County is concentrated in three sectors. The government sector was the largest source of employment for the county in 2001 (32 percent). The service and trade sectors were 27 percent and 19 percent respectively. In terms of employment, the county's economy is specialized in three sectors; government, retail, and agriculture. The county did not experience fluctuations in employment from the growth and decline

of the mineral industry during the 1970s and 1980s. Total employment in Albany County increased steadily in the 1990s, mainly in the service sector, followed by the retail trade, and construction sectors. In the government sector, federal civilian employment and state government employment declined, but local government employment increased by 10 percent.

Carbon County: Employment in Carbon County is concentrated in three sectors: service, government, and trade. Each of these sectors accounts for about 20 percent total employment. Most of the government employment is in non-federal (62 percent), including county school districts, and state agencies (26 percent). Carbon County's economy is specialized in five sectors: mining, transportation/public utilities, agriculture, government, and retail trade. Since 1990, county employment has decreased slightly. Much of this decrease is related to growth and declines in the mineral industries. Carbon County's annual employment growth rate has been about one percent – substantially below both the Wyoming and U.S. averages. Payroll reductions over the last decade have occurred in mining, government, and transportation/public utilities. The largest increases were in service and retail trade.

Jackson County: In 2001, nearly 30 percent of Jackson County's employment was concentrated in agriculture. Government and the service sector each contribute about 17 percent to total jobs in the county.

Converse County: In 2001, over 55 percent of Converse County's employment was concentrated in government, service, and trade. In terms of employment, the fastest growing individual sectors have been construction, trade, and manufacturing. Small losses have been experienced in wholesale trade and agriculture. Between 1980 and 1990, the county lost 24 percent of total jobs (along with losing 20 percent of its population over that same time period). There has been a disproportionate increase since 1990 in both employment (1066 jobs) and population (1,201 individuals). Since 1990, county employment has increased by nearly 20 percent but is substantially below the 1980 level, primarily due to declines in the mineral industries. While the county's employment growth rate was higher than Wyoming's or the US between 1970 and 1998, the county also experienced greater fluctuations in employment than either Wyoming or the U.S. Employment is specialized in six sectors: mining, agriculture, transportation/public utilities, agricultural services, construction, and government.

Another perspective of employment can be viewed when examining the community level. Carbon County has several distinct economies within the county (see following table). The economies of these three towns, Saratoga, Encampment, and Baggs, are closely tied to the forest. Agriculture is the largest employer in both Saratoga and Encampment and is the second largest employer in Baggs. All three towns have relatively high employment in agriculture. With the reopening of sawmills in both Saratoga and Encampment, manufacturing is now even more important today to these towns than shown here for 2000. In Baggs, oil and gas exploration and production is the largest employer. Potential for coalbed methane

development in the area could increase the local dependence upon the mining industry in the future.

Table 3-209. Sub-county employment in Carbon County, 2000.

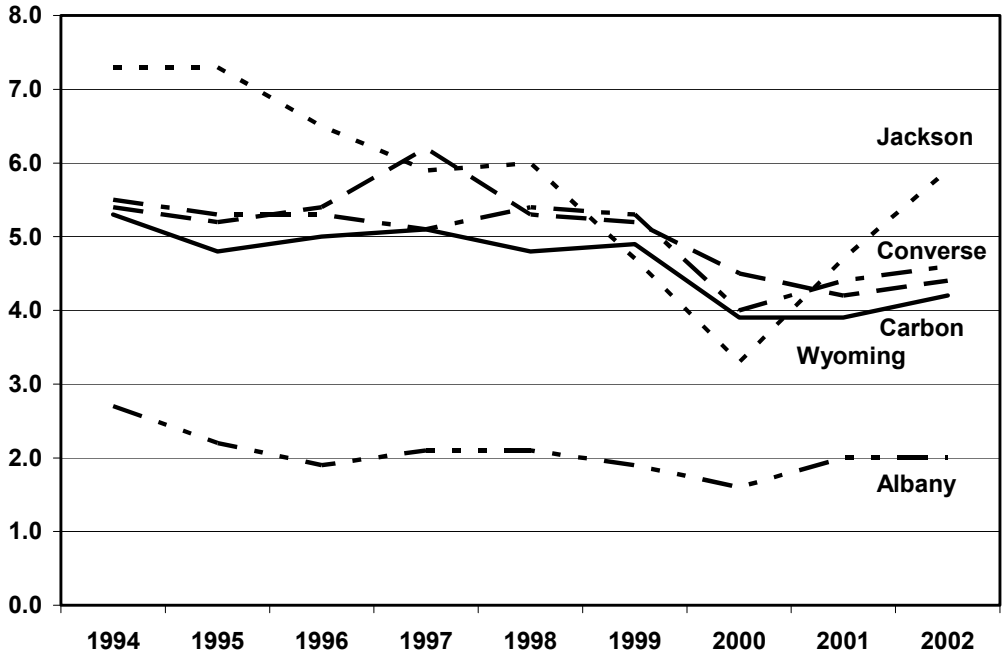
Industry	Saratoga		Encampment		Baggs	
	(jobs)	(percent)	(jobs)	(percent)	(jobs)	(percent)
Agriculture	160	13.3%	78	20.5%	56	16.3%
Mining	25	2.1%	13	3.4%	75	21.9%
Construction	105	8.8%	35	9.2%	27	7.9%
Manufacturing	107	8.9%	37	9.7%	7	2.0%
Wholesale	9	0.8%	13	3.4%	0	0.0%
Retail	129	10.8%	23	6.1%	33	9.6%
Transportation	26	2.2%	28	7.4%	22	6.4%
Utilities	27	2.3%	2	0.5%	13	3.8%
Information	17	1.4%	2	0.5%	4	1.2%
Finance & Insurance	16	1.3%	15	3.9%	1	0.3%
Real Estate	17	1.4%	0	0.0%	5	1.5%
Professional Services	68	5.7%	17	4.5%	6	1.7%
Educational Services	116	9.7%	39	10.3%	28	8.2%
Health & Social Services	95	7.9%	24	6.3%	11	3.2%
Arts/Entertainment/Recreation	39	3.3%	7	1.8%	0	0.0%
Lodging & Food Services	116	9.7%	24	6.3%	21	6.1%
Other Services	49	4.1%	10	2.6%	14	4.1%
Public Administration	79	6.6%	13	3.4%	20	5.8%
Total	***1,200***	***100.0%***	***380***	***100.0%***	***343***	***100.0%***

Source: U.S. Department of Commerce, U.S. Census Bureau 2000

Unemployment in the Medicine Bow area has been both higher and lower than the Wyoming statewide average. Carbon and Converse Counties generally run about half a percent higher than the state average. Limited job opportunities and reliance upon volatile commodity markets may account for the generally higher

unemployment rates in these counties. Residents of these counties generally have long family histories in their area, and consequently they resist moving when jobs are scarce. Jackson County, similar in many ways to these two Wyoming counties, tends to have the highest and most volatile levels of unemployment in the area. The sawmill closure in Walden during the mid-1990's may account for the high unemployment rates early in the period shown. Because of the small workforce base in the county, small changes in total jobs result in high percentage changes in unemployment. In contrast, Albany County generally runs 2-3 percent lower than the Wyoming average. Despite a large student component in the workforce, employment is generally tight in Albany County.

Figure 3-7. Unemployment rate by county, 1994-2002.



Source Wyoming Department of Employment, Labor Market Information 2003 and Colorado Department of Labor and Employment, Labor Market Information 2003.

Income

The other side of employment is income. Job-holders are provided wages and other forms of compensation for their labor. This labor income is shown in the following table. While trade provides nearly 20 percent of the employment, it provides only 11 percent of the labor income. A similar pattern exists for agriculture which provides 6 percent of the employment, but provides only 2 percent of the local labor income. In contrast, manufacturing provides about 4 percent of the employment, but provides 7 percent of the labor income. Labor income in the southern counties is dominated by employment in Federal, State, and local governments. Residents of Converse County derive most of their

labor income from the mining, transportation, communication and utility sectors in addition to government.

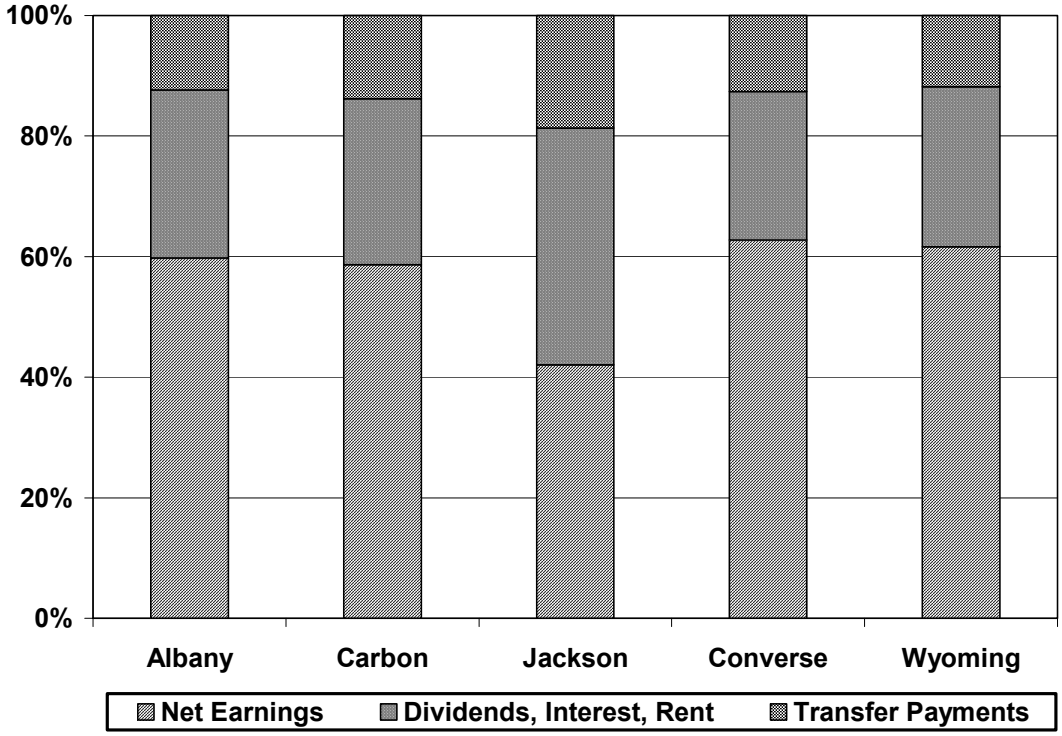
Table 3-210. Labor income by major industry and county, 2001 ($ thousand).

