

U. S. FOREST SERVICE

REGULATORY RISK ASSESSMENT FOR THE PROPOSED RULE

SPECIAL AREAS; ROADLESS AREA CONSERVATION; APPLICABILITY TO THE NATIONAL FORESTS IN COLORADO

August 25, 2008

EXECUTIVE SUMMARY

The Forest Service, U.S. Department of Agriculture proposes to establish a State-specific rule to provide management direction for conserving Colorado roadless areas. This rule is estimated to have more than \$100,000,000 of economic impact and will regulate environmental issues; therefore, the rule requires a regulatory risk assessment.

The purpose of this rule is “to provide lasting protection, within the context of multiple-use management, for roadless areas within the national forests in Colorado.” The risk addressed in this regulatory risk assessment is the risk that the proposed rule does not provide lasting protection, within the context of multiple-use management, for the roadless areas within the national forests in Colorado. Examining risk at the site-specific level is not practical in this assessment therefore this risk assessment will address broader programmatic risks.

In general, all of the alternatives are expected to reduce the risk of not providing protection to the roadless areas. Differences between the alternatives are based on varying restrictions, permissions, and boundaries resulting in different levels of road construction and reconstruction, tree-cutting, and other activities. Road construction, tree-cutting and energy development activities are associated with some adverse impacts on some of the roadless characteristics, but with all of the alternatives, these impacts are widely scattered and generally of short duration. Many impacts are mitigated or otherwise reduced. Overall, differences in the degree of risk between the alternatives are very small. Relatively speaking, Alternative 1 (2001 Rule) presents the lowest risk of not providing lasting roadless protection over the other two alternatives. However, due to uncertainty over its legal status and ongoing litigation a case can be made that Alternative 1 presents a higher risk of not providing lasting roadless protection over the long term. Alternative 2 (Proposed Rule) has a reduced degree of risk compared with Alternative 3 (Forest Plans) as it would impose additional restrictions limiting the amount of roading, tree cutting, and mineral development beyond those imposed under existing individual forest plans. The Proposed Rule will advance the purpose of providing lasting protection to the roadless areas and reduce the risk that such protection is not afforded.

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I. Introduction

The State of Colorado submitted a petition requesting specific regulatory protections for inventoried roadless areas within the State. The petition was the result of the recommendation of a 13-member bipartisan task force assembled to make recommendations to the Governor about National Forest Service (NFS) inventoried roadless areas in Colorado. The task force held nine public meetings throughout the State, reviewed over 40,000 public comments, and conducted a comprehensive review of Colorado's 4.4 million acres of inventoried roadless areas before making a recommendation to the Governor to petition the Secretary of Agriculture to initiate rulemaking. In August 2007, the Secretary of Agriculture accepted the State's petition and directed the Forest Service to work in cooperation with the State of Colorado to initiate rulemaking. A proposed rule and environmental impact statement (EIS) for Special Areas; Roadless Area Conservation; Applicability to the national forests in Colorado was prepared.

Need for a Regulatory Risk Assessment

A regulatory risk assessment is required by statute whenever the USDA proposes a major rule having more than \$100,000,000 of economic impact, as measured in 1994 dollars, where the primary purpose of the rule is to regulate issues of human health, safety or the environment (7 U.S.C. § 2204e). This rule is classified as economically significant due to an expected economic impact in excess of \$100,000,000. The purpose of this proposed rule is "to provide, within the context of multiple-use management, lasting protection for roadless areas within the national forests in Colorado."¹ Thus, the Colorado Roadless Rule satisfies the economic impact and subject matter criteria of 7 U.S.C. § 2204e and requires a regulatory risk assessment.

The regulatory risk assessment must examine the degree to which the proposed rule reduces the risk it was designed to address. For this regulatory risk assessment, the risk examined is the risk of not providing lasting protection, within the context of multiple-use management, for the roadless areas within the national forests in Colorado. This assessment is consistent with both the cost-benefit analysis and the draft environmental impact statement prepared for this rulemaking and relies heavily on these two documents for the program descriptions, anticipated impacts, and analyses presented below.

This assessment examines the programmatic effect of the proposed rule, but it should be noted that any changes in the management of roadless areas will occur at the site-specific level. Any actual risk reduction associated with the proposed rule will be dependent upon many site-specific factors. Examining risk at the site-specific level is not practical in this assessment, therefore, the risk of not providing lasting protection to roadless areas will be addressed at a broader programmatic level.

The level of analysis in this risk assessment is consistent with that practicable given that the proposed rule was not identified as an economically significant regulatory

¹ Proposed new text for 36 CFR 294.30, 73 Fed. Reg. 43560 (July 25, 2008)

action until the rule had entered the Departmental clearance process. A significant rule does not require a regulatory risk assessment; therefore no risk assessment was contemplated. During the clearance process, the rule was identified as an economically significant regulatory action and thus required a regulatory risk assessment.

This regulatory risk assessment compares the risk of not providing lasting protection to roadless areas between three alternatives: the 2001 roadless rule, the Colorado Roadless Area rule and the forest management plans that would be in place if the 2001 roadless rule is repealed.

The analysis is divided into two parts:

- 1) Problem formulation, which describes the structure of the risk assessment; activities, and management provisions of the proposed rule and alternatives; and roadless area characteristics and stressors; and
- 2) Risk assessment, which characterizes the risk of not providing lasting protection to the roadless areas.

II. Problem Formulation

A. Overview of analytical process

This regulatory risk assessment will use a format similar to the cost-benefit analysis and the draft environmental impact statement (DEIS) supporting the proposed rule. Two alternatives will be analyzed in addition to the Proposed Rule alternative: 1) the 2001 Rule and 2) Forest Plans. The Proposed Rule alternative would establish a state-specific roadless rule for Colorado modifying the roadless area boundaries and management provisions of the 2001 roadless rule in order to provide management flexibility. The roadless areas established under the proposed rule are referred to as the Colorado roadless areas (CRAs) in the cost-benefit analysis, DEIS, and the remainder of this analysis. The 2001 Rule alternative would retain the 2001 roadless rule's inventoried roadless area (IRAs) boundaries and roadless area management provisions. The Forest Plan alternative would establish a state-specific roadless area rule that exclusively uses management provisions in existing land management plans (forest plans) for the eight national forests in Colorado.

The ecological risk framework is used in this assessment to analyze the extent to which the alternatives affect risk. As applied to a regulatory risk assessment, the ecological risk framework consists of several steps. First, the risk to be assessed is identified. The activities and management provisions in the Proposed Rule and the two alternatives are listed and compared. The actions allowed in the alternatives limit the scope of the analysis. The key characteristics that define roadless areas are identified – these would be considered assessment endpoints in the terminology of ecological risk assessment. The condition of lasting protection for these roadless characteristics will be defined. The stressors or potential hazards that may degrade or alter the roadless characteristics are identified and discussed. In the second part of the analysis- the risk assessment - the effects of the projected activities on the roadless characteristics will be discussed. The risk of not providing lasting protection will be qualitatively characterized.

B. Risks this rule is intended to address

The proposed rule provides lasting protection, within the context of multiple-use management, for roadless areas within the national forests in Colorado. This regulatory risk assessment examines the degree to which the rule reduces the risk it was designed to address. The risk that the rule addresses is the risk of not providing lasting protection, within the context of multiple-use management, to the roadless areas within the national forests in Colorado. The provisions of the proposed rule are intended to provide lasting protection. In the absence of the proposed rule lasting protection is not guaranteed because current regulatory direction (2001 roadless rule) continues to be litigated. Activities or natural entities that may adversely affect the condition of important roadless area characteristics include road construction or reconstruction, tree-cutting, wildfires, invasive species, insects and plant diseases, energy resource development and pipeline construction and maintenance. These potential stressors are discussed in further detail in the Problem Formulation section, part E- Stressors.

The risk addressed by the Proposed Rule – not providing lasting protection to the roadless areas – is similar to the challenges faced by other land management agencies, such as the National Park Service, whose mission in part is to preserve unimpaired the natural and cultural resources and values of the national park system or the Bureau of Land Management which has established Area of Critical Environmental Concern management policies for lands where special management attention is required to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards. The risk of not providing protection for a particular purpose is not directly comparable between other land management programs as the purpose of providing lasting protection differs.

C. Activities and management provisions of the Proposed Rule and alternatives

The alternatives differ in the degree of conservation of roadless characteristics and values, primarily by providing a different mix of limitations on land use activities, specifically road building and tree cutting that may occur in roadless areas (Table 1).

1. 2001 Rule

The 2001 Rule alternative reflects current management of inventoried roadless areas (IRAs) under the 2001 roadless rule. The 2001 roadless rule established general prohibitions on road building and tree-cutting and removal within roadless areas (4.25 million acres) while permitting those activities under certain circumstances.

The 2001 Rule alternative would allow roads to be constructed or reconstructed in roadless areas under certain circumstances, such as those needed for—

- Protecting public health and safety;
- Emergency environmental response under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA);
- Reserved and outstanding rights;

Table 1. Comparison Between Actions Allowed by Alternative			
	2001 Rule	Proposed Rule	Forest Plans ¹
Road construction prohibited	Y	Y	N
Conditions where road construction or re-construction is allowed:			
Public motorized use of roads	N ²	N ²	Y
Public health and safety	Y	Y	Y
Emergency environmental response under CERCLA	Y	Y	Y
Reserved and outstanding rights	Y	Y	Y
Existing land-use authorizations	Y	Y	Y
Road-related resource damage	Y	Y	Y
Certain federal highway projects	Y	Y	Y
Road traffic safety	Y	Y	Y
Reasonable access to mineral leases in existing lease areas	Y ³	Y ³	Y ³
Reasonable access to oil and gas leases offered after effective date of rule.	N	N	Y ³
Future exploration and development of coal in North Fork coal mining area	N	Y ³	Y ³
Wildfire hazard reduction	Y	Y	Y
Future authorizations of utility conveyances for water and power across NFS lands	Y ⁴	Y	Y
Tree-cutting prohibited except for:	Y	Y	N
Threatened and endangered species management/improvement	Y	Y	NA ⁵
Maintain ecosystem properties that reduce uncharacteristic wildfire patterns	Y	Y ⁶	NA
Where incidental to management that is not prohibited	Y	Y	NA
Administrative uses	Y	Y	NA
Where roadless characteristics have been altered by road construction and timber sale	Y	NA ⁷	NA ⁷
Management and improvement of wildlife and plant species	N (T&E Only)	Y	NA
Wildfire hazard reduction	Y	Y	NA
Large-scale insect and disease management	N	Y	NA
Other considerations			
Pipeline construction through roadless areas prohibited	N ⁴	Y	N
EIS required for permanent road construction in roadless area	N	Y	N

¹ Each national forest has a unique land management plan that guides manage activities. In general, activities identified in the table are not prohibited unless specifically prohibited by the plan.

² Unless otherwise authorized, such as a public road traversing a roadless area.

³ Unless prohibited by terms and conditions of the lease for site specific purposes.

⁴ Provided no road is constructed.

⁵ Not applicable

⁶ Within an area identified in a community wildfire protection plan or wildland urban interface.

⁷ Such designation does not exist in alternative.

- Existing land use authorizations;
- Road-related resource damage;
- Certain federal highway projects;
- Road traffic safety; and
- Reasonable access to leasable minerals in existing leases.

The 2001 Rule allows tree-cutting, sale, or removal in certain circumstances, such as:

- To maintain or improve threatened, endangered, proposed, or sensitive species habitat;
- To maintain or restore the characteristics of ecosystem composition and structure, such as to reduce the possibility of uncharacteristic wildfire effects;
- Where it is incidental to the implementation of a management activity not otherwise prohibited;
- Where needed for personal or administrative uses provided for in 36 CFR Part 223- Sale and Disposal of National Forest System Timber; and
- Within portions of roadless areas where roadless characteristics have been substantially altered by the construction of a National Forest System (NFS) road and subsequent timber harvest

2. The Colorado Roadless Rule (Proposed Rule)

Under the Proposed Rule alternative approximately 4.031 million acres of NFS lands in Colorado would be identified as Colorado Roadless Areas (CRAs). If adopted, the Colorado Roadless Rule would not be subject to or affected by subsequent reconsideration, revision, or revocation of the 2001 roadless rule.

The Proposed Rule alternative allows the Chief of the Forest Service to make administrative corrections to the maps after providing public notice based on public need or changed circumstances. Significant changes involve a process comparable to that required for rule promulgation, which includes providing an opportunity for public comment.

The Proposed Rule alternative generally prohibits road construction and reconstruction and tree-cutting, sale, and removal, except under certain circumstances. The Proposed Rule alternative adds to the circumstances listed for the 2001 Rule alternative, to provide greater management flexibility to address serious forest health concerns, wildfire hazards, and demands for coal, water movement, and electrical utilities. The Proposed Rule alternative would supersede forest plan direction for road construction and reconstruction and tree-cutting in roadless areas except it would allow forest plan direction to be more restrictive.

Like the other alternatives, the Proposed Rule alternative would allow roads to be constructed or reconstructed under certain circumstances, such as those needed for—

- Emergency environmental response under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA);
- Reserved and outstanding rights;
- Existing land use authorizations;
- Road-related resource damage;
- Certain federal highway projects; and
- Road traffic safety.

The Proposed Rule alternative adds circumstances allowing road building, subject to forest plan direction, where needed for future authorizations of utility and water

conveyance structures associated with the transmission and distribution of electricity and water across NFS lands.

The Proposed Rule alternative also adds circumstances allowing temporary road building, subject to forest plan direction, where needed for—

- Protection of public health and safety;
- Wildfire hazard reduction in wildland-urban interface areas and areas identified in community wildfire protection plans;
- Reasonable access to leaseable minerals in existing lease areas as of the date of the Colorado Roadless Rule (long-term temporary roads may be built); and
- Exploration and development of coal in the North Fork coal mining area (long-term temporary roads may be built).

In all circumstances, roads constructed or reconstructed will be closed to public motorized use, unless specifically authorized. Road use will be restricted to its intended use or for administrative purposes, including emergencies and law enforcement activities.

Roads may only be constructed if the responsible official determines that one of the listed circumstances exists, and the official must consider a no-road option first. All temporary roads constructed in roadless areas shall be decommissioned and the affected landscape restored when the road is no longer needed. For roads built in support of oil, gas, or coal operations, road decommissioning would typically occur when the lease is terminated.