Industry	Southern Med Bow			Northern Med Bow	Total
	Albany	Carbon	Jackson	Converse	
Agriculture	$7,044	$8,142	$560	$5,983	$21,730
Mining	$829	$13,101	$452	$38,931	$53,313
Construction	$36,757	$18,304	$2,439	$14,829	$72,330
Manufacturing	$35,481	$22,849	$1,184	$4,416	$63,930
Transportation, communication & utilities	$15,636	$29,126	$2,114	$43,254	$90,130
Trade	$56,379	$28,511	$2,623	$15,425	$102,938
Finance, insurance, & real estate	$20,569	$9,728	$447	$4,608	$35,351
Services	$113,318	$37,526	$1,977	$24,965	$177,786
Government	$212,194	$65,093	$5,690	$39,183	$322,160
Total	$498,208	$232,380	$17,487	$191,593	$939,667

Source: U.S. Department of Commerce, Bureau of Economic Analysis 2003 and Fletcher and Taylor 2000.

Income from employment is only one source of income. Other important income sources include investment income, which represents property income including dividends, interest, and rents, and transfer payments, which are primarily government payments to individuals such as Social Security, Medicare, and Medicaid. See the Figure below. All of these sources combine to provide total personal income. Because personal income depends on more than wages and profits, it is recorded according to place of residence, not place of employment.

Figure 3-8. Personal income by source, 2001.



Source: U.S. Department of Commerce, Bureau of Economic Analysis 2003.

According to the Economic Analysis Division of the State of Wyoming, non-earned income is becoming increasingly important (Wyoming Department of Administration and Information 2002). As shown above, non-earned income accounted for about 40 percent of all income in the Wyoming counties. Non-earned income in Jackson County is nearly 60% of all personal income. Because the above Figure is based upon county totals, the results do not reflect what is true for most households but instead show countywide averages. A few very wealthy households could dominate the countywide picture for personal income. Counties with a high percentage of non-earned sources of income will be less vulnerable to local economic shocks, but may be more vulnerable to fluctuations in the national economy. Conversely, because transfer payments largely consist of social security payments, counties with a high proportion of transfer payments will experience less variation because transfer payments are very stable (ibid).

As Wyoming's population continues to grow older, both dividends, interest, and rent and transfer payments can be expected to increase as a percentage of total personal income. The median age in the 2000 census increased from 32.0 years in 1990 to 36.2 in 2000. Earnings by place of work and dividends, interest, and rent are both forecast to grow faster than the rate of inflation through 2009, therefore, it is also likely that wealth will grow (ibid).

Albany County: Labor earnings are the largest source of personal income in Albany County, representing 60 percent of total county personal income in 2001. Sixty-five percent of labor earnings in Albany County are concentrated in two sectors: government and service. Average earnings per job in Albany County have declined in real terms since 1981. In 1998, average earnings per job in Albany County were $20,710. The three sectors with the highest average earnings per job were federal civilian, manufacturing, and transportation and public utilities. Earnings per job in Albany County have been substantially below Wyoming and the U.S., averaging 18 percent and 26 percent less than both, between 1970 and 1998. The gap between Albany County and the U.S. had been widening over time, reflecting the increase in service and retail jobs and the loss in federal and state government jobs that tend to pay more.

Albany County has experienced relatively stable personal income growth. Investment income has been the fastest growing source of personal income in the county, followed by transfer payments and labor earnings. Retirement and medical payments represented over 80 percent of the increase in transfer payments between 1990 and 1998.

Carbon County: Personal income in Carbon County decreased in real terms between 1990 and 1998, due to a 13 percent decrease in inflation-adjusted labor earnings. Much of the decrease in labor earnings was in the mining sector, which decreased nearly 46 percent between 1990 and 1998. Other sectors with substantial losses include transportation/public utilities (-18 percent), government (-10 percent), and agriculture (-61 percent). The three fastest growing sectors in terms of labor earnings have been agricultural services, service, and finance/insurance/real estate. While labor earnings were decreasing, transfer payments increased 20 percent and investment income increased slightly (0.4 percent).

Investment income is relatively more important as a source of personal income in the county compared to the nation (23 percent versus 18 percent). This may reflect the fact that average earnings per job in the county have been substantially lower than the national average. Transfer payments have been also somewhat higher than in Wyoming or the nation.

Jackson County: In 2001, labor earnings and investment income were nearly identical in making up the largest sources of personal income in Jackson County. Earnings per job in Jackson County were the lowest per job earnings in the area, most likely because of the low earnings in the agricultural sector. Investment income and transfer payments are more important in Jackson County than in other parts of the impact area or the U.S. This may reflect the fact that the average earnings per job in the county are substantially lower than the national average.

Converse County: In 2001, labor earnings were the largest source of personal income in Converse County, representing slightly over 60 percent of total personal income. They are concentrated in three sectors: mining, transportation/public

utilities, and government. Labor earnings from mining in the county have been nearly 30 times the national average. Earnings per job in Converse County ranged from $53,133 for transportation/public utility employment to $2,017 for agricultural employment, with an average of $23,479. Low earnings per job for agriculture resulted from low agriculture prices.

The three fastest growing sectors in terms of labor earnings in the 1990s were mining , construction, and agricultural services. Three sectors lost labor earnings in that same period: wholesale, retail trade, and agriculture. From 1979 to 1998, average earnings in real terms had declined (inflation-adjusted) by over 30 percent, reflecting a loss in higher paying jobs such as mining, government, and transportation and an increase in lower paying jobs in the service and retail sectors.

Investment income and transfer payments mirror the Wyoming share of total personal income. Investment income is relatively more important in Converse County than in the U.S. (23 percent versus 18 percent) and has been the fastest growing source of personal income in the county.

Medicine Bow National Forest: Income associated with management of the Medicine Bow National Forest has historically been found in the labor earnings portion of personal income. With the changing economy of the West, however, this relationship is changing. For various reasons, traditional commoditities such as livestock grazing and timber production have been declining. Traditional commodity production still remains important to the social and economic fabric of communities bordering the Forest. However, investment income, associated with tourism, second homes, and new in-migrants, has become more prominent in the relationship to national forests than in past decades. Real estate development for resorts and second homes near national forests has grown enormously throughout the Rocky Mountain West, and will be an important factor in years to come in south-central Wyoming. Information from the Wyoming Housing Database Partnership indicates that nearly 20 percent of the new residents to Wyoming in 2001 indicated that their reason for moving to Wyoming was “a better quality of life” (While labor income typically is received by local residents, investment income is more likely to be received by non-residents.

Economic Dependency and National Forest Contributions

Every economy has one or more ‘engines’ that ultimately provide residents with jobs and income. In a real sense, area jobs and income depend on the size and vitality of these engines.

The economic dependency of the planning area can be discerned by breaking down employment into three components: basic industries, indirect basic industries, and local resident service (sometimes called induced) industries. *Basic industries* are those that bring money in from outside the area. This is done by exporting goods and services, or selling them to non-residents. Tourism is an example of an export

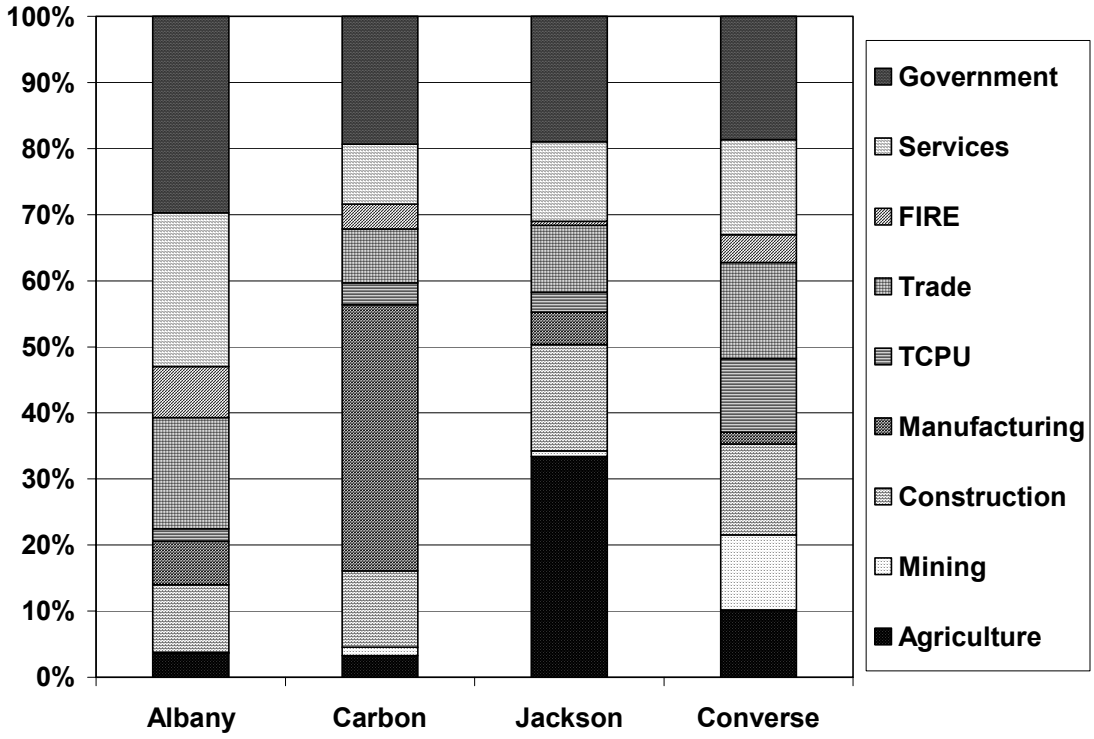
industry in the planning area. Other export industries are oil and gas extraction, livestock, and manufacturing. *Indirect support industries* are those that support the basic industries. These commonly include local suppliers of goods and services to basic industries. Wholesale trade and trucking would be examples of indirect basic industries. The third component is *local resident services*. These industries provide local residents such services as grocery stores and medical care.