The Proposed Rule alternative generally prohibits the cutting, sale, or removal of trees in roadless areas except under one of four circumstances. The responsible official must consider the need for the cutting, sale, or removal of trees along with other resource and community protection needs, consistency with applicable forest plans, and effects on roadless characteristics.

Under the Proposed Rule alternative, tree cutting is allowed in roadless areas subject to forest plan direction where needed for—

- Management and improvement of wildlife and plant species;
- Wildfire hazard reduction or treatment of large-scale insect and disease outbreaks in a wildland-urban interface or area covered by a community wildfire protection plan;
- Purposes incidental to management activities that are not otherwise prohibited by this Proposed Rule; or
- Personal or administrative use, as provided for in 36 CFR 223- Sale and Disposal of National Forest System Timber.

The following provisions are unique to the Proposed Rule alternative:

- The Proposed Rule alternative prohibits the construction of pipelines to transport oil or gas through a roadless area from a source or sources located exclusively outside a roadless area;
- The Proposed Rule alternative requires the Forest Service to offer cooperating agency status to the State of Colorado for all projects proposed to be implemented on NFS lands within roadless areas, as well as within ski areas in that are specifically excluded from roadless areas; and

- The Proposed Rule alternative requires preparation of an EIS when proposing construction of a forest road in a roadless area.

3. Forest Plans

The Forest Plans alternative would promulgate a state-specific rule directing that management of roadless areas will be based on direction in the forest plans for the eight national forests in Colorado. This alternative uses roadless areas in each forest plan or its associated records of decision that currently coincide with the 2001 roadless rule inventoried roadless areas. As with the 2001 roadless rule, the roadless areas (IRAs) under the Forest Plans alternative cover 4.25 million acres. Effectively, this alternative would exempt roadless areas within Colorado from the 2001 roadless rule.

Current forest plan direction for the management of roadless areas includes forest plan goals (desired conditions), objectives, forest-wide standards and guidelines, management area standards and guidelines, and descriptions of suitable uses. In each forest plan, roadless areas overlap a number of different land management allocations.

Forest plans may be updated through an amendment or revision process to reflect changed conditions or specific public or management needs. The revision process includes a review and update of the roadless area inventory for evaluation as recommended wilderness. In addition, project-level amendments to forest plans may be done to make a specific project consistent with the forest plan. Subsequent forest plan amendments and revisions may result in changes to roadless area boundaries or management direction. In the past few years, the trend has been to allocate more roadless areas to management prescriptions that conserve roadless area characteristics.

The Forest Plans alternative follows forest plan direction, Forest Service directives, and regulations for road construction and reconstruction. The directives and regulations discourage construction of new permanent roads and require responsible officials to minimize the miles of permanent roads. Furthermore, the directives encourage use of temporary roads when needed for single-use projects and authorizations.

Forest plan direction for road construction and reconstruction generally falls into one of four categories.

- *Roading is prohibited* except where needed for reserved and outstanding rights or other exemptions mandated by law, regulation, or policy.
- *Roading is generally restricted* based on a desired condition or a guideline; not a mandatory restriction.
- *Roading is limited* under certain circumstances, such as those related to the purpose for the road, road density standards, or protection of natural resources.
- *Roading is allowed* for any multiple-use management need, where consistent with law, regulation, or policy.

The Forest Plans alternative differs from the other two alternatives in that it does not include a general prohibition on road construction or reconstruction in the roadless areas. Roding in roadless areas is prohibited or limited only where there is specific forest plan direction.

Under the Forest Plans alternative, there is no general prohibition on tree-cutting, sale, or removal in the roadless areas. Tree-cutting, sale, or removal would be allowed anywhere those activities are not specifically prohibited or limited by forest-wide or management area direction in the applicable forest plan.

Like road construction and reconstruction, forest plan direction for tree-cutting, sale, or removal generally falls into one of four categories.

- *Tree-cutting, sale, or removal is prohibited* except where needed for reserved and outstanding rights, or for other exemptions mandated by law, regulation, or policy.
- *Tree-cutting, sale, or removal is generally restricted* based on desired conditions or guidelines; non-mandatory direction.
- *Tree-cutting, sale, or removal is limited* to certain circumstances, such as those related to the purpose of the activity or protection of natural resources.
- *Tree-cutting, sale, or removal is allowed* as needed to meet multiple-use management purposes.

Although management direction in the forest plans regarding tree-cutting differs by national forest, some direction is common among plans. Common to all forest plans, tree-cutting for such non-timber purposes as hazardous fuel reduction or wildlife habitat improvement may occur on NFS lands that are considered unsuitable for timber production. Also common to all forest plans, tree-cutting for timber production purposes is limited to NFS land identified as suitable for timber production.

Forest Service planning regulations allow forest plans to be amended or revised such that the permissions or prohibitions on road building or tree-cutting in roadless areas are subject to change. These changes in forest plan direction may occur as long-term programmatic amendments or shorter-term project-specific amendments or as forest plan revisions.

D. Roadless area characteristics and their attributes

1. Overview of the nine roadless area characteristics

(a) History of these characteristics

As part of the Wilderness Act of 1964, Congress directed the Secretary of Agriculture to study, by September 3, 1974, the suitability or non-suitability for designation as wilderness 34 administratively classified primitive areas, encompassing 5.5 million acres of the NFS. By the early 1970's many of the primitive area reviews had been completed and submitted to Congress. The remaining primitive areas were awaiting Congressional action or completion of the Forest Service's review. In 1972, the Agency undertook an inventory and evaluation of all undeveloped areas within the NFS that could be considered for possible inclusion in the national wilderness preservation system. The identification of these areas was based on the criteria that they met the definition of wilderness as per section 2(c) of the 1964 Wilderness Act. From 1972 to 2001 various efforts were made to inventory and manage roadless areas until their consideration by Congress for Wilderness designation. During this timeframe national concern over

roadless area management, including roadless areas not recommended for Wilderness designation continued to generate controversy. In 2001 the USDA promulgated the 2001 Roadless Area Conservation Rule (2001 roadless rule) to address the controversy in the context of a national rule. The rule's intent was to "provide lasting protection for inventoried roadless areas within the National Forest System in the context of multiple use management".

The 2001 roadless rule recognized that activities allowed to occur in roadless areas under the rule may compromise roadless area values. To assist the Agency in determining when roadless area values were being compromised, the 2001 roadless rule, established characteristics common to roadless areas. These characteristics have been carried forward into this rule from the 2001 roadless rule (66 Fed. Reg. 3245, Jan. 12, 2001).

(b) Roadless characteristics

(1). *High quality or undisturbed soil, water, and air.* These three key resources are the foundation upon which other resource values and outputs depend. Healthy watersheds catch, store, and safely release water over time, protecting downstream communities from flooding; providing clean water for domestic, agricultural, and industrial uses; helping maintain abundant and healthy fish and wildlife populations; and are the basis for many forms of outdoor recreation.

(2). *Sources of public drinking water.* National Forest System lands contain watersheds that are important sources of public drinking water. Roadless areas within the National Forest System contain all or portions of 354 municipal watersheds contributing drinking water to millions of citizens. Maintaining these areas in a relatively undisturbed condition saves downstream communities millions of dollars in water filtration costs. Careful management of these watersheds is crucial in maintaining the flow and affordability of clean water to a growing population.

(3). *Diversity of plant and animal communities.* Roadless areas are more likely than roaded areas to support greater ecosystem health, including the diversity of native and desired nonnative plant and animal communities due to the absence of disturbances caused by roads and accompanying activities. Inventoried roadless areas also conserve native biodiversity by serving as a bulwark against the spread of nonnative invasive species.

(4). *Habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land.* Roadless areas function as biological strongholds and refuges for many species.

(5). *Primitive, semi-primitive non-motorized, and semi-primitive motorized classes of dispersed recreation.* Roadless areas often provide outstanding dispersed recreation opportunities such as hiking, camping, picnicking, wildlife viewing, hunting, fishing, cross-country skiing, and canoeing. While they may have many wilderness-like attributes, unlike wilderness the use of mountain bikes, and other mechanized means of travel is often allowed. These areas can also take pressure off heavily used wilderness areas by providing solitude and quiet, and dispersed recreation opportunities.

(6). *Reference landscapes.* The body of knowledge about the effects of management activities over long periods of time and on large landscapes is very limited. Reference landscapes of relatively undisturbed areas serve as a barometer to measure the effects of development on other parts of the landscape.

(7). *Natural appearing landscapes with high scenic quality.* High quality scenery, especially scenery with natural-appearing landscapes, is a primary reason that people choose to recreate. In addition, quality scenery contributes directly to real estate values in nearby communities and residential areas.

(8). *Traditional cultural properties and sacred sites.* Traditional cultural properties are places, sites, structures, art, or objects that have played an important role in the cultural history of a group. Sacred sites are places that have special religious significance to a group. Traditional cultural properties and sacred sites may be eligible for protection under the National Historic Preservation Act. However, many of them have not yet been inventoried, especially those that occur in inventoried roadless areas.

(9). *Other locally identified unique characteristics.* Inventoried roadless areas may offer other locally identified unique characteristics and values. Examples include uncommon geological formations, which are valued for their scientific and scenic qualities, or unique wetland complexes. Unique social, cultural, or historical characteristics may also depend on the roadless character of the landscape. Examples include ceremonial sites, places for local events, areas prized for collection of non-timber forest products, or exceptional hunting and fishing opportunities.

These roadless characteristics and their key attributes will be used to analyze the risks of the alternatives for roadless areas. Each roadless characteristic will be described separately in further detail below.

2. High quality or undisturbed soil, water and air

This roadless characteristic addresses three key resources. These resources will be discussed separately to facilitate an overall understanding.

(a) High quality or undisturbed soil

Soil quality or health can be viewed simply as its capacity to function. Soil health has been defined as, “capacity of a specific kind of soil to function within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water quality, and support human health and habitation” (Karlen et al. 1997). Soil is a fundamental component of the ecosystem serving as a substrate for plant growth and a source of nutrients and moisture. Soil absorbs and stores water, slowly releasing the water and serving as a water source for growing plants. Indicators of high soil quality are linked to ability of soil to function. Soils that are able to retain and store water and are not subject to excessive erosion are considered to have high soil quality for the purposes of this assessment.

Many different soil types are found in roadless areas due to variability in the geologic parent material, elevation, precipitation, topographic variation, and geologic time during which soil formation has been taking place. For example, soils at high elevations are generally not as well-developed or as fertile as those occurring at lower

elevations because of the short growing season at high elevations, restricting the vegetative growth and microbial activity that contributes to a low rate of soil formation. Due to the wide variability in soil quality among the soils in roadless areas, an absolute measure of soil quality alone is not a useful indicator of the status of the roadless characteristic, “high quality or undisturbed soil.” Soil quality must be viewed relative to the undisturbed condition - an undisturbed high elevation soil will not have the same soil moisture capacity or erosive characteristics as an undisturbed low elevation soil. The indicators of the status of “high quality or undisturbed soil” used in this assessment are 1) soil moisture capacity equivalent to undisturbed soil of this type and 2) erosion equivalent to undisturbed soil of this type. Ground disturbance, especially human mediated disturbances, are of small geographic extent and short duration. Lasting protection for this roadless characteristic would be indicated for soils meeting these two conditions in the context of this regulatory risk assessment.

(b) High quality or undisturbed water

Two important indicators of the status of this roadless characteristic are water quality and water quantity. High quality water is characterized by compliance with State and Federal Clean Water Act standards. The major pollutants causing impairments in streams in roadless areas are selenium, other metals such as iron, zinc, and copper pathogens (fecal coliform and E. coli), and sediment. Pollutants associated with decreased water quality in lakes and reservoirs include biologic stressors, mercury, selenium, compounds significantly affecting water pH, and substances resulting in inadequate dissolved oxygen saturation. High quality water is best represented by no reduction in current long-term water quality.

High quality water quantity is best represented by no long-term reduction in current water flows. Water yield can be affected by large-scale changes in vegetation cover in a watershed. Lasting protection for this roadless characteristic would be indicated for water meeting these two conditions for water quality and water yield.

(c) High quality or undisturbed air

High quality air meets the goals or standards expressed in the Clean Air Act, the Wilderness Act, and the Organic Act. Important attributes of high quality air include compliance with Federal and State Clean Air Act standards. High quality and undisturbed air also meets the national visibility goal of having no human caused visibility impairment and greenhouse gases are not produced significantly above historical levels.

3. Public sources of drinking water

Public sources of drinking water are protected from water quality or water quantity degradation. Lasting protection implies that no long-term water quality degradation or decrease in water yield occurs and the municipal watersheds are maintained in a relatively undisturbed condition.

4. Diversity of plant and animal communities

Roadless areas provide large, relatively undisturbed blocks of important habitats for terrestrial and aquatic species. Conserving and protecting these large contiguous blocks of habitat provide habitat connectivity and biological strongholds for a diverse variety of terrestrial and aquatic plant and animal species including threatened, endangered, and sensitive species.

Conservation of this roadless characteristic is best measured by the elevational distribution of protected areas; decreased levels of additional timber harvest and road caused fragmentation; maintenance and restoration of some natural disturbance processes; maintenance of critical wildlife travel, migration, and dispersal corridors; a high level of security and seclusion for wildlife during incubation, hatching, birthing, and rearing of young; and connectivity between large blocks of unfragmented habitat with higher levels of snags and downed woody material compared to areas with more roads.

The diversity of plant and animal communities would generally be maintained under lasting protection. Lasting protection does not imply that there will be no changes in diversity as even natural systems experience changes in the number and types of species as the ecosystem matures or responds to natural disturbances.

5. Habitat for threatened, endangered, proposed, candidate, and sensitive species, and for those species dependent upon large, undisturbed areas of land

Like the roadless characteristic for diversity of plant and animal communities, roadless areas provide large, relatively undisturbed blocks of important habitats for threatened, endangered, proposed, candidate, and sensitive species. Lasting protection for this roadless characteristic would be indicated by continuing to provide critical habitats for federally or state listed species and providing habitat for sensitive plant species and those species dependent upon large, undisturbed areas of land.

6. Primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation

The standard Forest Service Recreational Opportunity Spectrum (ROS) classification system is used as the basis for analyzing the effects of alternatives on various types of recreation opportunities and settings (USDA Forest Service. 1986).

The ROS provides a framework for stratifying and defining classes of outdoor recreation environments, activities, and experience opportunities. The ROS is divided into six classes arranged along a continuum: primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, rural, and urban (USDA Forest Service. 1986). The basic assumption underlying the ROS is that quality outdoor recreation is assured by providing a diverse set of opportunities. The indicator of the status of this characteristic is the change in ROS classification toward a more developed setting. Lasting protection is indicated by maintaining primitive, semi-primitive non-motorized and semi-primitive motorized recreational opportunities for the public.

7. Reference landscapes

Reference landscapes contribute to the body of knowledge about the effects of forest management activities over long periods of time on large landscapes. Roadless areas in Colorado currently provide a natural setting, or baseline, that may be useful as a comparison to study the effects of more intensely managed areas. The indicator of the status of this characteristic is the ability of a roadless area to serve as a reference landscape. Lasting protection of this roadless characteristic occurs when large expanses of relatively undeveloped forest land exist for long-term study of trends in ecological condition.

8. Natural-appearing landscapes with high-quality scenery

Scenery with natural-appearing landscapes enhances people's lives and benefits society (Driver et al., 1991). Scenic quality is based on two definable elements, landscape character and scenic integrity. Roadless areas inherently have high scenic quality because of the lack of human-induced disturbance.

The Scenic Management System identifies landscape character and scenic integrity as the basis for scenic quality. Landscape character is the overall visual impression of landscape attributes that provide a landscape with an identity and sense of place; it consists of the combination of physical, biological, and cultural attributes that make each landscape identifiable and distinct. Scenic integrity objectives provide a measure of the wholeness or completeness of the landscape, including the degree of visual deviation from the landscape character valued by constituents. Scenic integrity is a continuum ranging over five levels of integrity from very high to very low. The indicator of the maintenance or improvement of this characteristic is maintaining or trending towards a high scenic integrity. Lasting protection for this roadless characteristic is the maintenance of landscapes with high scenic integrity and consistency with long-term sustainable landscape character goals.

9. Traditional cultural properties and sacred sites

Traditional cultural properties and sacred sites are considered cultural resources and may exist within roadless areas. Traditional cultural properties are places, sites, structures, districts, or objects that are historically significant in the beliefs, customs, and practices of a community. Sacred sites are places that are determined sacred by virtue of their established religious significance to or ceremonial use by an Indian religion. Federal agencies are to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and are to avoid adversely affecting the physical integrity of such sacred sites when practicable. Lasting protection for this roadless characteristic is afforded when cultural properties and sacred sites are preserved.

10. Other locally identified unique characteristics

Unique characteristics that may fall within this category include unusual geological formations or unique wetland associations. Lasting preservation for these unique characteristics is difficult to define without also identifying the characteristic.

Lasting protection may involve preservation of these characteristics in an undisturbed state, but it may also involve providing some type of disturbance at a historical rate. Because these characteristics are identified at a local level, this roadless characteristic is not amenable to analysis at a programmatic-level.

E. Stressors

A stressor is an entity or activity that can potentially result in an adverse effect to the roadless characteristics defined in the previous section.

1. Overview of methodology

For each of the stressors, the potential impact on the roadless characteristics is described. It is important to note that the potential impacts described may not occur, either due to the use of mitigation measures or because only a subset of the roadless acres may be exposed to these stressors.

Some of the stressors analyzed are activities that may be allowed in some portions of the roadless areas under certain circumstances in one or more of the alternatives analyzed. The two most important of these activities are road construction and tree-cutting. These are the activities that have the greatest likelihood of altering and fragmenting landscapes with a result of immediate, long-term loss of roadless area values and characteristics. Some of the other activities that are stressors may also include road construction and reconstruction as well as tree-cutting as integral components of the activities.

Other stressors, such as invasive species, wildfires, and insect pests or diseases, are not directly controllable by the Forest Service although their effects may be indirectly influenced by activities that are allowed under the three alternatives.

2. Road construction or reconstruction

The Forest Service authorizes and manages the NFS roads that are determined to be needed for permanent long-term use. Roads that currently exist on NFS lands have also been constructed to support recreational activities, special use permits, mineral and energy development, access to private land, and other multiple uses. Recreation is currently the single largest land use activity supported by the NFS roads in Colorado, with administrative and commercial uses making up the balance.

The Agency may also authorize the construction and use of temporary roads where needed for short-term, one-time, single use purposes. Temporary roads that have been built in roadless areas are typically those needed for a short-term, single land use activity.

Temporary roads must be decommissioned after use. Road decommissioning involves activities designed to stabilize and reestablish the roads to vegetative cover similar to the surrounding landscape, as directed in Forest Service Manual (FSM) 7703. The Forest and Rangelands Renewable Resources Planning Act requires that temporary roads be closed and revegetated within 10 years after the use of that road has ended. Decommissioning actions may involve the use of logs, rocks, or other natural materials to

discourage people from driving on the road, as well as the restoration of vegetative ground cover. Tilling, seeding, and recontouring may also be done when needed.

Roads built to support mineral and energy developments—such as for oil, gas, and coal development—are long-term NFS roads that must be maintained during their life. These mineral and energy development roads are closed to the public wherever possible, and decommissioned after they are no longer needed for that specific authorized use.

All roads authorized to be constructed on NFS lands are designed in accordance with a comprehensive set of road engineering design standards in (Forest Service Handbook (FSH) 7709.59, along with the applicable forest plan standards and guidelines and road standards, which include requirements for environmental protection. The Forest Service maintains NFS roads based on road maintenance levels that are part of the road management objectives assigned to each road, as described in the FSH 7709.58 on transportation system maintenance.

(a) Potential impact on high quality or undisturbed soil

Disturbance from road construction and other ground-disturbing activities can affect the soil by increasing erosion, compaction, and changes in soil properties affecting soil condition. Construction of permanent roads removes land from production and results in permanent loss of soil productivity. The permanent loss of vegetative cover associated with permanent roads also results in changes of water runoff and infiltration into the soil. Road construction could result in increases in erosion and landslides. Road decommissioning and rehabilitation will return the soil condition and productivity to a state similar to the pre-road condition.

(b) Potential impact on high quality or undisturbed water

Where road construction or reconstruction results in soil compaction, erosion, loss of vegetation cover, and excess water runoff, excess sediment and other pollutants can more easily enter water bodies and degrade water quality. Road construction and use on national forests can adversely affect watershed geomorphology, hydrologic processes, stream sedimentation, and chemical pollution (Gucinski et al., 2000; MacDonald and Stednick, 2003).

Road decommissioning will have beneficial effects on water quality because reduction of road density is one of the best watershed restoration treatments that can be used to improve watershed and stream health. Road decommissioning treatments that return the area to its original contour and soil condition by revegetating the area and reducing soil compaction will disperse surface water runoff and eliminate the road as a source of stream sedimentation. Actions that restore subsurface water flow paths further erase the effect of the road.

(c) Potential impact on high quality or undisturbed air

Road construction and vehicular use of unpaved roads result in fine particulate (dust) emissions. Road construction and use also result in an increase in volatile organic compounds from gasoline or soot from diesel engines.

(d) Potential impact on public sources of drinking water

Because the quality and quantity of public drinking water is tied very closely to water quality and quantity, the effects of the road construction stressor on public sources of drinking water are similar to those effects identified for undisturbed water (See 2.b. above).

(e) Potential impact on diversity of plant and animal communities

Terrestrial Species - Almost all roads present some level of positive and negative effects to animal species but vary greatly in degree and can shift over time (USDA Forest Service 2000c). Road construction can—

- Convert large areas of habitat to non-habitat.
- Facilitate poaching (illegal unregulated hunting) of animals.
- Facilitate more human activity, and many species are sensitive to harassment or human presence during particular seasons.
- Restrict the movements of species, especially small mammals.
- Enhance the spread of invasive nonnative species, thereby, indirectly affecting species and their habitat.

Aquatic species - Roads can degrade native aquatic (including riparian and wetland) ecosystems by altering natural drainage patterns, promoting ground-disturbing processes (e.g., mass wasting), and providing conduits for invasive, non-native organisms and pathogens. Roads have facilitated the consumptive (fishing) use of native species. The degree to which a road will negatively affect aquatic habitat is strongly associated with the specific road design, placement, construction practices, uses, and other factors. Examples of potential adverse impacts of road construction, reconstruction or use on aquatic species are—

- Sedimentation and organic material in aquatic systems from road surfaces or cut/fill slopes;
- Road construction and use can remove, displace, or destroy riparian and wetland vegetation; and vehicles can crush aquatic organisms and associated plant communities;
- Roads can block and reroute surface and subsurface water flows and can alter the composition and abundance of riparian and wetland plant communities;
- Road drainage features such as culverts can fragment aquatic habitats by creating barriers to all or some species life history stages; and
- Roads can facilitate the spread of pathogens and diseases such as whirling disease and bacterial kidney disease in aquatic systems.

The greatest concern for potential impacts on aquatic species and habitat is where aquatic species and habitat occur in the same roadless areas as projected roading and tree-

cutting activities would occur, especially where combined with projected oil, gas, or coal activities. Changes in plant or animal species diversity due to road construction, reconstruction, or use would result from the effects of this stressor on terrestrial and aquatic habitats; thus changing the types of animals and plants found in the area. Diversity may also be changed when human-mediated disturbances affect the reproduction of species or cause species that avoid humans to leave the area.

(f) Potential impacts on habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent upon large, undisturbed areas of land

Habitat for threatened, endangered, proposed, candidate, and sensitive species may experience the same impacts from road construction as described above for terrestrial and aquatic species. Habitat for species dependent upon large, undisturbed areas of land will experience the same impacts from road construction as those described for terrestrial species above (2.e).

(g) Potential impacts on primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation

As the concentration of roads increase in a roadless area, there is a greater potential to move the Recreation Opportunity Spectrum (ROS) classification to a more developed classification not associated with the primitive, semi-primitive motorized or semi-primitive non-motorized classes. Temporary roads are expected to be short-term and do not change the ROS setting. Permanent roads, especially those associated facilities or activities occurring over long time periods, will move the ROS of semi-primitive classes to roaded natural or other more developed categories.

(h) Potential impacts on reference landscapes

Road construction has the potential to affect the natural processes associated with reference landscapes, thereby, reducing a roadless area's ability to represent reference landscapes.

(i) Potential impacts on natural-appearing landscapes with high scenic quality

Road cuts and fills have the potential to reduce the scenic quality of an area.

(j) Potential impacts on traditional cultural properties and sacred sites

Road construction can cause direct disturbance of traditional cultural properties and sacred sites. Increased human activities from improved access in roadless areas would continue to pose a threat of damage, destruction, or loss of cultural resources, or impacts on sacred sites. The ability of tribal members to visit sacred sites and conduct traditional practices in private is reduced with increased access.

3. Tree-cutting activities

Tree-cutting requires silvicultural (forest management) prescriptions. Silvicultural prescriptions in roadless areas would mostly entail thinning dense forest stands in the lower elevations of the mountains. Typically the smaller understory trees (ladder fuels) would be removed and the healthiest dominant trees retained, favoring species that are adapted to the natural ecosystem and its fire regimes. Prescriptions may also include sanitation or salvage treatments that primarily remove dead or dying trees. Salvage, including clearcuts, would be expected in areas with beetle epidemics. Tree-cutting in roadless areas would most often be followed by prescribed burning, to reduce slash accumulations from the thinning treatments and restore favorable conditions for seeds to germinate.

Activities related to tree-cutting or timber harvesting may include: roading or maintenance; manually felling trees and scattering or piling the slash (unmerchantable trees, treetops, and limbs remaining on-site after tree-cutting); and use of large machines for cutting, masticating, chipping, or piling. Merchantable logs would primarily be skidded (dragged) to nearby roads using conventional ground-based systems, although cable or helicopter yarding equipment may also be used to transport logs (partially or fully suspended off the ground) to a landing site or clearing along a road. From the log landings, logs are loaded onto log trucks and hauled away.

(a) Potential impact on high quality or undisturbed soil

Tree-cutting changes the vegetative cover of the soil and can result in erosion and soil compaction. Tree-cutting can be associated with mass wasting of soil. Road construction associated with tree-cutting or removal is associated with the soil impacts described in 2(a) above for road construction.

(b) Potential impact on high quality or undisturbed water

Water quality impacts from tree-cutting typically come from the associated skidding (log dragging) and creation of log landings (storage areas cleared of vegetation) where log removal is prescribed. Increased runoff of sediment into streams may result from tree removal.

Water yield is unlikely to be affected by tree-cutting unless it results in large-scale changes in vegetation cover in a watershed. Large scale tree removal is associated with increased water yield and long-term hydrological changes that may require up to 60 years for recovery to the previous state (MacDonald and Stednick, 2003).

(c) Potential impact on high quality or undisturbed air

Indirect impacts on air quality by tree-cutting are due to the impacts from road construction and driving vehicles on unpaved roads. Dust and volatile organic compounds from gasoline or soot from diesel engines will increase because tree-cutting depends upon the use and construction of roads.

(d) Potential impact on public sources of drinking water

Tree-cutting that removes at least 20 to 30 percent of the basal area in a watershed may increase water yields. Hydrologic recovery to pre-disturbance water yield levels following this level of vegetation removal can take as long as 60 years (MacDonald and Stednick, 2003). Increased water yields may lead to the need for additional catchment facilities to handle the increased flows.

(e) Potential impact on diversity of plant and animal communities

Tree-cutting and wood removal can alter habitat availability, configuration, and effectiveness for terrestrial and aquatic species. Uneven-aged management and thinning would be the most common regimes used in roadless areas and would have variable effects on communities, depending on the species. For example, post-fire salvage logging may reduce the diversity of cavity-nesting birds (Hutto and Gallo, 2006; Wesolowski et al., 2005). The decrease in cavity nesters may be related to reductions in food availability compared to unlogged sites where sufficient snags are retained.

As with roads, fragmentation from timber harvest can create travel barriers to some species, which may make substantial amounts of suitable habitat inaccessible. These travel barriers can fragment and isolate populations into smaller subpopulations causing demography fluctuations, inbreeding, loss of genetic variability, and local population extirpations.