By incorporating the concept of economic multipliers to basic industries, the total effect that these industries have on the economy can be determined. The following Figure shows the share of all jobs throughout the economy that are generated by sales in the listed industry. For instance, sawmills generate jobs in the utilities industry by purchasing electricity and in the trade industry by purchasing supplies. All of these jobs are shown under the basic industry that ultimately generated the employment, i.e. sawmills (manufacturing).

The following Figure shows that government (Federal, State, and local) is an important basic source of employment throughout the planning area, accounting for 20-30 percent of all jobs in a variety of sectors. Sales of goods and services in the trade and services industries ultimately provide from 20 percent of all employment in Jackson County to 40 percent in Albany County. Trade and services are most important in Albany County, probably stemming from student expenditures at the University of Wyoming. In Carbon County, manufacturing (which includes oil refining in Sinclair and a sawmill in Saratoga) is very important to the local economy, providing over 40 percent of all jobs. According to this analysis, Converse County has a very balanced local economy where a single industry does not dominate.

Agriculture plays a leading role in the custom, culture, and land uses in the planning area. It is noteworthy; however, that agriculture is not generally one of the leading economic engines at the county level, except in Jackson County. In this northern Colorado county, over 30 percent of all jobs ultimately depend upon this traditional Western industry. Although agriculture is not the economic engine it once was, it still remains highly important to small, rural communities located throughout the planning area.

Figure 3-9. Economic dependency by county, 2000.



Source: Fletcher and Taylor 2000.

The following tables illustrate the employment and labor income contributed to area economies by the use and management of the Medicine Bow National Forest. As shown in the following Table, employment associated with the Forest accounts for about 7 percent of total employment in the southern part of the Forest, 83 percent of which are in the trade and service sectors. In Converse County, contributions by the Forest amount to 2 percent of total employment, 88 percent of which are in the government, trade, and service sectors.

Table 3-211. Medicine Bow National Forest contribution to planning area employment by major industry, 2001 (jobs).

Industry	Southern Med Bow			Northern Med Bow		
	Albany, Carbon, Jackson			Converse		
	Forest-related	Total Area	Percent of Total Area	Forest-related	Total Area	Percent of Total Area
Agriculture	44.7	1,833	2.4%	9.3	631	1.5%
Mining	2.2	373	0.6%	0.1	750	0.0%
Construction	7.1	1,925	0.4%	0.4	495	0.1%
Manufacturing	27.5	1,501	1.8%	0.4	198	0.2%
Transportation, Communications, & Utilities	38.4	1,053	3.6%	2.6	704	0.4%
Trade	1301.0	6,140	21.2%	42.6	1,244	3.4%
Finance, Insurance, & Real Estate	35.3	2,237	1.6%	2.7	350	0.8%
Services	569.2	8,006	7.1%	28.1	1,361	2.1%
Government	235.6	8,926	2.6%	47.7	1,304	3.7%
Total	2,261.1	31,995	7.1%	133.9	7,038	1.9%

The following table shows the source of the Forest Service contribution to employment in terms of national forest resource programs. Recreation is by far the most important contributor to employment in the southern area. In Converse County, recreation and Forest Service expenditures contribute over 90 percent of all the Forest-related jobs.

Table 3-212. Medicine Bow National Forest contributions to the planning area employment by program, 2001 (jobs).

Resource Program	Southern MBNF		Northern MBNF	
	Jobs	Percent	Jobs	Percent
Recreation	1,914.3	84.7%	62.2	46.5%
Grazing	46.3	2.0%	11.6	8.7%
Timber harvest	37.4	1.7%	0.0	0.0%
Forest Service expenditures	263.1	11.6%	60.1	44.9%
Total forest management	2,261.1	100.0%	133.9	100.0%

From the standpoint of labor income, Forest contributions to the local economies is roughly half that of employment. The reason stems from lower-than-average paying jobs associated with tourism and recreation. These lower incomes are partially offset by higher-paying Federal government jobs. From an income perspective, Forest contributions to agriculture rate as the third highest of any sector. Trade and services are the highest rated sectors in the south, and while government and trade rank highest in the north. See the Tables below.

Table 3-213. Medicine Bow National Forest contribution to the planning area labor income by major industry, 2001 ($ thousand).

Industry	Southern Med Bow			Northern Med Bow		
	Albany, Carbon, Jackson			Converse		
	Forest-related	Total Area	Percent of Total Area	Forest-related	Total Area	Percent of Total Area
Agriculture	$542	$15,747	3.4%	$154	$5,983	2.6%
Mining	$124	$14,382	0.9%	$7	$38,931	0.0%
Construction	$152	$57,501	0.3%	$8	$14,829	0.1%
Manufacturing	$720	$59,514	1.2%	$13	$4,416	0.3%
Transportation, Communications, & Utilities	$1,363	$46,876	2.9%	$88	$43,254	0.2%
Trade	$13,061	$87,513	14.9%	$404	$15,425	2.6%
Finance, Insurance, & Real Estate	$463	$30,744	1.5%	$34	$4,608	0.7%
Services	$6,868	$152,821	4.5%	$301	$24,965	1.2%

Industry	Southern Med Bow			Northern Med Bow		
	Albany, Carbon, Jackson			Converse		
	Forest-related	Total Area	Percent of Total Area	Forest-related	Total Area	Percent of Total Area
Government & other	$5,427	$282,977	1.9%	$1,083	$39,183	2.8%
Total	$28,720	$748,074	3.8%	$2,092	$191,593	1.1%

Table 3-214. Medicine Bow National Forest contributions to the planning area labor income by program, 2001.

Resource Program	Southern MBNF		Northern MBNF	
	$ Thousand	Percent	$ Thousand	Percent
Recreation	$21,795	76%	$596	28%
Grazing	$658	2%	$221	11%
Timber harvest	$766	3%	$0	0%
Forest Service expenditures	$5,500	19%	$1,275	61%
Total forest management	$28,720	100%	$2,092	100%

Livestock-Related Employment

Grazing on the Medicine Bow National Forest is an important component of the agriculture industry throughout the economic impact area. Of the 95 grazing permittees on the Forest, 42 (75 percent) are based in the three Wyoming counties of Albany, Carbon, and Converse. The remaining 25 percent of grazing permittees are based in Laramie, Platte, and Natrona Counties. The economic consequences of all grazing are included in this analysis, and are run through the economic models of the southern and northern portions of the Forest. As a result, a portion of the economic impacts shown for Converse County could occur in Natrona or Platte Counties. Likewise, a portion of impacts shown for Albany and Carbon Counties could occur in Laramie County. As noted at the outset of the Economic subsection, including Casper or Cheyenne in the analysis would mask the relative importance of the Forest to the more rural Albany, Carbon, Jackson, and Converse Counties. Although Platte County does not have a population center similar to Casper or Cheyenne, the very small grazing impacts did not merit inclusion of the county in the northern Med Bow model.

Data indicate local ranchers grazed about 74,000 animal-unit-months (AUMs) of cattle annually on the Forest between 1999 and 2001, and 12,600 AUMs of sheep per year. Due to the substantial variability in livestock prices, a 10-year average (1989-1998) was used to value MBNF livestock production for economic impact purposes. The 10-year average for cattle value of production, adjusted for inflation, was $35.88 per animal unit month (AUM). For sheep the inflation-adjusted average value of production was $21.60 per AUM.

Based on this information, livestock grazing on the Forest contributed $2.5 million to the region around the Forest. This revenue, in turn, generated $4.5 million of total economic activity throughout the region's economy. As a result of this economic activity, nearly 60 jobs were supported and $879,000 in labor earnings were generated.

For southern MBNF, average earnings per job livestock-related jobs were $14,200. For northern MBNF, average earnings per job were $19,000. Note that these numbers only represent the economic impact of livestock grazing on the MBNF and not private-land related or total livestock industry in the region. If the effects of changes in forest grazing on the entire grazing system or on the economic viability of the ranch are considered, the impacts could be 2 to 5 times greater (Van Tassell and Richardson 1998).

Timber Industry Employment

The estimates for the economic impacts of timber production from the southern MBNF (Carbon and Albany Counties) are based on a variety of primary data sources, including discussions with local mills and examination of typical industry production relationships (Taylor 2001; Keegan, T.A. Morgan et al. 2003). The economic impact of timber activity from the northern MBNF was not estimated because records indicated that the purchase and processing of timber from the Forest by firms located in that part of Wyoming has been very small in recent years.

Due to fluctuations in timber prices in recent years, the economic impact of timber production was based on quantity rather than price. The average for timber production from the Forest between 1999 and 2001 was 2.4 MMBF of sawtimber and 1.0 MMBF of POL. This production supported 37 jobs and generated $766,000 in labor earnings. Average earnings per job for MBNF timber related jobs were $20,500.

Recreation-Related Employment

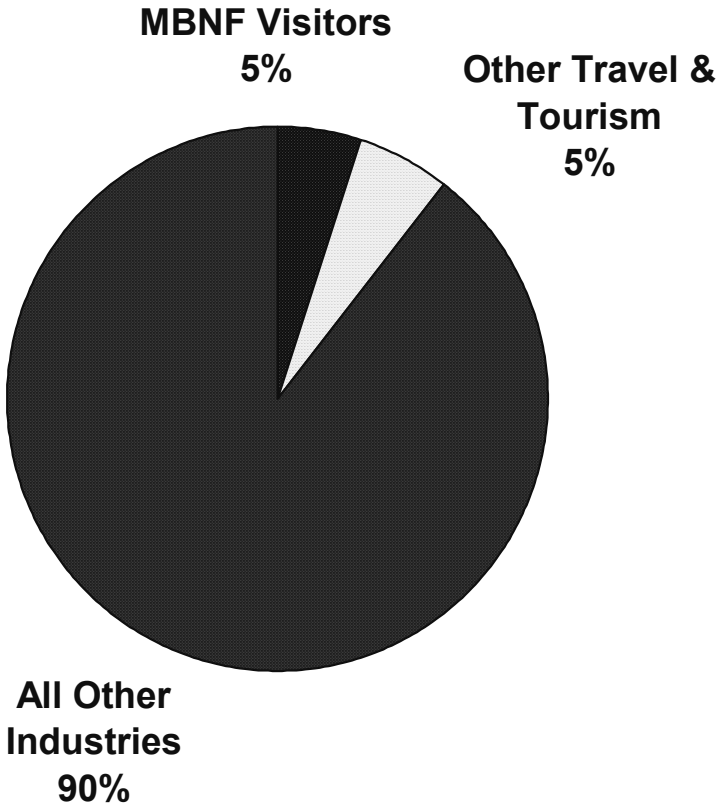
To estimate the economic impact of recreation, local resident use was separated from other Wyoming residents use and non-resident use. Recreation use by non-residents who spend outside money in the Forest economic area is tourism. Jackson County, CO resident recreation use of the Forest is assumed to be minimal, and all residents outside Albany, Carbon, and Converse Counties are considered non-residents or tourists. This estimation is necessary since economic impacts are based on new

dollars flowing into the regional economy. Resident recreation expenditures, however, represent a part of the current distribution of existing dollars already in the regional economy.