In fire-adapted ecosystems where fire suppression has altered composition and spatial distribution and configuration of openings, tree-cutting can be a tool that can be used to improve the condition of these ecosystems.

Tree-cutting may also reduce the potential of large stand-replacing insect and disease outbreaks and severe wildfires. These disturbance events can present both benefits and threats to some species (Wisdom et al., 2000; USDI Fish and Wildlife Service 1995; USDA et al., 1993), at least at a local level.

Tree-cutting and removal projected to occur in roadless areas may have beneficial effects, particularly if treatments reduce the magnitude and size of severe wildfire in those areas.

(f) Potential impacts on habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent upon large, undisturbed areas of land

Tree-cutting and removal projects can affect this characteristic by either directly impacting an individual or degrading habitat to a point that it will not support a species. The transitional area between the area where trees have been cut and the undisturbed forest may create a barrier to movement for those species dependent upon large undisturbed areas of land. Specific impacts are the same as described in (e) above.

(g) Potential impacts on primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation

Tree-cutting may change the natural appearance of some roadless areas for a period of time until the trees and other vegetation regenerate. Dispersed recreation opportunities

common to this characteristic would not likely change as a result of tree-cutting activities, but the feeling of remoteness and solitude may change in some portions for a period of time. In areas where tree-cutting also involves road construction, there is the potential to change the ROS setting. If the road construction for tree-cutting is temporary and the road is later decommissioned, the ROS setting would not change.

(h) Potential impacts on reference landscapes

Tree-cutting has the potential to affect the natural processes associated with reference landscapes, thereby, reducing a roadless area's ability to represent reference landscapes.

(i) Potential impacts on natural-appearing landscapes with high scenic quality

To varying degrees, tree-cutting and removal in a roadless area has the potential to change the natural-appearing landscape of the area, at least until vegetation regenerates, thereby affecting its scenic integrity. Project design and net acres treated are critical elements in determining potential impact.

(j) Potential impacts on traditional cultural properties and sacred sites

Tree-cutting can cause direct disturbance of traditional cultural properties and sacred sites. Increased human activities would continue to pose a threat of damage, destruction, or loss of cultural resources, or impacts on sacred sites. The ability of tribal members to visit sacred sites and conduct traditional practices in private can be impacted during tree-cutting.

4. Wildfires

Wildfires are unintentional fires that are often ignited by lightning. When a wildfire starts, the Forest Service applies one of several appropriate management responses, depending on the existing fire management plans for the area and other factors. The management response to a wildfire is based on considerations such as: the size and intensity of the wildfire; firefighter and public safety; protection of property and natural resources; weather and fuel conditions; road access and other physical constraints; and the management direction and objectives for the affected area. Where the wildfire is not posing a threat to people, property, or resource values and would likely result in beneficial ecological effects, the management response may be wildfire use, where the wildfire is managed to achieve resource benefits.

Over the past 100 years, wildfires in forest ecosystems have shown a trend toward being larger, more intense and more destructive than fires historically occurring in those ecosystems.

(a) Potential impact on high quality or undisturbed soil

Large, high-severity, stand-replacing wildfires cause a loss of protective vegetative ground cover and create a hydrophobic layer or "seal" over the soil surface, resulting in massive runoff of rainfall water; thereby, inducing erosion.

(b) Potential impact on high quality or undisturbed water

Water quality is adversely affected by runoff water carried rapidly down burned slopes, carrying ash, topsoil, and small woody material into stream drainages (MacDonald and Stednick, 2003). Where wildfires result in removal of vegetation over streams, increases in stream temperature and light penetration will also occur.

Large, high-intensity wildfires are also known to cause temporary increases in water yield and peak flows on NFS lands in Colorado. Short-duration, high-intensity rainstorms following a fire can produce high peak flows and flash floods that can change channel structures and adversely affect water quality because of high sediment loads. The threat of post-fire floods during summer convective storms is greatest in the first 2 or 3 years following the fire.

(c) Potential impact on high quality or undisturbed air

Large quantities of smoke may be produced by wildfires, especially high-intensity wildfires, and is likely to affect visibility and scenic quality. Prescribed burning produces short-duration increases in particulates, carbon monoxide, nitrogen oxides (NO_x), organics, and hydrocarbons. Smoke from prescribed burning is carefully controlled to minimize smoke accumulations that could otherwise affect visibility and scenic quality in roadless areas, or affect public health and safety.

(d) Potential impact on public sources of drinking water

Municipal drinking water sources may be impacted by large-scale high-intensity wildfire due to the resulting water quality and quantity impacts described in (b) above.

(e) Potential impact on diversity of plant and animal communities

Fires can have both beneficial and adverse effects on aquatic habitat (Swanston 1991; Wright et al. 1976, Wright et al. 1982). Fires increase variability in forest composition and structure (Bisson et al., 2003), which helps maintain aquatic habitat diversity as well. However, fires can reduce vegetation in a manner that has the same adverse effects previously described in relation to historic timber harvest practices. Wildfires can increase aquatic habitat exposure to harmful ultraviolet radiation (UV-b), to increased nutrient inputs from ash and charcoal, and to ammonium toxicity from smoke diffusion (Landsberg and Tiedemann 2000; Minshall in press; Pilliod et al. in press). Fires can also result in increased flooding, increased delivery of sediment and woody material into streams, decreased stream channel stability, and increased erosion (Gresswell 1999; Minshall in press; Pilliod et al. in press). Fire suppression can have negative effects on aquatic habitat and species related to the amount of ground-disturbing activity in and near streams and other aquatic habitat (Bisson et al. 2003; Pilliod et al. in press).

Terrestrial species may experience a loss or degradation of habitat due to wildfires. While some level of wildfires naturally occur in the forest ecosystem, more frequent fires or more intense and damaging fires may alter terrestrial habitats causing a change in diversity of plants and animals. Furthermore, uncharacteristically severe fires might eliminate seed banks.

For many ecosystems, fire has played an important role in creating and maintaining suitable habitat at varying temporal and spatial scales. Many species evolved under the influence of recurrent fire, including stand-replacing events, and their long-term persistence relies heavily on the maintenance of important habitat components by these kinds of disturbance events. Changes in the historical intensity or magnitude of fire may change the types of species found in the ecosystem.

Fire has a number of landscape-level fire effects on fauna according to Smith (2000): (1) changes in availability of habitat patches and heterogeneity within them; (2) changes in the compositions and structures of larger areas, such as watersheds, which provide the spatial context for habitat patches; and (3) changes in connection among patches. During the course of post-fire succession, all three of these landscape features are in flux.

(f) Potential impacts on habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent upon large, undisturbed areas of land

Large, high-intensity wildfire has the potential to extirpate populations of threatened, endangered or sensitive species, destroy their seed banks, and modify or eliminate critical habitats. Habitats for these species are affected by wildfire as described above for all aquatic and terrestrial species.

(g) Potential impacts on primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation

Wildfire events are considered a part of the landscape's natural processes. Such natural disturbance and resultant landscape changes (even if visually unappealing) are consistent with high or very high levels of scenic integrity. Thus, this maintenance of scenic integrity signals no change in dispersed recreation opportunities consistent with this characteristic.

(h) Potential impacts on reference landscapes

While wildfire can be a natural event that would not affect this characteristic, uncharacteristic large high-severity wildfire can affect the ecological balance of a roadless area; thereby, removing it as a reference landscape for many years.

(i) Potential impacts on natural-appearing landscapes with high scenic quality

The scenic quality of a forest is not static; it changes over time. Wildfire events, insect or disease infestations, avalanches, and other natural events are considered a part of that landscape's natural processes. Within the Forest Service's scenery management classification system, such natural disturbance events and resultant landscape changes (even if visually unappealing) are consistent with high or very high levels of scenic integrity.

(j) Potential impacts on traditional cultural properties and sacred sites

Wildfire can damage historic and prehistoric buildings and structures, culturally modified trees, artifacts, features, and other surface remains. By removing vegetation, fires expose sites and make them more vulnerable to erosion damage and vandalism.

5. Invasive species

(a) Potential impact on high quality or undisturbed soil

Invasive plants may increase soil erosion and disrupt soil moisture regimes due to decreased litter production and quality over native species. Increased soil temperatures are also associated with establishment of invasive plants.

Roads and vehicular travel on roads are widely accepted as major source for the spread of invasive plants throughout the western United States (Sheley et al., 1995; USDA Forest Service 2003).

(b) Potential impact on high quality or undisturbed water

Invasive plants may increase runoff, alter stream flow, sediment deposition, and erosion thereby reducing water quality and creating instability of the watershed.

(c) Potential impact on high quality or undisturbed air

Invasive species are not expected to either negatively or positively affect high quality or undisturbed air.

(d) Potential impact on public sources of drinking water

Because the quality and quantity of public drinking water is tied very closely to water quality and quantity, the impacts from invasive species identified in (b) above are also expected to affect this roadless characteristic.

(e) Potential impact on diversity of plant and animal communities

Invasive plants can degrade national forests and other natural areas. This degradation can happen as a result of altering ecosystem functions of energy flow, nutrient cycling, watershed stability, and reducing biological diversity

Tree-cutting, road construction and associated ground-disturbing activities can provide favorable conditions for establishment of invasive species, which are known to reduce habitat availability and suitability for some species.

Aquatic species may be affected by invasive plants and animals. Invasive plant species can aggressively out-compete native species and are known to alter stream flow and water temperature regimes; reduce vegetative groundcover; alter bank stability and increase sediment inputs; alter nutrient and organic matter inputs; and overall, alter macroinvertebrate and fish habitat and populations (Sheley and Petroff, 1999). Invasive animal species are known to cause dilution of native gene pools and depletion of populations by hybridization, predation, and competition; reduction of native populations by non-native pathogens; reduction in reproductive success in native species (e.g. crayfish consuming eggs); and disruption of food chains and alterations in nutrient cycling (e.g. change in the relative abundance of zooplankton versus phytoplankton).

Terrestrial species may be affected by non-native plants or animals. The establishment of non-natives can lead to habitat loss, inter-specific competition, loss of quality forage, and lowered reproductive success for some wildlife species. The spread of invasive pathogens to native populations results in population loss.

(f) Potential impacts on habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent upon large, undisturbed areas of land

As discussed in (e) above, invasive species could alter critical habitat for threatened, endangered, proposed, candidate, and sensitive species.

(g) Potential impacts on primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation

Invasive species are not expected to either negatively or positively affect this roadless characteristic.

(h) Potential impacts on reference landscapes

Invasive plants can degrade national forests and other natural areas. This degradation can happen as a result of altering ecosystem functions of energy flow, nutrient cycling, watershed stability, and reducing biological diversity. This alteration of ecosystem functions could lead to a roadless area not functioning as a reference landscape.

(i) Potential impacts on natural-appearing landscapes with high scenic quality

Invasive species can degrade scenic beauty, all of which can negatively affect resources values in roadless areas by changing the natural appearing landscapes.

(j) Potential impacts on traditional cultural properties and sacred sites

Because invasive species can degrade the natural appearing landscapes they may degrade the values for which a sacred site was established. Also, some plant species could overwhelm a traditional cultural property to where it would decay at an abnormal rate.

6. Insects and plant diseases that damage trees

Colorado's national forests are experiencing an unprecedented mountain pine beetle epidemic and other major forest health challenges related to spruce beetle, subalpine fir decline, and sudden aspen decline.

(a) Potential impact on high quality or undisturbed soil

Insects and plant diseases indirectly affect soil quality through the removal of trees, removal of the leaf canopy, and changing the nutrient and water flow in areas where trees have died or dropped their leaves.

(b) Potential impact on high quality or undisturbed water

The wide-spread mountain pine beetle epidemic that is killing lodgepole pine and other pine species throughout Colorado is likely contributing to some temporary increases in water yield. Many roadless areas will continue to be affected by continued pine tree mortality, together with potential wildfires, resulting in future short-duration increases in water yield.

(c) Potential impact on high quality or undisturbed air

Large scale insect and disease outbreaks would have no affect on air resources. However, treatment of such outbreaks with chemicals or dust from ground disturbance could affect the resource. Such activities would be short lived.

(d) Potential impact on public sources of drinking water

For the reasons mentioned in (a) and (b) above, large scale insect and disease outbreaks can cause degradation to sources of public drinking water.

(e) Potential impact on diversity of plant and animal communities

Roadless areas provide a diverse array of vegetation types, thereby, providing habitat for a diversity of plant and animal communities. Large scale insect and disease outbreaks have the potential to alter the array of habitat, thereby, leading to a reduction in the diversity of plant and animal communities. Large scale insect and disease outbreaks create an abundance of fuels for wildfires. Insect and disease damage is indirectly linked to the types of effects on the diversity of plant and animal communities related to wildfire (discussed above 4.e)

(f) Potential impacts on habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent upon large, undisturbed areas of land

As discussed in (e) above, large scale insect and disease outbreaks can degrade critical habitat for threatened, endangered, proposed, candidate, and sensitive species.

(g) Potential impacts on primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation

Like wildfire, large scale insect and disease outbreaks are natural events and are considered a part of the landscape's natural processes. Such natural disturbance and resultant landscape changes (even if visually unappealing) are consistent with high or very high levels of scenic integrity. Thus, this maintenance of scenic integrity signals no change in dispersed recreation opportunities consistent with this characteristic.

(h) Potential impacts on reference landscapes

Reference landscapes contribute to the body of knowledge about the effects of forest management activities over long periods of time and on large landscapes. Reference landscapes provide comparison areas for evaluation and monitoring. Because large scale insect and disease outbreaks are natural events generally triggered by overall forest health these events, in and of themselves, would not be viewed as degrading the roadless characteristic.

(i) Potential impacts on natural-appearing landscapes with high scenic quality

The scenic quality of a forest is not static; it changes over time. Wildfire events, insect or disease infestations, avalanches, and other natural events are considered a part of

that landscape's natural processes. Within the Forest Service's scenery management classification system, such natural disturbance events and resultant landscape changes (even if visually unappealing) are consistent with high or very high levels of scenic integrity.

(j) Potential impacts on traditional cultural properties and sacred sites

Large scale insect and disease outbreaks are not generally expected to impact cultural properties or sacred sites. When the cultural property is a culturally modified tree, there is a possibility that the insect or disease outbreak will affect the tree. Indirectly, insect and disease outbreaks may result in large amounts of standing dead trees or other hazardous fuels that would increase the possibility of an intense, stand-replacing wildfire that could adversely impact cultural properties or sacred sites.

7. Mineral extraction and exploration

(a) Potential impact on high quality or undisturbed soil

Developing oil and gas fields can result in soil erosion. New mine sites, well pads, roads and pipelines increase the potential for accelerated erosion and soil compaction. Built structures alter stream channels, increase erosion, and sediment rates. Roads constructed associated with energy development will create the same type of impacts on the soil as discussed earlier (2.a)

(b) Potential impact on high quality or undisturbed water

Ground disturbing activities associated with mineral exploration or extraction may result in increased erosion and sediment transport to surface waters. Waste water of insufficient water quality may be injected into deep aquifers as a form of disposal. Oil and gas and mineral extraction may result in chemical contamination of water by hydrocarbons or other chemicals. The dissolution of methane into groundwater may degrade water quality. The most likely route of chemical contamination associated with mineral extraction or exploration is through chemical spills. The risk of chemical spills increases with the amount of energy development activity. Disposal of produced water from oil and gas development would also be regulated by the State to protect water quality.

(c) Potential impact on high quality or undisturbed air

Methane gas is emitted from natural gas and coal production. Coal mines are responsible for approximately 8 percent of all methane emissions (Intergovernmental Panel on Climate Change, 2007). Methane is emitted from underground mines through a venting system, which is required for safety purposes.

(d) Potential impact on public sources of drinking water

Because the quality and quantity of public drinking water is tied very closely to water quality and quantity, the impacts on public sources of drinking water from mineral extraction and exploration are similar to those discussed for high quality or undisturbed water above (7.b.).

(e) Potential impact on diversity of plant and animal communities

Oil and gas development (initial road and pad construction and drilling of wells) usually occurs intensively over the first few years. Once production has been established, subsequent activity generally consists of well and road maintenance and inspections by operators and agency personnel. Producing wells and associated facilities are likely to exist on the landscape for more than 15 years, and the roads, pads, and other disturbed sites are eventually reclaimed after their use for oil and gas operations has ended. Coal mining activities mostly occur underground. Typical coal-related surface uses for the underground mines include construction of methane gas ventilation shafts and drainage wells, exploration drilling, resource monitoring, and road construction (most roads are associated with the methane vents).

Those operations can contribute to the following impacts on species (Abing, 2007):

- Physical removal of habitat and increased disturbance to adjacent habitats;
- Increased fragmentation of landscapes, habitats, and connectivity;
- Increased introduction and spread of invasive plants and animals;
- Increased potential for road-related mortality of wildlife due to collisions and human access; and
- Increased disturbance and associated physiological and reproductive effects on certain wildlife.

(f) Potential impacts on habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent upon large, undisturbed areas of land

The impacts on habitat for threatened, endangered, proposed, candidate, and sensitive species from mineral extraction and exploration are similar to those discussed for diversity of plant and animal communities above (7 e).

(g) Potential impacts on primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation

Roads built in roadless areas to support energy resource development would more likely result in a longer-term change in the recreation setting; there would be a higher potential for the ROS setting to change from semi-primitive motorized to a roaded natural setting. This is most likely to occur in portions of certain roadless areas where new roads together with the facilities and activities associated with oil, gas, or coal operations are projected to occur over a long period of time.

(h) Potential impacts on reference landscapes

Like road construction, mineral development has the potential to affect the natural processes associated with reference landscapes, thereby, reducing a roadless area's ability to represent reference landscapes.

(i) Potential impacts on natural-appearing landscapes with high scenic quality

The surface disturbance from the development of wells, well pads, and roads, as well as production in high concentrations can degrade natural-appearing landscapes with high scenic quality.

(j) Potential impacts on traditional cultural properties and sacred sites

Surface activities can cause direct disturbance of traditional cultural properties and sacred sites. Increased human activities from improved access in roadless areas would continue to pose a threat of damage, destruction, or loss of cultural resources, or impacts on sacred sites. The ability of tribal members to visit sacred sites and conduct traditional practices in private is reduced with increased access.

8. Construction and maintenance of pipelines and other utility conveyances

Utilities and water conveyance structures are defined as facilities associated with the transmission and distribution of electricity and water across NFS lands. Utilities are defined as existing and future powerlines. Water conveyance structures are defined as existing and future diversion structures, headgates, pipelines, ditches, canals, and tunnels; the term water conveyance structure does not include reservoirs.

(a) Potential impact on high quality or undisturbed soil

Soil disturbance from ground-disturbing activities can affect the soil by increasing erosion, compaction, and changes in soil properties affecting soil condition. Construction of permanent facilities removes land from production and results in permanent loss of soil productivity. The permanent loss of vegetative cover associated with permanent facilities also results in changes in runoff and infiltration of water into the soil. Construction could result in increases in erosion and landslides. Where access roads are decommissioned and rehabilitated soil condition and productivity will return to a state similar to the pre-road condition.

(b) Potential impact on high quality or undisturbed water

Where construction results in soil compaction, erosion, loss of vegetation cover, and excess water runoff, excess sediment and other pollutants can more easily enter water bodies and degrade water quality. Construction can adversely affect watershed geomorphology, hydrologic processes, stream sedimentation, and chemical pollution.

Construction access road decommissioning will have beneficial effects on water quality because reduction of road density is one of the best watershed restoration treatments that can be used to improve watershed and stream health. Road decommissioning treatments that return the area to its original contour and soil condition by revegetating the area and reducing soil compaction will disperse surface water runoff and eliminate the road as a source of stream sedimentation. Actions that restore subsurface water flow paths further erase the effect of the road.

Day-to-day production activities may lead to accidental spills of chemicals or oil, which may degrade surface water.

(c) Potential impact on high quality or undisturbed air

Construction and maintenance can result in fine particulate (dust) emissions along with an increase in volatile organic compounds from gasoline or soot from diesel engines.

(d) Potential impact on public sources of drinking water

Because the quality and quantity of public drinking water is tied very closely to water quality and quantity, the impacts of construction and maintenance of pipelines and other conveyances on public sources of drinking water are similar to the impacts discussed for high quality or undisturbed water above (8 b).

(e) Potential impact on diversity of plant and animal communities

Terrestrial species - Almost all construction activity presents some level of benefit and threat to animal species but varies greatly in degree and can shift over time (USDA Forest Service, 2000). Construction activity—

- Can convert large areas of habitat to non-habitat;
- Restricts the movements of small mammals;
- Facilitates more human activity, and many species are sensitive to harassment or human presence during particular seasons;
- Can restrict the movements of species, especially small mammals; and
- Can enhance the spread of invasive nonnative species, thereby, indirectly affecting species and their habitat.

Aquatic species – Construction can degrade native aquatic (including riparian and wetland) ecosystems by altering natural drainage patterns, promoting ground-disturbing processes (e.g., mass wasting), and providing conduits for invasive, non-native organisms and pathogens. The degree to which construction will negatively affect aquatic habitat is strongly associated with the specific design, placement, construction practices, uses, and other factors. The following are examples of adverse impacts on aquatic species or habitats.

- Sedimentation and organic material in aquatic systems from surface disturbance
- Construction can remove, displace, or destroy riparian and wetland vegetation; and vehicles can crush aquatic organisms and associated plant communities
- Construction can block and reroute surface and subsurface water flows and can alter the composition and abundance of riparian and wetland plant communities
- Drainage features such as access road culverts can fragment aquatic habitats by creating barriers to all or some species life history stages

- Construction and maintenance can facilitate the spread of pathogens and diseases such as whirling disease and bacterial kidney disease in aquatic systems

Oil or chemical spills from day-to-day oil and gas or coal operations will likely adversely affect aquatic species habitat if such spills reach aquatic habitat.

(f) Potential impacts on habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent upon large, undisturbed areas of land

The impacts on habitat for threatened, endangered, proposed, candidate, and sensitive species from construction or maintenance of pipelines and other conveyances are similar to the impacts on plant and animal diversity above (8 e).

(g) Potential impacts on primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation

As the concentration of these types of activities increase in a roadless area it has a greater potential to move the ROS classification to a more developed classification not associated with the primitive, semi-primitive non-motorized or semi-primitive motorized class.

(h) Potential impacts on reference landscapes

These types of activities have the potential to affect the natural processes primarily associated with wildlife by creating habitat fragmentation and barriers to migration. These activities can also transport invasive species by maintenance vehicles. Together, these impacts can reduce a roadless area's ability to represent reference landscapes.

(i) Potential impacts on natural-appearing landscapes with high scenic quality

These types of lineal activities with wide rights-of-ways have the potential to reduce the scenic quality of an area.

(j) Potential impacts on traditional cultural properties and sacred sites

Construction can cause direct disturbance of traditional cultural properties and sacred sites. Increased human activities from improved access in roadless areas would continue to pose a threat of damage, destruction, or loss of cultural resources, or impacts on sacred sites. The ability of tribal members to visit sacred sites and conduct traditional practices in private is reduced with increased access.

III. Risk Assessment

A. Overview

Common types of impacts on the roadless characteristics occur in each of the alternatives. These common impacts will be discussed in the overview section. Differences in the extent of the impacts will be addressed in the separate discussions for

each alternative below. Differences in the risk reduction associated with the alternatives are related to differences in the intensity, geographic extent and duration of the seven stressors discussed in section II.E above. The following tables provide context to the potential intensity of key stressors.

Table 2. Miles of existing authorized roads in roadless areas

	Alternatives 1 and 3 (IRAs)	Alternative 2 (CRAs)
NFS road miles	1322	166
Other authorized road miles	22	7
Road miles no longer needed	52	43
Total existing road miles	1,396	216

CRAs=Colorado roadless areas; IRAs=inventoried roadless areas; NFS=National Forest System

Note: CRAs include 309,000 acres of unroaded areas that are not included in IRAs, and exclude 520,800 acres of substantially altered areas and 8,200 acres of ski areas that are included in IRAs.

Data source: Forest Service Region 2 INFRA-GIS roads databases, April 2008.

Table 3. Average annual road construction and reconstruction miles projected by alternative

Type of projected roading activity	Average annual road construction and reconstruction		
	Alternative 1	Alternative 2	Alternative 3
	----- miles -----		
Road construction	5	21	28
Road reconstruction	1	0	2
Total construction/reconstruction	6	21	30

Miles are rounded to the nearest mile.

Data source: Forest Service Region 2 INFRA-GIS roads databases, April 2008.

Table 4. Average annual projections of oil and gas wells and pads, and total coal reserve acres where roading is allowed in roadless areas, by alternative

	Average annual projections		
	Alternative 1	Alternative 2	Alternative 3
Number of wells	16	45	48
Number of well pads	4	11	11
Acres of coal reserves	3,700	29,000	31,000

Sources: Roadless Areas GIS Database 2008; USDI Geological Service, Colorado Geological Survey, and USDI Bureau of Land Management leasable minerals databases (April 2008).

Table 5. Projected average annual tree-cutting acres and harvest volumes in roadless areas by alternative

Type of activity	Average annual projections		
	Alternative 1	Alternative 2	Alternative 3
Tree-cutting acres without harvest	700	6,300	12,200
Tree-cutting acres with harvest	50	1,300	4,100
Total tree-cutting acres	800	7,600	16,300
Harvest volume (ccf)*	800	1,700	24,400

1 ccf (hundred cubic feet) = approximately 0.5 Mbf (thousand board feet).

All figures have been rounded to the nearest hundred.

Totals may not add due to rounding.

Data source: Forest Service Region 2 INFRA-GIS roads databases, April 2008.

1. Impacts common to all alternatives on high quality or undisturbed soil, water and air

(a) High quality or undisturbed soil

The primary activities that could affect soil resources in roadless areas include road construction and reconstruction; existing roads and road uses; timber harvest; livestock grazing; fires (all types); oil, gas, and coal development; and recreation activity. Cumulative soil erosion has been documented intensively for these activities in related research. Soil disturbance from road construction and other ground-disturbing activities can affect the soil resource by increasing erosion, compaction, and other soil quality conditions. Tree-cutting, especially when accompanied by road construction, can result in soil erosion.

In all of the alternatives, the soil resource in the roadless areas would generally remain in a functioning condition, with no significant loss of long-term soil productivity due to the limited geographic extent of projected ground-disturbing activities within the roadless areas, the mitigation measures typically applied to road construction and other ground-disturbing activities to avoid soil quality impacts, and the rehabilitation measures required after projects are complete.

(b) Potential impact on high quality or undisturbed water

All of the alternatives have the potential to adversely affect water quality when ground-disturbing activities occur such as construction of roads, skid trails, log landings, oil-gas well pads, mining sites, communications sites, or other constructed features. Prescribed burning, hard-rock mining, livestock grazing, camping, hiking, biking, off-highway motor vehicle uses, and many other ongoing land use activities would continue to contribute to localized impacts to water quality but would be effectively mitigated through the use of site-specific watershed conservation practices and best management practices (BMPs). The extent and effect of activities would not be measurably different under any of the alternatives. Under all the alternatives, the impacts would be localized and geographically scattered across millions of acres of roadless areas, so the impact on any one

drainage or watershed in a given year would be small. There will be beneficial effects on water quality associated with the projected road decommissioning.

Currently, water yield in Colorado is not being measurably altered by ongoing activities in roadless areas. Large, high-intensity wildfires may cause temporary increases in water yield and peak flows as well as adversely affect water quality because of high sediment loads.

(c) Potential impact on high quality or undisturbed air

Under all of the alternatives, smoke and particulate material from wildfires may impair visibility and affect air quality. Emissions from prescribed fire will be of limited duration and mitigated using site-specific mitigation measures.

Road construction and vehicular use of unpaved roads could result in fine particulate (dust) emissions. Road construction and use could also result in an increase in volatile organic compounds from gasoline or soot from diesel engines. However, emissions from road construction will be of limited durations and mitigated using site-specific mitigation measures.

2. Impacts common to all alternatives on public sources of drinking water

Because the quality and quantity of public drinking water is tied very closely to water quality and quantity, the impacts identified in 1(b) above serve for this roadless characteristic as well.