Tourism on the Forest in 2001 contributed $68.6 million in visitor expenditures to county economies in Albany, Carbon, and Jackson Counties and $2.0 million to Converse County's economy. These dollars generated over $116.8million in economic activity throughout the region's economy. As a result, over 1,900 jobs were supported and over $22 million in labor earnings were generated.

Average earnings per job for recreation-related employment were $11,400 in the southern part of the forest and $9,600 in the north. Based on work by Dean Runyan Associates (Wyoming Department of Audit 2001, 2002) and estimates developed here, it is estimated that Forest-based tourism accounts for about half of all travel and tourism employment in the 4-county analysis area. Dean Runyan Associates have estimated that all travel and tourism account for about 10 percent of total area employment. See the following figure.

Figure 3-10. Share of total area employment resulting from visitors to the Medicine Bow National Forest.



ENVIRONMENTAL CONSEQUENCES

Direct and Indirect Effects

Direct and indirect effects on planning area jobs and income are generated by changes in recreational uses of the national forest; agency expenditures (salaries, equipment, contracts); and the use of timber and forage resources. A change in recreation or timber production may mean an increase in jobs and income to local communities. In addition, if production is decreased in one resource and increased in another, there is a shifting of jobs from one industry to another. To estimate changes in income and employment for each alternative, the forest used two computer models. See Appendix B for a more detailed discussion of the models and analysis methodology.

The tables below display estimated employment and labor income in the year 2010 throughout the planning area that is attributable to the Medicine Bow National Forest. A base of outputs averaged from 1999 to 2001 and the local 2001 economy was used as a starting point; thus, the tables reflect how jobs might change from these levels. The jobs displayed are annual average jobs. Labor income is compensation paid by business proprietors to employees and themselves.

The employment and income effects of the alternatives to timber, agriculture, recreation, and the forest operations are illustrated in the following Tables.

The largest absolute effects in employment would be felt in manufacturing (sawmills) and trade (tourism) in Alternatives A through E. Under the experienced budget level, employment would rise by about 10 percent for Alternative D FEIS, and up to 11 percent for Alternative B. For Alternative F, nearly 420 jobs would be lost – mostly in trade and services associated with reduced snowmobile use.

Table 3-215. Employment by program by alternative in 2010.

Resource	Base year (2001)	Change in Jobs by Alternative in 2010						
		A	B	C	D DEIS	D FEIS	E	F
Experienced budget level								
Recreation	1,977	123	123	123	123	123	123	-403
Grazing	58	0	0	0	0	0	0	-15
Timber harvest	37	120	147	120	120	120	80	-1
Forest Service expenditures	323	0	0	0	0	0	0	0

Resource	Base year (2001)	Change in Jobs by Alternative in 2010						
		A	B	C	D DEIS	D FEIS	E	F
Total forest mgt	**2,395**	**243**	**270**	**243**	**243**	**243**	**204**	**-418**
Percent change from 2001	---	10.2%	11.3%	10.2%	10.2%	10.2%	8.5%	-17.4%
Full budget level								
Total forest mgt	**2,395**	**713**	**687**	**672**	**646**	**631**	**604**	**-179**
Percent change from 2001	---	29.7%	28.7%	28.1%	27.0%	26.4%	25.2%	-7.5%

Table 3-216. Employment by major industry by alternative in 2010.

Industry	Base year (2001)	Change in Jobs by Alternative in 2010						
		A	B	C	D DEIS	D FEIS	E	F
Experienced budget level								
Agriculture	54	5	5	5	5	5	3	-12
Mining	2	0	0	0	0	0	0	0
Construction	7	3	4	3	3	3	2	-1
Manufacturing	28	71	86	71	71	71	47	-1
Transportation Comm, & Utilities	41	8	9	8	8	8	6	-6
Trade	1,344	106	110	106	106	106	100	-328
Finance, Insurance, & Real Estate	38	5	5	5	5	5	4	-6
Services	597	39	42	39	39	39	36	-57
Government	283	7	8	7	7	7	5	-6
Total forest management	**2,395**	**243**	**270**	**243**	**243**	**243**	**204**	**-418**
Percent change from 2001	---	10.2%	11.3%	10.2%	10.2%	10.2%	8.5%	-17.4%

Industry	Base year (2001)	Change in Jobs by Alternative in 2010						
		A	B	C	D DEIS	D FEIS	E	F
Full budget level								
Total forest mgt	**2,395**	**713**	**687**	**672**	**646**	**631**	**604**	**-179**
Percent change from 2001	---	29.7%	28.7%	28.1%	27.0%	26.4%	25.2%	-7.5%

Total earnings in 2010 by program will increase or hold steady for every alternative, except for Alternative F. Under Alternative F, reductions in income will be felt primarily in trade and services. Real increases from 9 to 14 percent are anticipated under Alternatives A through E. Because of the difference in wages among industries, the pattern of gains and losses is slightly different for income than it is for employment. No reductions overall are expected under the full or desired budget level.

Table 3-217. Earnings by program by alternative in 2010.

Resource	Base year (2001)	Change in Income - Millions of Dollars by Alternative in 2010						
		A	B	C	D DEIS	D FEIS	E	F
Experienced budget level								
Recreation	$22.4	$1.4	$1.4	$1.4	$1.4	$1.4	$1.4	-$4.3
Grazing	$0.9	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	-$0.2
Timber harvest	$0.8	$2.4	$3.0	$2.4	$2.4	$2.4	$1.6	$0.0
Forest Service expenditures	$6.8	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Total forest mgt	**$30.8**	**$3.8**	**$4.3**	**$3.8**	**$3.8**	**$3.8**	**$3.0**	**-$4.5**
Percent change from 2001	---	12.3%	14.1%	12.3%	12.3%	12.3%	9.7%	-14.6%
Full budget level								
Total forest mgt	**$30.8**	**$13.5**	**$12.9**	**$12.6**	**$12.1**	**$11.8**	**$11.3**	**$0.5**
Percent change from 2001	---	43.7%	42.0%	41.0%	39.3%	38.4%	36.6%	1.6%

Table 3-218. Earnings by major industry by alternative in 2010.

Industry	Base year (2001)	Change in Millions of Dollars by Alternative in 2010						
		A	B	C	D DEIS	D FEIS	E	F
Experienced budget level								
Agriculture	$0.7	$0.0	$0.1	$0.0	$0.0	$0.0	$0.0	-$0.2
Mining	$0.1	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Construction	$0.2	$0.1	$0.1	$0.1	$0.1	$0.1	$0.0	$0.0
Manufacturing	$0.7	$1.7	$2.0	$1.7	$1.7	$1.7	$1.1	$0.0
Transportation Comm, & Utilities	$1.5	$0.2	$0.3	$0.2	$0.2	$0.2	$0.2	-$0.2
Trade	$13.5	$1.1	$1.1	$1.1	$1.1	$1.1	$1.0	-$3.1
Finance, Insurance, & Real Estate	$0.5	$0.1	$0.1	$0.1	$0.1	$0.1	$0.0	-$0.1
Services	$7.2	$0.5	$0.5	$0.5	$0.5	$0.5	$0.4	-$0.8
Government	$6.5	$0.2	$0.2	$0.2	$0.2	$0.2	$0.1	-$0.2
Total forest management	**$30.8**	**$3.8**	**$4.3**	**$3.8**	**$3.8**	**$3.8**	**$3.0**	**-$4.5**
Percent change from 2001	---	12.3%	14.1%	12.3%	12.3%	12.3%	9.7%	-14.6%
Full budget level								
Total forest management	**$30.8**	**$13.5**	**$12.9**	**$12.6**	**$12.1**	**$11.8**	**$11.3**	**$0.5**
Increase from experienced budget level	---	43.7%	42.0%	41.0%	39.3%	38.4%	36.6%	1.6%

Recreation Program: As discussed in the Recreation section of this chapter, nearly all recreation use is expected to increase in the near future. One of the most popular activities in the Medicine Bow National Forest is snowmobiling. This winter activity has become a very important for both locals and tourists in recent years. Growth of snowmobiling in Wyoming is expected to exceed the national average (Taylor and Lieske 2002). Because of resource considerations in Alternative F, snowmobile use is projected to be the only recreation activity constrained by management in 2010. These constraints will cause reductions in winter employment and income in communities such as Saratoga, Encampment, and Laramie. Because of these constraints, winter-based employment in 2010 will drop from current levels by about 400 jobs under Alternative F. Restrictions on non-trail snowmobile riding will occur under other alternatives, but adjustments by users are anticipated. Experience levels

may drop with some increased crowding on trails, but use levels are not anticipated to change substantially. Employment associated with other winter recreation activities are expected to increase by about 20 jobs over current levels, and are included in the total winter-based estimates.

Because growth in summer recreation is expected to be healthy, tourism-employment in 2010 should increase by about 50 jobs. Income from tourism follows a pattern similar to employment.

Grazing Program: The range program is not expected to change in the foreseeable future, except under Alternative F. Economic losses attributable to Alternative F would be modest if only Forest Service grazing is considered. However, these losses could be significantly greater if the effects of the decrease in forest grazing on the total grazing system or the economic viability of the ranch is considered.