3. Impacts common to all alternatives on diversity of plant and animal communities

All surface disturbing activities have the potential to affect negatively plant and animal habitat by converting habitat to non-habitat, restricting the movements of species, and enhancing the spread of invasive species. The degree to which a road, tree cutting, mineral extraction, or other surface disturbing activity will negatively affect plant and animal habitat is strongly associated with project design and placement, construction practices, long-term maintenance uses, and other factors.

Long-term human use of an area can facilitate poaching and make species sensitive to harassment.

Large scale insect and disease outbreaks have the potential to alter the array of habitat, thereby, leading to a reduction in the diversity of plant and animal communities. Outbreaks can also create an abundance of fuels for wildfires, which in turn can affect the diversity of plant and animal communities as outlined above (II E 4 e).

4. Impacts common to all alternatives on habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent upon large, undisturbed areas of land

Habitat for threatened, endangered, proposed, candidate, and sensitive species may experience the same impacts from surface disturbing activities as described above for animal and plant habitats. During project-level planning and implementation, potential adverse impacts would be identified and either avoided or mitigated, in accordance with

direction in forest plans, laws, regulations, and agency policies. Each new undertaking on NFS lands requires evaluation of effects on threatened and endangered (T&E) and sensitive species, management indicator species (MIS), and migratory bird species; appropriate conservation measures must be considered in the decisionmaking process.

Threatened, endangered, proposed, or candidate plant species may be affected by invasive species. The degree to which invasive species are likely to occur is related to the amount of road construction, road use, and tree-cutting.

Activities projected under any of the alternatives are not expected to directly impact threatened, endangered, proposed, or candidate plant species for these activities do not overlap those of the threatened or endangered plants.

Sensitive plant species may overlap with road construction, tree-cutting, or energy resource development. Under all of the alternatives, the Forest Service would try to avoid sensitive plant species during project implementation.

5. Impacts common to all alternatives on primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation

Under all alternatives, no new roads would be expected to be built within areas allocated in forest plans to a primitive ROS setting. The primitive ROS class occurs on a small proportion of the roadless area acreage, such as in recommended wilderness and some special interest areas where the forest plan direction is designed to maintain unroaded and undeveloped ROS settings. Thus, the portions of roadless areas allocated in forest plans to primitive ROS classes would not likely be affected by any of the alternatives.

Roads associated with tree-cutting, mineral development, and utility and pipeline structures are expected to occur in the semi-primitive classes. As the concentration of these types of activities increase they have a greater potential to move the ROS classification to a more developed class not associated with these classes.

6. Impacts common to all alternatives on reference landscapes

Where additional roading and associated tree-cutting and energy resource development are projected to occur in roadless areas, the quality of those roadless areas as reference landscapes could be degraded or lost, depending on project design and acres affected. The substantially altered acres and other acres where roads and tree-cutting have already occurred in roadless areas would continue to be of little value as reference landscapes where natural settings are needed.

7. Impacts common to all alternatives on natural-appearing landscapes with high scenic quality

Where additional roading and associated tree-cutting and energy resource development are projected to occur in roadless areas, the scenic quality of those roadless areas could be degraded or lost. The substantially altered acres and other acres where roads and tree-cutting have already occurred in roadless areas would continue to be of little value as natural-appearing landscapes with high scenic quality.

8. Impacts common to all alternatives on traditional cultural properties and sacred sites

Forest Service land management practices have the potential to affect buried or surface remains of archaeological sites, historic sites, and sites of traditional or religious importance to tribes. Whenever roads or other facilities are constructed, there may be a variety of associated impacts on cultural resources that affect the integrity of those sites; however, effects on cultural resources are not significant among the three alternatives.

B. 2001 Rule

This alternative has the potential to adversely affect soil and water quality when new ground-disturbing activities occur in the roadless areas—including construction of new roads, skid trails, log landings, oil-gas well pads, mining sites, communications sites, or other constructed features. The least amount of road construction and reconstruction as well as the least amount of tree-cutting is allowed under this alternative relative to the other two alternatives. The impacts to soil productivity due to ground disturbing activities are least under this alternative. Impacts to water quality due to tree-cutting and roading are minimized in this alternative as these activities would be widely scattered and not expected to be concentrated in one watershed. Conservation and mitigation measures would be used to minimize any water quality impacts resulting from tree-cutting or roading.

This alternative has the potential to constrain the ability to address wildfire hazard in priority areas, which increases the chance of experiencing large, unwanted, or uncharacteristic fires in municipal watersheds within or adjacent to roadless areas, thus increasing the risk of sedimentation in water and water quality degradation associated with high-severity wildfire. High quality air may be affected by smoke-related impacts from wildfires. Methane from underground coal mines will most likely be vented to the atmosphere.

The projected increase in invasive species is least under this alternative, but large-scale insect damage is more likely under this alternative. Higher levels of dead and downed trees would be expected under this alternative. This would result in more accumulation of fuel for wildfires. Hazardous fuel treatments and forest health treatments to reduce insect or diseases are least likely under this alternative than the other two. Long-term and widespread improvement in forest or rangeland health would be least likely under this alternative.

Indirect impacts on endangered, threatened, candidate, or proposed plant species due to invasive species are least under this alternative. Individual sensitive species may be adversely affected but is not expected to result in a loss of viability or a trend toward federal listing. This alternative provides the greatest protection for terrestrial wildlife species and habitat of the three alternatives and results in the least human activity – and disturbance. Habitats for plants and animals may be modified by high-intensity, stand-replacing wildfires.

This alternative would retain the greatest amount of acreage of roadless area that could serve as reference landscapes. Where additional roading, tree-cutting, or energy development occurs, the quality of the roadless area as a reference landscape is degraded or

lost. The scenic quality of the landscape would remain at the current high level of scenic integrity under this alternative. This alternative does contain some substantially altered acreage and developed ski areas which do not contribute to a high level of scenic integrity.

Impacts to cultural or sacred sites are expected to be the lowest for the 2001 Rule alternative relative to the other two alternatives. This alternative results in the lowest risk of ground-disturbing activities that could damage cultural resources. However, the risk of a stand-replacing high-intensity wildfire that could damage cultural resources is greatest in this alternative due to the reduced amount of fuel management.

C. Colorado Roadless Rule (Proposed Rule)

Like the 2001 Rule alternative, this alternative has the potential to adversely affect soil and water quality when new ground-disturbing activities occur in roadless areas—including construction of new roads, skid trails, log landings, oil-gas well pads, mining sites, communications sites, or other constructed features. The Proposed Rule alternative allows for more road construction and reconstruction as well as more tree-cutting than the 2001 Rule alternative, but less than the Forest Plans alternative. This alternative would have a slightly greater risk of adverse impacts on soil and water quality in roadless areas compared to what was described for 2001 Rule alternative.

The Proposed Rule alternative poses a slightly greater risk to municipal water supplies from authorized activities compared to the 2001 Rule alternative simply because of the increase in projected ground-disturbing activities under the Proposed Rule alternative. However, municipal water supplies in the water assessment areas would continue to be adequately protected by use of watershed conservation practices, BMPs, and other mitigation measures. Any impacts would be scattered across many different roadless area watersheds. In addition, the risk of a large-scale high-intensity wildfire in a roadless area resulting in water quality impacts on a municipal water supply assessment area would be less than the 2001 Rule alternative, because more acreage is treated to abate wildfires under the Proposed Rule alternative. High quality air may be affected by smoke-related impacts from wildfires, but would be short-term. Methane from underground coal mines may be collected and removed.

Under this alternative, there would be an increase in the amount of road construction and reconstruction, tree-cutting and removal activities, and leaseable mineral activities. Thus the potential introduction and spread of invasive plants would be higher under this alternative than the 2001 Rule alternative. However, on more than 90 percent of the roadless areas these ground-disturbing activities are not projected to occur. Thus, overall, there would remain a relatively low risk of substantially increasing invasive plant infestations in the roadless areas.

Large-scale insect damage is likely under this alternative, but at a lesser level than the 2001 Rule alternative. High levels of dead and downed trees would continue to be expected under this alternative. This would result in accumulation of fuel for wildfires. Hazardous fuel treatments and forest health treatments to reduce insect or diseases are more likely under this alternative than the 2001 Rule alternative. Thus, long-term and widespread improvement in forest health would be higher.

The estimated effect on T&E species would not substantially vary by this alternative because no additional roading, tree-cutting, or energy development is projected to occur in the portions of roadless areas that support T&E plants. Individual sensitive species may be adversely affected but is not expected to result in a loss of viability or a trend toward federal listing, even though this alternative results in increased human activity and disturbance than the 2001 Rule alternative. This alternative results in less protection for terrestrial wildlife species than the 2001 Rule but more than the Forest Plans alternative based on projected activities in roadless areas where important wildlife habitat occurs.

This alternative is likely to retain a large proportion of roadless acreage as reference landscapes; a smaller proportion than the 2001 Rule alternative and a higher proportion than the Forest Plans alternative. Where additional roading, tree-cutting or energy development occurs, the quality of the roadless area as a reference landscape is degraded or lost. The scenic quality of the landscape would remain at the current high level of scenic integrity under this alternative. Also, substantially altered acres are not included in this alternative and would not add to or subtract from the value of reference landscapes. However, the additional unroaded acres included (and not included in the 2001 Rule alternative) would enhance the acreage that provides potential reference landscapes with natural settings.

Compared to the other alternatives, this alternative would result in a moderate risk of adverse impacts on cultural resources from ground-disturbing activities such as road construction and use, tree-cutting and removals, or energy resource development activities. It would also result in a moderate risk of adverse impacts on historic landscapes and settings, and on traditional uses by tribes or rural community groups. The risk of adverse effects from authorized activities in roadless areas would still be relatively low. The risk of uncharacteristic stand-replacing high-intensity wildfire that could damage cultural resources is reduced due to higher levels of hazardous fuels treatment than under the 2001 Rule alternative.

D. Forest Plans

This alternative has the greatest potential to result in the largest amount of road construction and reconstruction as well as the largest amounts of tree-cutting and mineral development. Thus, this alternative has the highest potential to adversely affect soil and water quality when new ground-disturbing activities occur in the roadless areas—including construction of new roads, skid trails, log landings, oil-gas well pads, mining sites, communications sites, or other constructed features. This risk is mitigated through use of post-project rehabilitation of disturbed soil, BMPs, and regulatory permit requirements.

The alternative is less likely to experience smoke-related impacts than other two alternatives due to wildfires as this alternative provides the greatest amount of hazardous fuel reduction treatments. It is unlikely that prescribed fire used to reduce hazardous fuels will result in emissions that exceed air quality criteria. Most emissions would be of limited durations and mitigated using site-specific mitigation measures.

This alternative poses a slightly greater risk to municipal water supplies from authorized activities compared to the other alternatives simply because of the increase in projected ground-disturbing activities. However, municipal water supplies in the water

assessment areas would continue to be adequately protected by use of watershed conservation practices, BMPs, and other mitigation measures. Any impacts would be scattered across many different roadless area watersheds. In addition, the risk of a large-scale high-intensity wildfire in a roadless area resulting in water quality impacts on a municipal water supply assessment area would be reduced when compared to the other alternatives because more acreage is treated to abate wildfires.

There is a risk of indirect adverse impacts on federally listed and sensitive plants due to establishment and spread of invasive species; this risk is equivalent to the risk associated with the Proposed Rule alternative. Sensitive species will experience a greater risk of adverse indirect effects than T&E species due to the larger number of sensitive plant species habitats than habitats for threatened or endangered species. The increased risk to sensitive species is partially mitigated through Forest Service active weed management programs

Large-scale insect damage is reduced under this alternative from higher levels of hazardous fuel treatments and forest health treatments. Thus, long-term and widespread improvement in forest or rangeland health would be highest.

This alternative will likely retain the lowest proportion of roadless acreage as reference landscapes and the smallest proportion of semi-primitive acreage among the three alternatives. More acres will shift to roaded natural in the areas where energy operations are projected to occur. Also, the alternative is likely to maintain the least acreage classified as high to very high scenic integrity levels. More acreage will shift to moderate or low scenic integrity levels.

Traditional cultural properties and sacred sites are likely to be provided the least protection due to the potential for increased soil disturbance from activities and increased public access. However, they may have the lowest exposure to catastrophic wildfire.

E. Comparative Assessment

In general, all of the alternatives are expected to provide for lasting protection of the roadless characteristics, thereby reducing the risk that lasting protection will not be provided to roadless areas. Differences between the alternatives are based on the varying restrictions, permissions, and boundaries resulting in different levels of road construction and reconstruction, tree-cutting, and other activities discussed above. Overall, differences in impacts on the roadless characteristics, and therefore the degree of risk of not providing lasting protection between the alternatives, are very small. Table 6 compares the risk of not providing lasting protection to roadless area characteristics by alternative.

Potential adverse impacts on high quality or undisturbed soil in roadless areas would differ slightly among the alternatives based on different levels of projected roading, tree removal, and energy resource development activities. The 2001 Rule alternative would have the least potential for adverse impacts and the Forest Plans alternative would have the greatest potential for adverse soil impacts. However, the actual differences among alternatives would be insignificant because effects from those projected activities would be mitigated through the use of site-specific analysis, watershed conservation practices, and other BMPs, including post-project rehabilitation of disturbed soil. While some adverse impacts to soil would include changes in soil

moisture capacity or erosion rates, the ground disturbances mediating such changes would be limited in geographic extent and distributed over many different roadless areas. Thus, the actual effects on soil quality would be minor and of short duration. All of the alternatives result in a low risk of not providing lasting protection for high quality or undisturbed soil.

The relative differences in impacts on high quality or undisturbed water in roadless areas between the three alternatives would be minimal. The 2001 Rule alternative would have the least risk of adverse effects on water quality, and the Proposed Rule alternative would have a slightly higher risk, followed by the Forest Plans alternative with the greatest risk of adverse impacts in the roadless areas. However, these differences are insignificant because the actual impacts on water quality anticipated from any alternative would be small in magnitude and scattered over a wide geographic area. Most of the potential effects would be of short duration, with disturbed soil areas rehabilitated after projects are completed in those areas. Potential water quality impacts from authorized activities in roadless areas would be effectively mitigated by site-specific watershed conservation practices, BMPs, and regulatory permit requirements. Future activities under the alternatives are not expected to cause exceedences of water quality standards or contribute to the list of impaired water bodies. Changes in water yield are most likely to be associated with high-intensity, stand-replacing wildfire or removal of more than 30 percent of the basal area through tree-cutting. None of the alternatives allow the level of tree-cutting that would alter water yields. All of the alternatives result in a low risk of not providing lasting protection for the high quality or undisturbed water.