Timber Program: As discussed in the Timber section, the timber industry in the southern Medicine Bow NF area has been undergoing major changes. The sawmill located in Saratoga has been sold by Louisiana-Pacific Corporation to Intermountain Resources, Inc. The sawmill located in Encampment has reopened under the management of 44 Lumber. Bighorn Lumber in Laramie is expected to continue as it has for many years. Because of volatility in lumber markets and a history of uncertain supplies, it is unclear what the future holds. Mills now opening at 1 shift could later operate at two. In contrast, mills could choose to close quickly if supplies become more uncertain, even moving the entire mill out of state. To account for this uncertainty in the economic effects analysis, several production scenarios were developed. Considered in the analysis were production capacities of local mills running with one and two shifts, possible mill closures, Medicine Bow NF harvest levels since 1986, timber products from fuel reduction management, anticipated Forest budget limitations, supplies from the nearby national forests, and supplies from state and private ownerships. Details of the analysis can be found in Appendix B. Timber harvest levels resulting from this analysis can be found in the Timber section of this chapter. Estimates of timber-related economic effects under each alternative were ultimately based upon a one-shift production capacity for all local mills. This same production level could also be achieved if the Saratoga mill was closed and all other mills operated at two shifts. State and private lands were assumed to supply no more than 20 percent of total volume --or 10 MMBF-- annually. Timber from other national forests was assumed to provide 18 MMBF annually. Volume currently under contract was not factored into the estimates for either current impacts or those in 2010. Because of the long-term nature of this analysis, volume offered by the Forest Service is considered to be identical to volume harvested.

Employment stemming from the processing of timber from the Medicine Bow National Forest has been very low in recent years. Estimates for 2010 show significantly higher levels of employment. Such changes are not achieved overnight, but may require several years to realize. In the DEIS, it was estimated that such

harvest levels could not be reached for 10 years. Based upon more recent timber program increases, it now appears that even the highest harvest levels in this FEIS could be achieved by 2010. Most of these changes can be expected in the communities that have processing facilities or from which employees commute (e.g. Walden).

Jobs directly and indirectly resulting from timber harvest and processing are expected to increase under all alternatives, except Alternative F. Alternatives A through D FEIS would result in at least 120 more jobs in 2010 than were experienced in 2001. Alternative E would result in 80 more jobs. Should budget levels increase to the desired condition level, most of the additional jobs would come from a larger timber program.

Forest Service Budgets: Local expenditures by the Forest Service can impact the local economy. This happens in two ways: 1) Forest Service employees receive paychecks and spend a portion of their wages locally and 2) the Forest Service purchases goods and services from local suppliers and contractors. Two budget levels were analyzed for each alternative. The first held budgets at recently experienced levels, or about $7.4 million. The second level increased budgets to better achieve desired conditions on the Forest. That level was set at $12.5 million. Given current fiscal realities in the total Federal budget for domestic programs, the experienced budget level provides a more likely basis for future expectations.

Cumulative Effects

Socio-economic changes in the planning area are caused by actions initiated by individuals, businesses, governments, and other organizations. Millions of decisions will be made by thousands of players over the next decade, all affecting such things as employment, income, housing, and transportation. It is impossible to account for these decisions separately. Projections of employment and income prepared for the State of Wyoming implicitly account for all of these changes. Implicitly, these projections also account for a continuation of current Forest management. These projections provide a comprehensive context for considering the effects of Forest management. Projections of employment and income to 2010 were based upon estimates generated for and used by Wyoming (Woods and Poole 2002) and Colorado (Center for Business and Economic Forecasts 2002).

Employment and Income: The following Table offers a look at the estimated effects in light of northern and southern area employment and income growth. Timber, again, dominates the picture in the southern area of Albany, Carbon, and Jackson Counties. The influence that use and management of the Medicine Bow National Forest has in the area economy is expected to increase slightly for Alternatives A through E, but drop substantially under Alternative F. The distribution of these effects is unlikely to be equal across the 3-county area. Communities with a strong agriculture industry, such as Baggs, would not be affected, except for Alternative F. Communities with sawmills (Saratoga,

Encampment, and Laramie) would likely see moderate to large increases in employment and income, except for Alternative F. Communities with a strong tourism base, such as Saratoga, would see a gradual increase in winter economic activity as snowmobile-related tourism grows. Reductions would be experienced under Alternative F, and contribute substantially to the overall job and income reduction from 2001. These reductions would not be compensated for by anticipated employment growth out to 2010.

In the northern part of the Forest, Forest-related jobs and income will mostly continue as they are today. The only drop in Forest-related impacts would occur under Alternative F, and then only about 2 percent compared with no action (Alternative A).

Changes prompted by Forest use and management are not expected to significantly alter long-term unemployment rates. Some short-term unemployment and industry shifts are likely under Alternative F where large reductions in recreation use and timber harvest are anticipated.

Table 3-219. Cumulative employment impacts, experienced budget level, 2010.

Southern MBNF (Albany, Carbon, & Jackson)										
	2001		*2010*							
Economic Indicator	***Impact Area***	***MBNF Total***	***Impact Area***	**Alt. A**	**Alt. B**	**Alt. C**	**Alt. D-DEIS**	**Alt D-FEIS**	**Alt. E**	**Alt. F**
Employment										
Total (Jobs)	31,995	2,261	35,462	2,929	2,903	2,889	2,863	2,848	2,821	2,041
% of base	100.0%	7.1%	100.0%	8.3%	8.2%	8.1%	8.1%	8.0%	8.0%	5.8%
% change from Alt A	---	---	---	---	-0.9%	-1.4%	-2.3%	-2.8%	-3.7%	-30.3%
Labor Income										
Total ($ million)	$748.1	$28.7	$886.7	$41.3	$40.7	$40.5	$39.9	$39.6	$39.1	$28.4
% of base	100.0%	3.8%	100.0%	4.7%	4.6%	4.6%	4.5%	4.5%	4.4%	3.2%
% change from Alt A	---	---	---	---	-1.3%	-2.0%	-3.3%	-4.0%	-5.3%	-31.3%

Northern MBNF (Converse)										
Employment										
Total (Jobs)	7,038	133.9	7,833	178	178	178	178	178	178	175
% of base	100.0%	1.9%	100.0%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.2%
% change from Alt A	---	---	---	---	0.0%	0.0%	0.0%	0.0%	0.0%	-1.6%
Labor Income										
Total ($ million)	$191.6	$2.1	$230.2	$3.0	$3.0	$3.0	$3.0	$3.0	$3.0	$2.9
% of base	100.0%	1.1%	100.0%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%
% change from Alt A	---	---	---	---	0.0%	0.0%	0.0%	0.0%	0.0%	-1.8%

Demographics: Population trends often follow economic trends. As jobs are created, those in search of employment move into an area. Projections, as shown earlier in this section, suggest futures that vary somewhat across Albany, Carbon, Jackson, and Converse Counties. In the northern area of Converse County, population is expected to grow by about 10 percent from 2000 to 2010. The small change that Forest Service activities could mean to employment in Converse County suggests that the Medicine Bow NF will not be a major player in affecting demographic trends.

The southern area could be vastly different from the northern area. Of the three counties in the southern area, Carbon County is the most suseptible to resource management influences. Projections show no or very small population growth over the next decade for Carbon County. Sawmill jobs, and consequently the households supported by these jobs, are very important to the communities of Saratoga and Encampment. Employment that is sustained by Forest Service timber, especially as a substitute for current timber supplies, would likely be very significant. With little population growth in the future, demographics in these communities could be shaped significantly by the Forest Service influence. Alternatives A through E would positively influence county demographics, while Alternative F would be the most disruptive to communities in Carbon County.

Local Governments

AFFECTED ENVIRONMENT

An important aspect of local communities is the financial capacity of county government. This is important since it determines the ability of the county to provide local government services and maintain public infrastructure.

Costs to Counties

As the population growth continues throughout the Rocky Mountain west, private development often increases near national forest boundaries. Homes situated adjacent to the national forest boundary typically offer more privacy, better views, greater opportunities for recreation and wildlife viewing, and more pleasant immediate surroundings than might be available further away from public lands. These amenities are highly valued by homeowners, but with these amenities come higher risks of wildfire and higher costs of services by local governments. Irregular boundaries, less-developed roads, and longer distances from community centers make for expensive law enforcement, public schools, and emergency services.

Where whole communities are closely situated near national forest boundaries, the risk of wildfire damage is even greater. Collaboration between the Forest Service and local governments can help all levels of government in controlling wildfire risks, planning for private land development, and carrying out their respective service obligations. One facet of collaboration is found in the specialized management of National Forest System lands where planned or current development of private land is intermixed. Management area 7.1 is a mechanism for managing fire in these intermixed lands.

Services and Infrastructure

The costs borne by local governments for serving visitors to the national forests includes law enforcement and judicial services, rescue and other emergency services, and wear on local public infrastructures (such as parks, streets, and water and sewer systems).

Land Ownership

The following table illustrates the percent of each county's land ownership in private, federal, and state ownership. The pattern of landownership in Wyoming ranges from nearly 96% public in Teton County to 96% private on the eastern plains. Of the counties surrounding the Forest, Laramie and Platte have a high percent of land in private ownership, followed by Converse and then Albany. Carbon County has the least private land.

Table 3-220. Percent distribution of land by public agencies for select counties in 1998.

	Albany	Carbon	Converse	Platte	Natrona	Laramie
U.S. Forest Service	13.7%	12.4%	9.5%	0.1%	0.2%	0.0%
Bureau of Land Management	11.0%	39.8%	5.3%	.05%	40.6%	0.6%
Bureau of Reclamation	0.0%	1.3%	0.0%	1.7%	0.8%	0.0%
State	7.6%	4.2%	7.1%	15.7%	5.9%	12.3%
County	<1%	<1%	<1%	<1%	<1%	<1%
Private	66%	39.2%	72%	78.3%	46.5%	89.4%

Source: Wyoming Department of Administration and Information, Economic Analysis Division. 2002

Land Use Planning

Converse County

Converse County's Land Use Plan emphasizes cooperation among landowners, including public land managers. Approximately 25 percent of total land area in Converse County is in public (local, State, or Federal) ownership. The Plan discourages the creation of any more public lands. The local governments are to only support proposals for increased activity on government lands that have adequate access to dedicated public roads. They support land use exchanges and sales that make blocks of land more marketable, manageable and logical.

The Plan requires land management agencies to consider adjacent private lands, watersheds, ecosystems, and area management in planning, as well as the social, historical, and economic conditions, customs, and culture. The County encourages timber harvest activities at levels higher than in recent past, and to promote the agricultural productivity of the County. The Medicine Bow Land and Resource Management Planning process included a cooperating agency agreement with the County to ensure this cooperation was present.

Among the County's objectives, they encourage a higher level of timber harvest than in the past, including "vigorous thinning" to reduce the likelihood of catastrophic fires. In addition, the County recognizes the importance of the Forest for recreation and water resources. The County plan identified the need to ensure soil and water conservation on all lands within the County. Any changes to current conditions require the proponent to study the socio-economic impacts of such changes, and proposed mitigation.

Carbon County

Carbon County's Land Use plan has identified opportunities for the Forest Service to work with the Planning Director, the Board of County Commissioners or interested private parties in a more cooperative way; specifically, there is an identified need for the Forest Service to provide workshops for grazing permittees. The Plan also identified the need for consultation with the planning office on land exchanges that may or may not conflict with zoning ordinances. In addition, there was a recommendation that the Forest Service work cooperatively with the State, County and the Conservation Districts on planning. This revision was completed under agreement with these entities.

A recreation corridor between Encampment and Colorado is identified as a priority for the county. This corridor is viewed in the county plan as a generator of year-round recreation opportunities in anticipation that tourism could replace any job and income losses from the agriculture sector. The 2002 Medicine Bow Roads Analysis (RAP) responded to the vision for this corridor.

The vision in the County's Plan is also to better facilitate the development of the Green Mountain Ski Resort on a private section inside the Forest boundary. This would also include changes in maintenance of the Hog Park road. There is still discussion occurring regarding the Forest Service and the County's role in the recreation corridor.

Albany County

The Specific Land Use Goals for Albany County that pertain most to Forest Management include the emphasis on preserving traditional qualities and land uses. Development proposals are encouraged to consider the natural resources, including land, water wildlife, and open spaces. The Plan does not identify specific requirements of Forest Service management, other than the standards for land development, which would apply to activities on the Forest near private developments.

Trends in Agricultural Land Uses

The conversion of agricultural land to rural residential development is a widespread phenomenon in many counties adjacent to National Forests. A recent study by the American Farmland Trust (2002) estimates that 11 percent of all prime ranchland (those with rural development densities, located near public lands, year-round water availability, mixed grass and tree cover, and a high variety of vegetation classes) are threaten by conversion to residential development (see *Communities – Demographics section*). In Wyoming, the Trust estimates that 2.6 million acres of ranchland are at risk. Many of these ranches hold federal livestock grazing permits.

One of the concerns associated with this type of conversion is that they may cause financial problems for local governments and schools. Numerous studies from across the country have indicated that the conversion of agricultural land to residential use is a net fiscal loss to county taxpayers. While tax revenues typically increase from such conversion, the increase is generally more than offset by the increase in expenses.

The following table illustrates the cost to county government and schools from the conversion of agricultural land to residential use for the Wyoming counties adjacent to the MBNF. In all case the conversion represents a net fiscal loss to county taxpayers. The net cost range from $2.77 per acre in Carbon County to $8.46 per acre in Platte. The difference in net costs between counties is the result of difference in the sources of revenue, the expenditure level, and the percentage of residence living in rural areas of the county. The last column of the table indicates the annual net cost per ranch conversion for the counties based on the average size of ranches in the county that hold grazing permits.

Table 3-221. County costs of conversion of agricultural land.

	Change in Revenue *	Change in Costs *	Annual Net Cost *	Annual Net Cost Per Acre	Average Size of Ranch (Acres)	Annual Net Cost Per Ranch Conversion
Albany	$809	$992	$183	$5.23	10,643	$55,647
Carbon	$1,620	$1,717	$97	$2.77	12,808	$35,497
Converse	$1,989	$2,257	$268	$7.66	12,902	$98,797
Natrona	$1,245	$1,429	$184	$5.26	19,299	$101,459
Platte	$2,255	$2,551	$296	$8.46	5,517	$46,656

** Based on conversion of 35 acres of agricultural land to one rural residence*

Source: Coupal, McLeod, and Taylor 2002

County Road Maintenance

Numerous roads crossing the forest fall under the jurisdiction of agencies other than the Forest Service. Few Forest roads serve as primary through-routes that connect communities, but several are used by communities for recreation and commercial access. According to the 2002 Roads Analysis Report (RAP), shared road maintenance is not occurring on key access roads (USDA Forest Service 2002). There are no maintenance agreements between the Forest Service and the counties. Cooperative agreements can be established to share road improvement and maintenance responsibilities where all partners can benefit.

The Wyoming Department of Transportation, and the Forest Service, Federal Highway Administration (FHA) signed an agreement in 1997 which set forth general procedures for planning, programming, environmental studies, design, construction and maintenance of designated Forest Highways. This program currently includes the Battle Highway (State Hwy 70), Snowy Range Road (State Hwy 130), Sage Creek Road (Carbon County Road 401), and the Douglas-Esterbrook Road.

Portions of these are still under the jurisdiction of the forest. When funding is secured, improvements will be completed to FHA standards, and they will be turned over to the state or county. The table below illustrates the costs currently absorbed by each county to maintain their road system. At present, there are no other formal agreements between the Forest and any Wyoming counties to share in road operations or maintenance. See the 2002 Forest RAP for more discussion on the Forest Service roads maintenance program.

Table 3-222. Cost to maintain county roads and bridges (FY2001).

Albany	$633,397
Carbon	$1,016,109
Converse	$1,057,995
Natrona	$1,395,464
Platte	$438,570

Source: Wyoming Department of Audit, Public Funds 2001, 2002.

County Receipts

The following discussing considers two aspects of county government revenues that could be directly or indirectly related to activities on the Medicine Bow National Forest: 1) Federal land payments and 2) receipts from assessed property and sales taxes.

Five counties contain lands within the Medicine Bow National Forest -- Albany, Carbon, Converse, Platte, and Natrona. This is a different set of counties than those substantially affected by economic activity analyzed earlier in this section. These counties receive payments simply because national forest lands are located within their boundaries. The counties analyzed in previous sections are affected because local firms interact with visitors and commodities from the national forest.

Counties that contain National Forest System lands receive payments from the federal government to generally compensate for two costs. The first cost is that borne by local governments for serving visitors to the national forests (compensated by the 25% Fund). A general relationship between land location and visitor use is implied in enabling legislation, but the level of actual visitor use is not a factor in the formula. The second cost is the loss of property tax revenues (compensated by

Payment in Lieu of Taxes (PILT) payments). These payments may or may not compensate counties fully for property taxes lost because of Federal ownership.

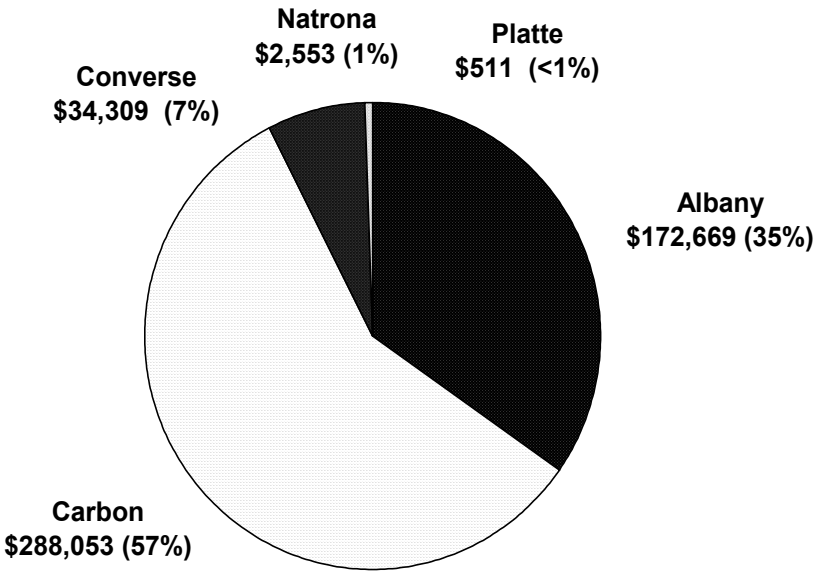
Forest Payments

The Act of May 23, 1908 (as amended) required payments equal to a 25 percent share of annual revenues coming from the sale of forest products, user fees, and special use permits (such as grazing) on each national forest. These payments were made to states, then distributed to the counties, with the restriction that they could be expended only on education or roads. The remaining 75 percent was not retained by the Forest Service, but rather deposited in the U.S. Treasury. These 25% Fund payments were not limited by annual congressional appropriations.

The Secure Rural Schools and Community Self-Determination Act of 2000 provided counties with an additional payment option. The new law offered counties an option for payments that do not fluctuate with national forest revenues. Fixed amounts based on recent history unlink these payments from changing uses and revenues of a national forest. Under this option, counties receive the average of the three highest 25% Fund payments during the period of fiscal years 1986 through 1999. This option provides stability of payments but removes the opportunity for larger payments. The fixed amounts have additional requirements for their use. Counties had until September 30, 2001, to decide whether they would continue with annually varying 25% Fund payments for choose fixed amounts. All of the five counties that have public lands managed by the Medicine Bow National Forest have elected the fixed payment option.

The figure below shows the share and amount of payments received by each county. All counties receive a share of the total payment proportionate to the share of Medicine Bow National Forests lands within their jurisdiction. It should be noted that these amounts do not include federal revenue sharing from the Thunder Basin National Grasslands.

Figure 3-11. Medicine Bow National Forest payments to states and counties, 2002.



PILT Payments

Payment in Lieu of Taxes (PILT) is a payment determined by formula in the Payments in Lieu of Taxes Act of 1976. PILT is a federal revenue-sharing program administered by the Bureau of Land Management that is designed to compensate local governments for the presence of tax-exempt federal lands within their jurisdictions. The formula takes into account such factors as other forms of revenue sharing, acreage, and population. These payments are made directly to counties and may be used for any purpose. PILT payments can be and recently have been limited by Congress through the appropriations process. Congress has not appropriated sufficient funds to fully pay counties since 1994.

PILT payments are determined in part by other Federal land revenue sharing received by a county, including payments made by the USDA-Forest Service. Consequently, the best portrayal of total federal payments affected in whole or in part by the USDA-Forest Service is to combine payments from the Forest Service and PILT. Total payments in 2002, the most recent year available for both Forest Payments and PILT, are shown in the following table.

Table 3-223. PILT and Forest payments as a share of total county revenues, 2002.