There is no major difference in the effects on air quality among the three alternatives. Potential smoke-related impacts from wildfires are more likely to occur in roadless areas under the 2001 Rule alternative, and least likely to occur under the Forest Plans alternative. Under all three alternatives, air quality is expected to remain in compliance with federal and state standards. More emission of methane gas from natural gas operations or underground coal mining operations is expected under the Proposed Rule or the Forest Plans alternative. Methane gas emissions from coal mining that could contribute to cumulative amounts of greenhouse gases in the atmosphere; however, the methane from these coal mining operations would dissipate to such diluted concentrations as to be insignificant. Methane gas may be collected and removed from coal mines under the Proposed Rule alternative. All of the alternatives result in a low risk of not providing lasting protection for the high quality or undisturbed air.

The alternatives do not significantly differ in their impacts on public sources of drinking water. Ground disturbing activities that have the potential to affect water quality are least likely under the 2001 Rule alternative and most likely under the Forest Plans alternative. Potential water quality impacts from authorized activities in roadless areas would be effectively mitigated by site-specific watershed conservation practices, BMPs, and regulatory permit requirements. Future activities under the alternatives are not expected to cause exceedences of water quality standards or contribute to the list of impaired water bodies. Changes in water yield are most likely to be associated with high-intensity, stand-replacing wildfire or removal of more than 30 percent of the basal area through tree-cutting. None of the alternatives allow the level of tree-cutting that would

alter water yields. Wildfires are more likely under the 2001 Rule alternative and least likely under the Forest Plans alternative. All of the alternatives result in a low risk of not providing lasting protection for the public sources of drinking water.

The alternatives differ slightly in their impacts on plant and animal diversity. Conservation of biodiversity would be similar for the Proposed Rule and the 2001 Rule alternatives but would be realized to a lesser degree under the Proposed Rule. The Forest Plans alternative, because of fewer restrictions, would probably pose a higher risk of affecting biological diversity. Consideration of the impacts on animal and plant biodiversity and habitat would occur at the site-specific level when a project is planned. Predicted impacts will be minimized through mitigation measures. Under all of the alternatives, a level of plant and animal diversity will generally be maintained. All of the alternatives reduce the risk of not providing lasting protection in comparison to unmanaged lands outside of the NFS.

The alternatives do not substantially differ in their estimated effect on habitat for threatened, endangered, candidate, and proposed species and for those species dependant upon large, undisturbed areas of land. No effects are anticipated on T&E plant species, under any of the alternatives, because no additional roading, tree-cutting, or energy development activities are projected to occur in the portions of roadless areas that support T&E plants. The only difference among alternatives in the risk to T&E plants is related to the higher risk under the Proposed Rule and the Forest Plans alternative, compared to the 2001 Rule alternative that invasive plants would spread into T&E plant communities. The risk of impact on sensitive plants would be higher under the Proposed Rule alternative and the Forest Plans alternative compared to the 2001 Rule alternative primarily because of (a) the higher likelihood of increases in invasive plants spreading into sensitive plant communities and (b) the higher likelihood of inadvertent mistakes that may be made during project implementation. These differences in risk are correlated with the differences in the amount of projected activities in roadless areas that support sensitive plants.

Considering the overall effects of each alternative on habitat for aquatic species, including T&E species, the 2001 Rule alternative would pose the least risk of adverse impact and would generally have the least potential for adverse effects on protecting aquatic species and habitat compared to the more intensively managed lands outside roadless areas. The Proposed Rule alternative would have more potential for adverse impacts to aquatic species due to projected activities, with the greatest potential for adverse effects under the Forest Plans alternative. Activities projected under the Proposed Rule alternative would not likely result in measurable declines in overall population trends on any national forest for any of the aquatic T&E species, sensitive species, or MIS. A beneficial effect of the Proposed Rule and the Forest Plans alternatives would be associated with the increased amount of fuel reduction treatment acres in roadless areas, which could reduce wildfire severity roadless areas, resulting in beneficial effects on aquatic habitat and species.

The greatest concern for potential impacts to aquatic species and habitat occurs when aquatic species and habitat overlap with roadless areas where roading and tree-cutting activities are projected, especially where combined with projected oil-gas or coal

activities. This risk of adverse impacts on aquatic species would be highest under the Forest Plans alternative, slightly less under the Proposed Rule alternative, and lowest under the 2001 Rule alternative. The roadless areas of highest concern occur on the Grand Mesa, Uncompagrahe, and Gunnison (GMUG); San Juan; and White River NFs.

The 2001 Rule alternative would afford terrestrial species and habitats the most protection because it is most restrictive for activities in the roadless areas that could be detrimental to T&E, sensitive, MIS, and migratory bird species. By comparison, the Proposed Rule alternative offers a lower level of protection in roadless areas than the 2001 Rule alternative due to activity permissions in areas with important terrestrial species and habitats. The Forest Plans alternative correspondingly would have the highest potential for adverse impacts to terrestrial species and habitat. Detrimental effects from an expected increase in invasive plants, animals, and pathogens would be greatest under the Forest Plans alternative and least under the 2001 Rule alternative. The Proposed Rule would result in an intermediate level of effects to the extremes of the other two alternatives. Given the temporary status of most roads projected for roadless areas, the impact of these roads would be relatively short-term. However, increases in roads could encourage non-motorized recreational use as well as unauthorized motorized use that could increase potential impacts to wildlife. The increased ability to treat acres for forest health and fuels under the Proposed Rule and the Forest Plans alternatives could improve habitats for early seral species in some areas and reduce the potential for a severe stand-replacing wildfire that could adversely impact terrestrial habitat. In general, for all alternatives, activities may affect individual animals but are not likely to adversely affect populations or critical habitat of T&E species, nor result in the loss of viability or cause a trend toward Federal listing for sensitive species. There is increasing potential for change in population trends for MIS under the Proposed Rule and the Forest Plans alternatives respectively, depending upon the location, timing, intensity, and magnitude of activity. But, as with plants and aquatic species, potential adverse effects to terrestrial species are expected to be either avoided or minimized through compliance with standards and guidelines in land management plans and other applicable laws, regulations, and policy. All of the alternatives result in a low risk of not providing lasting protection for habitat for threatened, endangered, candidate, and proposed species and those species requiring large, undisturbed areas of land.

All of the alternatives provide some degree of lasting protection for primitive, semi-primitive non-motorized and semi-primitive motorized recreational opportunities. The 2001 Rule alternative would retain the greatest proportion of roadless area acres in a primitive or semi-primitive setting, at the lowest level of human development. Smaller proportions of the IRAs would show evidence of motorized vehicle use or be in a roaded natural setting. None of the projected activities under the 2001 Rule alternative would be expected to reduce the quality of hunting and fishing opportunities. The Proposed Rule alternative would retain the majority of the CRA acres in a semi-primitive setting, although there would be more CRA acres with roads and energy operations. The higher levels of human activity and development would shift some areas from offering semi-primitive opportunities to a more roaded natural setting. Excluding the substantially altered areas and developed ski areas in CRAs would allow the CRAs to appear more

consistent with semi-primitive and unroaded characteristics expected in roadless areas. The inclusion of unroaded areas in CRAs would further protect and provide for dispersed recreation in generally unroaded and semi-primitive settings. Hunting and fishing opportunities likely would not change under the Proposed Rule alternative because of the dispersed nature of projected road and tree-cutting activity and the large amount of NFS lands not altered by these activities. The Forest Plans alternative would result in higher levels of human activity and development in IRAs that are not consistent with typical roadless area characteristics. The effects of the IRA boundaries would be the same as described for the 2001 Rule alternative; however, more of the IRAs that offer semi-primitive settings would shift toward roaded natural settings as more roading, tree cutting, and energy resource development occurs in the IRAs. All of the alternatives have a low risk of not providing lasting protection to primitive, semi-primitive non-motorized, and semi-primitive motorized classes of recreational opportunities.

Roadless area characteristics and values typically include “natural-appearing landscapes with high scenic quality.” The CRAs currently have a high degree of scenic integrity

The 2001 Rule alternative would retain the greatest number of roadless area acres at high to very high scenic integrity levels; scenic quality would remain largely unaltered. Many substantially altered area acres would continue to reflect moderate to low scenic integrity levels, inconsistent with general roadless area characteristics and values. The Proposed Rule alternative would retain the majority of the 4.03 million acres of CRAs at high to very high scenic integrity levels. Projected levels of road construction and other activity could result in a higher potential than the 2001 Rule alternative for portions of roadless areas to shift to a moderate to low scenic integrity levels. Substantially altered landscapes would not be included in the CRAs and would therefore not detract from scenic integrity in designated roadless areas. The new unroaded areas included in CRAs would likely add to the number of areas protected at high to very high scenic integrity levels compared to the Forest Plans alternative. The Forest Plans alternative would retain fewer acres in the IRAs at the current high to very high scenic integrity levels, compared to the other alternatives. More portions of IRAs would gradually shift to a moderate to low scenic integrity level due to the levels of projected activity. Potential effects would be moderated under all alternatives through project-level compliance with scenic integrity and visual quality objectives specified in land management plans.

Cultural properties and sacred sites are afforded some level of protection under all of the alternatives. The 2001 Rule alternative is likely to provide the most protection due to limited public access and limited amount of ground disturbing activities. The Forest Plans alternative is likely to provide the least protection due to the increased level of ground disturbing activities. The Proposed Rule alternative provides an intermediate level of protection. All of the alternatives are likely to reduce the risk of not providing lasting protection for this roadless characteristic.

Relatively speaking, Alternative 1 (2001 Rule) presents the lowest risk of not providing lasting roadless protection over the other two alternatives. However due to uncertainty over its legal status and ongoing litigation a case can be made that Alternative 1 presents a higher risk of not providing lasting roadless protection over the long term.

Alternative 2 (Proposed Rule) has a reduced degree of risk compared with Alternative 3 (Forest Plans) as it would impose additional restrictions limiting the amount of roading, tree cutting, and mineral development beyond those imposed under existing individual forest plans. The Proposed Rule will advance the purpose of providing lasting protection to the roadless areas and reduce the risk that such protection is not afforded.

Table 6. Change in impacts and risk of not providing lasting protection to roadless area characteristics from activities allowed under three alternative management strategies			
Roadless Characteristic	2001 Rule	Proposed Rule	Forest Plans
High Quality or undisturbed soil	<p>Least risk of adverse impacts to soil resources of all alternatives.</p> <p>Some localized soil erosion, soil compaction, and changes in soil properties on sites disturbed by limited road construction or tree cutting.</p> <p>Adverse impacts to soil resources of small geographic extent and scattered throughout a much greater area.</p> <p>Potential effects of short duration.</p> <p>Low risk of not providing lasting protection</p>	<p>Greater risk than the 2001 Rule, but less risk of adverse impacts to water resources than the land management plan alternative</p> <p>Some localized soil erosion, soil compaction, and changes in soil properties on sites disturbed by limited road construction or tree cutting.</p> <p>Potential effects of short duration.</p> <p>Low risk of not providing lasting protection</p>	<p>Greatest risk of adverse impacts to soil resources of all alternatives</p> <p>Some localized soil erosion, soil compaction, and changes in soil properties on sites disturbed by limited road construction or tree cutting.</p> <p>Potential effects of short duration.</p> <p>Risk mitigated through use of post-project rehabilitation of disturbed soil, best management practices, and regulatory permit requirements</p> <p>Low risk of not providing lasting protection</p>
High Quality or undisturbed water	<p>Least risk of adverse impacts to water resources of all alternatives.</p> <p>Adverse impacts to water resources of small geographic extent and scattered throughout a much greater area.</p> <p>Potential effects of short duration.</p> <p>Risk mitigation accomplished through site-specific watershed conservation practices, best management practices, post-project</p>	<p>Greater risk than the 2001 Rule, but less risk of adverse impacts to water resources than the land management plan alternative</p> <p>Adverse impacts to water resources of small geographic extent and scattered throughout a much greater area.</p> <p>Potential effects of short duration.</p> <p>Risk mitigation accomplished through site-specific watershed conservation practices, best management practices, post-project rehabilitation of</p>	<p>Greatest risk of adverse impacts to water resources of all alternatives</p> <p>Adverse impacts to water resources of small geographic extent and scattered throughout a much greater area.</p> <p>Potential effects of short duration.</p> <p>Risk mitigation accomplished through site-specific watershed conservation practices, best management practices, post-</p>

	<p>rehabilitation of disturbed soil and regulatory permit requirements</p> <p>Low risk of not providing lasting protection</p>	<p>disturbed soil and regulatory permit requirements</p> <p>Low risk of not providing lasting protection</p>	<p>project rehabilitation of disturbed soil and regulatory permit requirements</p> <p>Low risk of not providing lasting protection</p>
High Quality or undisturbed air	<p>More likely to experience smoke-related impacts than other two alternatives due to wildfires as this alternative provides the least amount of hazardous fuel reduction treatments.</p> <p>Most emissions from prescribed fire will be of limited durations and mitigated using site-specific mitigation measures, thus unlikely to result in emissions that exceed air quality criteria.</p> <p>Low risk of not providing lasting protection</p>	<p>More likely to experience smoke-related impacts due to wildfires than the forest plan alternative but less likely than the 2001 Rule as this alternative provides an intermediate amount of hazardous fuel reduction treatments to the other two alternatives</p> <p>Most emissions from prescribed fire will be of limited durations and mitigated using site-specific mitigation measures, thus unlikely to result in emissions that exceed air quality criteria.</p> <p>Low risk of not providing lasting protection</p>	<p>Less likely to experience smoke-related impacts than other two alternatives due to wildfires as this alternative provides the greatest amount of hazardous fuel reduction treatments.</p> <p>Most emissions from prescribed fire will be of limited durations and mitigated using site-specific mitigation measures, thus unlikely to result in emissions that exceed air quality criteria.</p> <p>Low risk of not providing lasting protection</p>
Public Sources of Drinking water	<p>Most likely to protect municipal watersheds through limitation on ground disturbing activities, however, current limitations on roads in roadless areas constrains the ability to address wildfire hazard in priority areas, which increases the chance of experiencing large, unwanted, or uncharacteristic fires in municipal watersheds within or adjacent to roadless areas.</p> <p>Low risk of not providing lasting protection</p>	<p>Likely to protect municipal watersheds through limitation on ground disturbing activities, however, limitations on roads in roadless areas somewhat constrains the ability to address wildfire hazard in priority areas, which increases the chance of experiencing large, unwanted, or uncharacteristic fires in municipal watersheds within or adjacent to roadless areas.</p> <p>Low risk of not providing lasting protection</p>	<p>Depending on project design, least likely to protect municipal watersheds, however, greatest ability to address wildfire hazard in priority areas, which reduces the chance of experiencing large, unwanted, or uncharacteristic fires in municipal watersheds within or adjacent to roadless areas.</p> <p>Low risk of not providing lasting protection</p>
Diversity of Animal Communities	<p>Provides terrestrial and aquatic animal species with the most protection relative to the other two alternatives due to the protection of important wildlife and aquatic habitat</p> <p>Low risk of not providing lasting protection</p>	<p>Provides terrestrial and aquatic animal species with an intermediate level of protection relative to the other two alternatives due to the protection of important wildlife and aquatic habitat</p> <p>Low risk of not providing lasting protection</p>	<p>Provides terrestrial and aquatic animal species with the least protection relative to the other two alternatives due to less protection of important wildlife and aquatic habitat than the other alternatives</p> <p>Low risk of not providing lasting protection</p>

<p>Diversity of plant communities</p>	<p>Provides higher levels of standing and downed dead trees in roadless areas than other alternatives.</p> <p>98% of the high-risk areas will not be treated and remain susceptible to declining forest health. These areas are likely to become less resilient to large-scale insect and disease outbreaks and more likely to experience mortality from fuel buildup.</p> <p>Most likely to maintain high degree of habitat diversity; critical travel, migration, and dispersal corridors; and islands of refugia or biological strongholds.</p> <p>Low risk of not providing lasting protection</p>	<p>81% of high-risk areas will not be treated.</p> <p>Allows for additional road construction resulting in more ground disturbance, increased soil erosion, disruption in surface and subsurface water flow and potential spread of invasive plant species than the 2001 Rule.</p> <p>Likely to maintain high degree of habitat diversity; critical travel, migration, and dispersal corridors; and islands of refugia or biological strongholds.</p> <p>Low risk of not providing lasting protection</p>	<p>59% of high-risk areas will not be treated.</p> <p>Allows for the most road construction resulting in the greatest potential for ground disturbance, increased soil erosion, disruption in surface and subsurface water flow and potential spread of invasive plant species.</p> <p>Least likely to maintain high degree of habitat diversity; critical travel, migration, and dispersal corridors; and islands of refugia or biological strongholds.</p> <p>Low risk of not providing lasting protection</p>
<p>Habitat for Threatened, Endangered or Sensitive Species or species dependent upon large areas of land</p>	<p>No projected likelihood of adverse impacts on endangered plants because none occur in the roadless areas under this alternative.</p> <p>No projected likelihood of adverse impacts on threatened plants because road construction or reconstruction, tree-cutting or energy activities do not occur in same locations as the threatened plants.</p> <p>Some risk of losing sensitive plants is associated with road construction or reconstruction, tree-cutting or energy resource development. This risk is lowest for this alternative because this alternative allows for less of these activities.</p> <p>The risk of indirect adverse impacts on Federally listed and sensitive plants due to establishment and spread of</p>	<p>No projected likelihood of adverse impacts on endangered plants because none occur in the roadless areas under this alternative.</p> <p>No projected likelihood of adverse impacts on threatened plants because road construction or reconstruction, tree-cutting or energy activities do not occur in same locations as the threatened plants.</p> <p>Some risk of losing sensitive plants is associated with road construction or reconstruction, tree-cutting or energy resource development. This alternative allows for more of these activities than the 2001 Rule, but less than the Forest Plans.</p> <p>There is a risk of indirect adverse impacts on Federally listed and sensitive plants due to establishment and spread of invasive species and the risk is higher for this alternative than</p>	<p>No projected likelihood of adverse impacts on endangered plants because none occur in the roadless areas under this alternative.</p> <p>No projected likelihood of adverse impacts on threatened plants because road construction or reconstruction, tree-cutting or energy activities do not occur in same locations as the threatened plants.</p> <p>Some risk of losing sensitive plants is associated with road construction or reconstruction, tree-cutting or energy resource development. This alternative allows for the most of these activities and results in the greatest risk.</p> <p>There is a risk of indirect adverse impacts on Federally listed and sensitive plants due to</p>

	<p>invasive species is lowest for the alternative. Sensitive species will experience a greater risk of adverse indirect effects than T&E species due to the larger number of sensitive plant species habitats than habitats for threatened or endangered species. The increased risk to sensitive species is partially mitigated through Forest Service active weed management programs.</p> <p>Low risk of not providing lasting protection</p>	<p>the 2001 Rule, but lower than the Forest Plans. The risk of indirect adverse effects on sensitive species is considerably higher for this alternative than for the 2001 Rule. Sensitive species will experience a greater risk of adverse indirect effects than T&E species due to the larger number of sensitive plant species habitats than habitats for threatened or endangered species. The increased risk to sensitive species is partially mitigated through Forest Service active weed management programs.</p> <p>A small beneficial effect due to the allowed fire control activities under this alternative could reduce the risk that sensitive species found in the forest cover type (10% of sensitive species) would experience destruction</p> <p>Low risk of not providing lasting protection</p>	<p>establishment and spread of invasive species; this risk is equivalent to the risk associated with the Proposed Rule. The risk of indirect adverse effects on sensitive species is equivalent to that of the Proposed Rule. Sensitive species will experience a greater risk of adverse indirect effects than T&E species due to the larger number of sensitive plant species habitats than habitats for threatened or endangered species. The increased risk to sensitive species is partially mitigated through Forest Service active weed management programs.</p> <p>A small beneficial effect due to the allowed fire control activities under this alternative could reduce the risk that sensitive species found in the forest cover type (10% of sensitive species) would experience destruction of the plant population or their seed bed due to wildfire.</p> <p>Low risk of not providing lasting protection</p>
<p>Primitive, semi-primitive non-motorized and semi-primitive motorized recreational opportunities</p>	<p>Likely to retain the greatest proportion of primitive or semi-primitive acreage among the three alternatives.</p> <p>Not expected to affect primitive ROS</p> <p>Low risk of not providing lasting protection</p>	<p>Likely to retain a large proportion of roadless acreage in a semi-primitive setting; a smaller proportion than the 2001 Rule and a higher proportion than the Forest Plans.</p> <p>Not expected to affect primitive ROS</p> <p>Low risk of not providing lasting protection</p>	<p>Likely to retain the lowest proportion semi-primitive acreage among the three alternatives. More acres will shift to roaded natural in the areas where energy operations are projected to occur.</p> <p>Not expected to affect primitive ROS</p> <p>Low risk of not providing lasting protection</p>

Reference Landscapes	Likely to retain the greatest proportion of reference landscapes among the three alternatives. Low risk of not providing lasting protection	Likely to retain a large proportion of roadless acreage as reference landscapes; a smaller proportion than the 2001 Rule and a higher proportion than the Forest Plans. Low risk of not providing lasting protection	Likely to retain the lowest proportion of reference landscape acreage among the three alternatives. More acres will be available for development. Low risk of not providing lasting protection
Natural-appearing landscapes with high scenic quality	Likely to maintain the most roadless acreage classified as high to very high scenic integrity levels Low risk of not providing lasting protection	Maintains slightly less roadless acreage at high to very high scenic integrity levels. Scenic integrity of some acres likely to be reduced by the roads and road-related activities projected in the roadless area. Low risk of not providing lasting protection	Likely to maintain the least acreage classified as high to very high scenic integrity levels. More acreage will shift to moderate or low scenic integrity levels in this alternative than in the other two. Low risk of not providing lasting protection
Traditional cultural properties and sacred sites	Likely to provide the most protection due to limited soil disturbance activities and limited public access. Low risk of not providing lasting protection	Likely to provide adequate protection due to limited public access and project design. Low risk of not providing lasting protection	Likely to provide the least protection due to the potential for increased soil disturbance from activities and increased public access. Low risk of not providing lasting protection

IV. References

- Abing, T. 2007. Minerals specialist report. Idaho Roadless Area: Draft Environmental Impact Statement. USDA Forest Service Intermountain Region. www.roadless.fs.fed.us/idaho (April 2008).
- Bisson, P.A.; Rieman, B.E.; Luce, C.; Hessburg, P.F.; Lee, D.C.; Kershner, J.L.; Reeves, G.H.; Gresswell, R.E. 2003. Fire and aquatic ecosystems of the western USA: current knowledge and key questions. *Forest Ecology and Management*. 178: 213-229.
- Driver, B.L.; Brown, P.J.; Peterson, G.L. 1991. *Benefits of leisure*. State College, PA: Venture Publishing.
- Gucinski, H.; Furniss, R.R.; Ziemer, M.J.; Brookes, M.H., eds. 2000. *Forest roads – a synthesis of scientific information*. Washington, DC: U.S. Department of Agriculture, Forest Service. 117 p.
- Gresswell, R.E. 1999. Fire and aquatic ecosystems in forested biomes of North America. *Transactions of the American Fisheries Society*. 128: 193-221.
- Hutto, R.L.; Gallo, S.M. 2006. The effects of postfire salvage logging on cavity-nesting birds. *Condor*. 108: 817-831. www.dbs.umt.edu/research_labs/huttolab/. (April 2008).
- Intergovernmental Panel on Climate Change [IPCC]. 2007. *Climate change 2007: climate change impacts, adaptation and vulnerability. Summary for policymakers*. www.ipcc.ch/ipccreports/assessments-reports.htm. (April 2008).
- Karlen, D.L.; Mausbach, M.J.; Doran, J.W.; Cline, R.G.; Harris, R.F.; Schuman, G.E. 1997. Soil quality: a concept, definition, and framework for evaluation. *Soil Science Society of America Journal*. 61: 4–10.
- Landsberg, J.D.; Tiedemann, A.R. 2000. Fire management. In: Dissmeyer, G.E., ed. *Drinking water from forests and grasslands*. Gen. Tech. Rep. SRS-39. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 124-138.
- MacDonald, L.H.; Stednick, J.D. 2003. *Forests and water: a state-of-the-art review for Colorado*. Colorado Water Resources Research Institute Completion Report No. 196. Fort Collins, CO: Colorado State University. 65 p.
- Minshall, G.W. In press. Community/food web responses of stream macroinvertebrates to fire. *Forest Ecology and Management*.

- Pilliod, D.S., Bury, R.B.; Hyde, E.J.; Pearl, C.A.; Corn, P.S. In press. Potential effects of fire and fuel reduction practices on aquatic amphibians in the United States. *Forest Ecology and Management*.
- Sheley, R.; Manoukian, K.; Marks, G. 1995. Preventing noxious weed invasions. *Montana State University Technical Bulletin*. Bozeman, MT: Montana State University Extension Service.
- Sheley, R.; Petroff, R. 1999. Biology and management of noxious rangeland weeds. Corvallis, OR: Oregon State University Press: 1, 5, 69–71.
- Smith, J.K., ed. 2000. Wildland fire in ecosystems: effects of fire on fauna. Gen. Tech. Rep. RMRS-GTR-42, vol.1. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 83 p. www.fs.fed.us/rm/pubs/. (April 2008).
- Swanston, D.N. 1991. Natural Processes. In: Meehan, W.R., ed. Influences of forest and rangeland management on salmonid fishes and their habitats. Special publication 19. Bethesda, MD: American Fisheries Society: 139-179.
- U.S. Department of Agriculture [USDA], Forest Service. 1986. ROS book: recreation, heritage, and wilderness resources. Washington, DC. 276 p
- U.S. Department of Agriculture [USDA], Forest Service; U.S. Department of Commerce [USDC], National Marine Fisheries Service; U.S. Department of the Interior [USDI], Bureau of Land Management, Fish and Wildlife Service, and National Park Service; U.S. Environmental Protection Agency [EPA]; Forest Ecosystem Management Assessment Team [FEMAT]. 1993. Forest Ecosystem Management: an ecological, economic, and social assessment. Washington, DC: U.S. Government Printing Office. 1993-793-071.
- U.S. Department of Agriculture [USDA], Forest Service. 2000. Biological evaluation specialist report for Forest Service roadless area conservation FEIS. Unpublished report. 90 p. www.roadless.fs.fed.us/documents/feis/specprep/. (April 2008).
- U.S. Department of Agriculture [USDA], Forest Service. 2003. Backcountry road maintenance and weed management. 7100 Engineering, July 2003. 0371-2811-MTDC. Washington, DC. 26 p.
- U.S. Department of the Interior [USDI], Fish and Wildlife Service. 1995. Recovery plan for the Mexican spotted owl (*Strix occidentalis lucida*); Volume I. Albuquerque, NM. 172 p.

- Wesolowski, T.; Czeszczewik, D.; Rowinski, P. 2005. Effects of forest management on the three-toed woodpecker (*Picoides tridactylus*) distribution in the Bialowieza Forest (NE Portland): conservation implications. *Acta Ornithologica*. 40(1): 53-60.
- Wisdom, M.J.; Holthausen, R.S.; Wales, B.K.; Hargis, C.D.; Saab, V.A.; Lee, D.C.; Hann, W.J.; Rich, T.D.; Rowland, M.M.; Murphy, W.J.; Eames, M.R. 2000. Source habitats for terrestrial vertebrates of focus in the interior Columbia basin: broad scale trends and management implications. Gen. Tech. Rep. PNW-GTR-485. 3 vols. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. www.fs.fed.us/pnw/pubs/gtr485/. (April 2008).
- Wright, H.A.; Churchill, F.M.; Clark, S.W. 1976. Effect of prescribed burning on sediment, water yield, and water quality from dozed juniper lands in central Texas. *Journal of Range Management*. 29(4): 294-298.
- Wright, H.A.; Churchill, F.M.; Clark, S.W. 1982. Soil loss, runoff, and water quality of seeded and unseeded steep watersheds following prescribed burning. *Journal of Range Management*. 35(3): 382-385.