County	Total Revenue	PILT	Forest Payments	PILT & Forest Payments as Percent of Total
Albany	$7,441,361	$766,105	$172,669	12.6%
Carbon	$13,821,296	$682,128	$288,053	7.0%
Converse	$6,317,611	$356,983	$34,309	6.2%
Platte	$4,352,529	$126,358	$2,553	3.0%
Natrona	$28,864,165	$1,584,785	$511	5.5%
Total	$60,796,962	$3,516,359	$498,095	6.6%

Source: Wyoming Department of Audit, Public Funds 2001, 2002.

County Assessed Valuation

Property taxes are the largest source of revenue for Wyoming counties, accounting for one-half of total county revenue, statewide (Wyoming Department of Audit, Public Funds 2001, 2002.). Of the counties surrounding the Forest, property taxes range from 65 percent of Albany County's total county revenue to 30 percent of Platte County's total revenue. Both Carbon and Converse receive more than one-half their total revenue from property taxes.

Albany County

Total assessed valuation for Albany County in 2002 was $193 million. Over 80 percent of the valuation comes from residential and commercial properties, far above the statewide average. At $6,103 per capita of assessed valuation Albany County is substantially lower than the statewide average of $22,397. This reflects the lack of mineral production in Albany County.

Carbon County

In 2002, total assessed valuation for Carbon County was $515 million. Minerals alone accounted for 73 percent of locally assessed valuation for the county. Because of mineral production in the county, Carbon County's per capita-assessed value is nearly 50 percent greater than the statewide average.

Converse County

In 2002, the assessed valuation for Converse County was $360 million. Compared to Wyoming, Converse County's tax base is moderately dependent upon mineral production and quite dependent upon railroads properties. Per capita is $28,947, about 30 percent greater than the statewide average.

Platte County

In 2002, the assessed valuation for Platte County was $68 million. Compared to Wyoming, Platte County's tax base is dependent upon REA electric and gas pipeline properties. Per capita is nearly $12,615, almost 60 percent of the statewide average.

Sales and Lodging Tax Revenues

Since 1994, the state-imposed sales tax rate in Wyoming has been 4 percent (Liu 2002). The revenue from sale tax collections are distributed between state and local governments with 72 percent allocated to state government and 28 percent returned to local government in the county of origin. The local government share is allocated between the county and towns based on population. Wyoming counties also have the option of imposing an additional 1 percent sales tax through public election. The optional sales tax revenue, less administrative costs, is returned to the county of origin. In addition, Wyoming counties may also impose a second 1 percent sales tax. The revenues from this tax are designated solely for capital improvements. The total tax rate in Albany County has remained steady in recent years at 6 percent, while the rate in Converse County has remained steady at 5 percent. The total tax rate in Carbon County dropped from 6 percent to 5 percent in 2002.

Cities, towns and counties in Wyoming may impose an excise tax of up to 4 percent on all sleeping accommodations for guests staying less than 30 days. This tax extends to mobile accommodations such as tents, trailers, and campers, as well. At least 90 percent of the tax distributions must be used to promote travel and tourism within the county, city or town imposing the tax. The amount remaining, not to exceed 10 percent of the total amount distributed, may be used for general revenue within the governmental entity imposing the tax. The lodging tax in Albany County is 3 percent, while in Carbon and Converse Counties the rate is 2 percent.

In Colorado, the state sales tax rate is 2.9 percent (Colorado Department of Revenue 2003). Counties and municipalities may add to the statewide tax rate. Jackson County has added an additional 3 percent sales tax. Walden does not impose an additional sales tax. There is no lodging tax in Jackson County.

The following Table shows the total sales tax collected, the proportion of the sales tax revenue that can be attributed to travel and tourism, and total lodging tax collections. 2001 is the latest year that complete data are available. The shares of sales tax that is generated by travel and tourism are based on visitor expenditure estimates from Dean Runyan Associates, who provides such data for both Wyoming and Colorado. The table indicates that sales tax revenues from the counties have been increasing over time and that while the amount from travel and tourism has been increasing the reliance of sales tax revenues from travel and tourism has been steady or decreasing slightly in recent years. Jackson County is very dependent upon travel and tourism for its sales tax revenues. In Wyoming, Carbon County is nearly

twice as dependent upon these sources of tax revenues as Albany and Converse Counties.

Table 3-224. Sales and lodging taxes for counties strongly influenced by recreation use of the Medicine Bow National Forest, 1997-2001.

Measure/Jurisdiction	1997	1998	1999	2000	2001
Total Sales Tax Revenues					
Albany - county	$3,391,511	$4,008,339	$4,282,092	$4,449,821	$4,734,142
Albany - municipalities	$5,245,982	$5,859,810	$6,210,048	$6,401,865	$6,756,710
Carbon - county	$484,493	$1,366,556	$3,015,276	$3,409,614	$3,551,260
Carbon - municipalities	$3,102,457	$4,522,058	$4,269,292	$4,789,318	$4,988,281
Converse - county	$760,631	$1,076,850	$1,030,090	$1,128,860	$1,133,722
Converse - municipalities	$1,617,044	$2,289,304	$2,189,894	$2,399,872	$2,410,209
Jackson – county*	$88,223	$80,188	$85,619	$86,902	$107,439
Share of Sales Tax Revenues Generated by Travel & Tourism					
Albany County/Towns	17%	16%	16%	16%	16%
Carbon County/Towns	28%	25%	22%	20%	20%
Converse County/Towns	13%	10%	12%	10%	11%
Jackson County	79%	87%	93%	92%	n/a
Lodging Tax Revenues Generated by Travel & Tourism					
Albany County/Towns	$152,145	$167,903	$195,050	$281,810	$299,793
Carbon County/Towns	$136,126	$171,128	$184,891	$205,050	$199,686
Converse County/Towns	$51,290	$50,584	$63,866	$64,636	$54,583
Jackson County, CO	-----	-----	-----	-----	-----

* No local sales tax for Walden, CO.

Sources: Liu 2002, Colorado Economic and Demographic Information System 2003, Colorado Department of Revenue 2003, and Dean Runyan Associates 2001, 2002.

ENVIRONMENTAL CONSEQUENCES

Direct and Indirect Effects

County Land Use Plans

The landownership pattern around the Forest is generally not contiguous. The Forest Service and private landowners share the difficulty in managing land that's fully enclosed by other ownership. Management Area allocations were chosen for these small parcels that would be most compatible with adjacent management. In addition,

the Forest Service is still working at successful land exchanges that would minimize the number of these outlier parcels.

See the *Fire and Fuels* section for a discussion on the potential effects to communities from wildfire.

The effects of management area allocations on the plan for a recreational corridor in Carbon County are dependent on agreements made between the Forest and the County on management, operations, and future developments. This is a site-specific decision requiring its own analysis.

The Forest Service uses the State's approved Best Management Practices in any project with the potential to affect soil and water conditions. See the Aquatic and Soil resource sections of this chapter for more information.

Development, Subdivisions, and the Cost of Community Services

There has always been an interplay between public and private land management decisions in communities and jurisdictions in the rural West. Federal land management decisions can affect local landowners, business owners, and local governments. Conversely, these same parties can affect the use and management of Federal lands. Two loci where such relationships might be affected by the Medicine Bow NF Forest Plan revision are 1) potential changes to the agriculture industry and 2) potential changes to private land development.

Alternative F could result in a reduction to the livestock industry. Grazing reductions in these alternatives could result in employment losses from the 2001 base (as displayed in the economic subsection of this chapter). Although such losses in Alternative F are expected to be small (about 14 employees if only Forest Service grazing is considered), a few ranches could be affected enough to prompt their sale. Van Tassell and Richardson (1998) have shown that locally sizable reductions in Federal grazing can significantly affect the viability of ranching operations in Wyoming. Such losses could enhance the rate at which agricultural lands are developed for residential and second-home uses. Van Tassell and Richardson note that "…because of the price most land around national forests can demand, the danger is those lands would be subdivided into ranchettes or other residences rather than stay in productive agricultural use." Should these indirect effects come to pass under Alternative F most of the effects will be felt in small communities in the southern part of the Medicine Bow N.F.

Given the scenario presented above, local governments could expect an increase in the net cost of services. Coupal, McLeod, and Taylor (2002) projected the effect of land use change on the fiscal condition of counties throughout Wyoming. They found that "…rural residential development costs more to taxpayers than it contributes in revenues; and conversely, that agricultural land contributes more to county coffers than it asks for in services." Should reductions in permitted grazing

occur as a result of Alternatives F, it is possible that local governments could incur costs ranging from 4% to 20% more for services to the affected lands.

Trends in rural residential development are expected to continue in Wyoming apart from any change in the Medicine Bow Forest Plan. Areas where development on private lands adjoins the National Forest boundary can raise special problems related to wildfire and local government services. The specialized management of adjoining National Forest System lands is one way that the Forest Service and local governments can collaborate on solutions for these unique problems. Management Area (MA) 7.1, Residential/Forest Interface, is designed for such intermixed lands. This management area has been applied near 26 communities and developments inside and around the Forest. Specific acres have not been identified in the plan, but the effective perimeter around these 26 locations could extend up to about ¼ mile. (See Fire and Fuels Management section for a list of identified communities.)

Information to quantify the potential cost savings or increased effectiveness of services associated with each alternative is unavailable. However, the Residential/Forest Interface Management Area has been designed to greatly benefit local governments and communities. Continued collaboration during implementation will improve the benefits of this management area.

Revenues to Counties

Revenues to counties have been examined in two ways: Federal payments and sales tax Because all of the counties that contain lands managed by the Medicine Bow National Forest have elected to receive the full payment amount, both Forest Payments (25% Fund) and PILT payments are now independent of Forest outputs. Sawmills can be important contributors to local government and special district tax revenues, including school districts. If other sources of volume continue, the Medicine Bow National Forest is expected to provide sufficient volumes to maintain a local industry and associated tax revenues. The exception to this is Alternative F, where minimal harvest levels would threaten the viability of at least one mill.

Tourism tax revenues are expected to change only as a result of Alternative F which severely restricts snowmobile use. Forest management under other alternatives should not affect anticipated growth in summer or winter tourism, and thus sales and lodging tax receipts should grow with estimated tourism growth. These revenues are estimated to be 6 percent higher than they were in 2001. Under Alternative F, revenues would drop from 2001 levels by about 19 percent.

Cumulative Effects

Cumulative effects analysis considers the consequences of the alternatives in concert with the consequences of other actions. The vast number of these potential actions is described in the economic part of the Communities section. The effects described

here occur in 2010. The counties considered vary depending upon the effect discussed, just as they vary above in the affected environment discussion.

Forest payments would not be affected by these actions. Although PILT payments would not be affected by the amount in Forest receipts, PILT can be affected by changes to county populations. None of the alternatives analyzed in this FEIS would substantively alter the population growth anticipated for the planning area. Again, it is unlikely that PILT would be affected.

As stated above, second homes and other rural residential development will likely continue regardless of decisions made here. Only under Alternative F is there a potential for ranch consolidation and residential development to be increased by this Forest Plan revision. Albany, Carbon, and Converse Counties are the most likely to be affected.

Local and Wyoming tourism promotions, changes in supply on other public or private lands, new technologies, and other factors all influence the future of tax revenues associated with recreation/tourism in the Medicine Bow area. There are no projections for tax revenues associated with total recreation/tourism out to 2010 in Albany, Carbon, Jackson, and Converse Counties. Because of this, it is not possible to put sales and lodging tax revenues estimated as part of this EIS in an appropriate context.

Financial and Economic Efficiency

Both financial and economic efficiency are analyzed in this section. Financial efficiency examines revenue and cost implications from the perspective of the Forest Service. It could also be said that this is the perspective of the taxpayer. Only those revenues and costs that are recorded in financial records are included in this analysis.

Economic efficiency examines a broader definition of benefits by including values for national forest uses that are not captured in the marketplace. Willingness-to-pay values for recreation use are the primary additions over a financial analysis. Estimated market value for meat gained by grazing livestock on public land is also included. Water values have been excluded from this analysis, but not because the values themselves are unavailable; rather, research has found that determining changes in water yields at the programmatic level is very difficult to accomplish. Annual variations in yield have not been well correlated with management-area allocations. This is not true at the project level. Consequently, there are no estimates of water yield changes to which values can be assigned. See Appendix B for a description of values used in the economic analysis.

Many non-market, non-use values are excluded from this economic efficiency analysis. Some outcomes or effects, such as biological diversity, visual amenities, and some social impacts have no monetary values or costs that have been established by USDA or the Forest Service. While some research studies have explored the development of such values, it is reasonable to handle these items in a non-monetary fashion. This is done in other sections of this EIS. The agency cost of achieving these non-monetary outputs is included in both the economic and financial analyses.

Net public benefit is an important concept in the 1982 planning regulations for carrying out a forest plan revision. Net public benefit is defined as the overall value to the nation of all outputs and positive effects (benefits) minus all the associated Forest Service inputs and negative effects (costs) for producing those primary benefits, whether they can be quantitatively valued or not. Thus, net public benefits conceptually are the sum of this economic analysis *plus* the net value of nonpriced outputs and costs. It is not the result of an economic analysis alone. This concept is the basis upon which the Regional Forester selects an alternative for implementation. Net public benefits are discussed in the Record of Decision.

The main criterion used in assessing financial and economic efficiency is *present net value* (PNV), which is defined as the value of discounted benefits (or revenues) minus discounted costs. A PNV analysis includes all outputs, including timber, grazing, and recreation, to which monetary values are assigned. As noted above, the monetary values include both market and nonmarket values received by the public.

In addition, a financial efficiency analysis is completed to determine the net financial returns of each alternative. A financial efficiency analysis is the PNV of Forest Service revenues and costs. The following Table displays the economic and financial PNV for each alternative under both the experienced budget and desired condition budget levels. 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 (2002 to 2051). Revenues are not reduced for payments made to states and counties. The reduction of PNV in any alternative as compared to the most financially or economically efficient solution is the economic trade-off, or opportunity cost, of achieving that alternative.

Table 3-225. Economic and financial efficiency (present net value over 50 years in millions of 2002 dollars).

	A	B	C	D DEIS	D FEIS	E	F
Experienced Budget Level							
Financial net revenues	-117.2	-108.2	-117.2	-118.1	-118.1	-130.5	-159.5
Economic net benefits	448.7	457.7	448.7	447.8	447.8	435.5	391.1
Desired Condition Budget Level							
Financial net revenues	-149.3	-157.4	-164.0	-171.6	-178.2	-188.2	-273.1
Economic net benefits	416.7	408.6	401.9	394.4	387.7	377.7	277.4

As shown in the previous table, financial PNV (Forest Service revenues minus Forest Service costs) varies from a low of -$273.1 million for Alternative F at the desired condition budget to a high of -$108.2 million for Alternative B at the experienced budget. In all cases, Forest Service costs exceed revenues. What makes Alternative B the highest financial PNV is high timber harvest levels and associated revenues accompanied by modest cost levels across all programs. Alternatives with preservation emphases, such as F, show the highest net cost to the taxpayer, because there are limited agency revenues associated with these emphases to offset similar levels of expense.

The economic PNV (society benefits minus all costs) ranges from a low of $277.4 million for Alternative F at the desired condition budget to a high of $457.8 million for Alternative B at the experienced budget level. The economic net benefits are about half the amount shown in the DEIS. This is because current and projected recreation use has been substantially modified using the most recent survey and published data. These updates are discussed in the recreation portions of this document. The net economic benefits are largely positive and over $500 million larger than the financial net revenues. This is primarily the result of non-market recreation benefits received by the recreating public. This result suggests that even with the limited monetary values available for the economic analysis, society benefits greatly from implementing any alternative fully considered in this document.

Potential Conflicts with Goals/Objectives of Other Agencies

The Forest has coordinated with various agencies in the formulation of alternatives; the development of goals, objectives, and standards and guidelines; and other important aspects of the revision process. Consultations include American Indian tribes; the Bureau of Land Management; U. S. Fish and Wildlife Service; Wyoming Game and Fish Department; and other local, state, and federal agencies. For a chronological list of coordinations accomplished, please see Appendix A. The administrative record, located at the Forest Supervisors office in Laramie, WY, contains proceedings of each of the coordination efforts.

The alternatives, associated effects, forest-wide standards and guidelines, and management area prescriptions are generally compatible and compliment 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.

Mitigating effects from mining activities could result in conflicts with federal mining laws. The U. S. Mining Laws Act of 1872 predates all other laws that govern Forest Service activities. Conflicts could arise between the mining activities allowed under the act and other resources, such as scenery, water, sensitive plants and animals, or recreation.

Federal requirements and authorities for maintenance and protection of water resources may conflict with the State of Wyoming's administration of water rights.

The Forest is cooperating with the Wyoming Game and Fish to investigate potential declines in big game hunting opportunities on the Forest. Increasing road densities and reductions in cover may be partially responsible for elk and other big game leaving the Forest prior to the fall big game hunting season.

Resource Commitments

Energy Requirements for Implementing the Alternatives

Energy is consumed in the administration and use of natural resources from the Forest. For the purpose of the Revised Plan, energy sources are gasoline, diesel fuel, liquefied petroleum, natural gas, electricity, and wood.

Although many activities consume energy, the following are considered significant in the implementation of any alternatives:

- 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 utilizing range vegetation is the amount required for hauling stock to and from the range and for permittee range improvement activities (watering, salting, and herding).
- Energy consumption related to recreation is based on the estimated number of dispersed and developed recreation visitor days, estimated trip lengths, and facility construction.
- 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, heating, and cooking of buildings; and fuel used in such equipment as small engines and burners.

Unavoidable Adverse Effects

The application of forest-wide standards and guidelines and resource protection measures would limit the extent and duration of any adverse environmental effects. Nevertheless, some adverse effects are unavoidable. For detailed disclosure of all effects, including unavoidable adverse effects, see the preceding Environmental Consequences discussions for each resource area (air, biological diversity, recreation, minerals, etc.).

Hazardous Materials

The use of motor vehicles and the transport of hazardous materials such as gasoline, other fuels, and building materials on roads and highways carry the potential for accidental spills.

Relationship Between Short-term Uses of the Environments and Long-term Productivity

Short-term uses are those expected to occur on the Forest over the next ten years. These uses include but are not limited to, recreation use, 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 ten 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.

Monitoring, as described in Chapter 4 of the Revised 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 Plan will be amended.

Although all alternatives were designed to maintain long-term productivity, there are differences between alternatives in the long-term availability or condition of resources. There may also be differences between alternatives in long-term expenditures necessary to maintain desired conditions. These types of differences between the alternatives are described in Chapters 2 and 3.

Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable commitment of resources is 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 commitment 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 restricts on resource use.

Decisions made in a forest plan do not represent actual irreversible or irretrievable commitment of resources. A forest plan determines what kind and levels of activities are appropriate on the Forest; it does not make site-specific or project decisions. The decision to irreversibly or irretrievable commit resources occurs:

1. When the Forest Service makes a project or site-specific decision.
2. 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.

Previous to this Revised Plan and subsequent to the regulations implementing the Federal Onshore Oil and Gas Leasing Reform Act completed on April 20, 1990 there was no oil and gas leasing analysis on the Medicine Bow National Forest. If a proposal to lease had been received, a site-specific NEPA analysis would have been required to develop stipulations and determine consistency with the Land and Resource Management Plan. The Record of Decision accompanying this Revised

Plan will authorize the Bureau of Land Management to lease certain portions of National Forest System lands based on the leasing analysis in this EIS and subject to the leasing stipulations in Plan Appendix E. Although surface disturbance cannot occur on leased land without further NEPA analysis and decision-making, issuance of a lease confers certain rights on the lessee and represents a commitment of resources. The effects of the exploratory and developmental wells on lands with moderate and low oil and gas development potential were analyzed and disclosed for all alternatives.

Examples of irretrievable resource commitments associated with Revised Plan decisions are as follows:

- Commodity outputs and uses (such as motorized recreation) would be 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 would be foregone if portions of the Forest are not allocated or recommended for and subsequently designated for these purposes.
- Timber volume outputs would be foregone on lands determined as not suitable for harvest.
- Commodity outputs would be reduced or foregone on areas allocated to specific uses or purposes, such as developed recreation sites, old growth habitat, or botanical areas.
- Non-commodity values, including scenic resources, may be reduced or foregone in areas allocated to commodity uses.
- To the degree that an alternative preserves or encourages the development of mature and old-growth habitat, opportunities to develop early successional habitat are reduced.