CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter describes the various aspects of the physical, biological, and human environment that may be affected by the management of National Forest System (NFS) roadless areas in Colorado. The term roadless areas, as used throughout this chapter, generally refers to both the inventoried roadless areas (IRAs) and Colorado roadless areas (CRAs) described in chapter 2.

Appendix A provides tables showing all the IRA acres and names, CRA acres and names, and a cross-walk between IRA and CRA names. Maps in chapter 2 display the IRAs and CRAs, and larger maps in the map packet show the differences between IRA and CRA boundaries.

This chapter focuses exclusively on the three alternatives that were described in detail in chapter 2:

Alternative 1 – 2001 Roadless Rule (no action)

Alternative 2 – Colorado Roadless Rule (proposed action)

Alternative 3 – Forest Plans

For each aspect of the physical, biological, and human environments potentially affected by the alternatives, this chapter describes the affected environment (conditions and trends associated with the roadless areas), followed by the environmental consequences (impacts or effects) associated with each alternative.

As mentioned in chapter 1, the scope of the proposal for rulemaking consists of broad regulatory management prohibitions and exceptions. This is not a proposal for implementing any site-specific projects or activities in roadless areas. When a specific action is proposed for implementation in a roadless area, it would undergo environmental analysis and public review pursuant to the National Environmental Policy Act (NEPA) before implementation could be authorized.

Commensurate with the broad geographic scale of this proposal—covering more than 4 million acres of land—and the lack of any site-specific proposed projects or activities; the potential effects are primarily described in qualitative and comparative terms.

The analysis of potential effects disclosed in this chapter relies on resource information readily available from geographic information system (GIS) map coverage, resource inventory databases, and resource specialist reports.

ANALYSIS FRAMEWORK (INCLUDING ROADS AND TIMBER RESOURCES)

This section provides the framework (projections and underlying assumptions) for analyzing the effects of the two primary activities that differ between the roadless area rulemaking alternatives:

- Road construction and reconstruction
- Tree-cutting and removal

These two activities are the focus because they have the greatest likelihood of altering and fragmenting landscapes with a result of immediate, long-term loss of roadless area values and characteristics. Thus, to set the stage for subsequent sections, this section describes the relative differences in the amount of tree-cutting and roading projected to occur in the reasonably foreseeable future within roadless areas over the next 15 years. Projecting the potential for future tree-cutting and roading activities in roadless areas beyond a 15-year time horizon would be overly speculative within the context of this analysis.

This section also describes the assumptions used in making those projections. The assumptions are based on such factors as topographic, environmental, budgetary, and economic constraints that would affect the likelihood of activities actually occurring, even where circumstances outlined in a given alternative would allow those activities to occur. Budgetary constraints include an assumption that the congressionally appropriated budget would remain flat over the next 15 years. Forest plan direction is another factor that constrains activities within roadless areas. Roading and tree-cutting are restricted within roadless areas wherever the applicable forest plan direction is more restrictive than what is allowed under each alternative.

Projections of roading and tree-cutting activities are made based on the 4.25 million acres of IRAs for alternatives 1 and 3, and the 4.03 million acres of CRAs for alternative 2, as described in detail in chapter 2. In addition, projections for alternative 2 include the activities that would likely occur in the substantially altered acres and ski area acres included in IRAs and not included in CRAs, for comparison purposes. Appendix C provides more detail regarding the foreseeable (projected) likelihood of roading, tree-cutting and energy resource operations in each roadless area for each alternative.

Analysis Assumptions and Projections

Road construction and reconstruction

Assumptions

The Forest Service manages a system of roads on NFS lands and assigns road management objectives for each NFS road. Road management objectives define the road design standard and maintenance level, the type of vehicle that may be used on the road, travel restrictions such as seasonal or year-round closures to public use, and other traffic requirements, as described in the Forest Service Manual on transportation analysis (FSM 7712.5). In addition to the NFS roads,

there are state, county, and local municipality roads that also occur on NFS lands, as well as privately owned roads that are needed to access private property.

The Forest Service authorizes and manages the NFS roads that are determined to be needed for permanent long-term use. From the 1940s through 1980s, most roads on NFS lands, including some that occur in roadless areas, were constructed to support timber harvest activities. 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. They are authorized for contracts and permits such as timber sale contracts, special use permits including oil and gas exploration permits, utility or other facility construction contracts, and other authorized uses, or they may be constructed for the Forest Service to use for administrative purposes.

Temporary roads must be decommissioned after use. The Forest Service decommissions authorized roads that are determined to be no longer needed. 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 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.

Unauthorized roads are those roads created without the agency's express permission. They include remnants of historical uses, such as old logging and mining roads, along with user-created roads that resulted from vehicle travel off designated roads and trails. The Forest Service rehabilitates unauthorized roads where necessary to reduce resource damage.

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 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 Forest Service handbook on transportation system maintenance, FSH 7709.58. Road maintenance levels assigned to NFS roads are defined as follows:

- Maintenance level 1 roads are *closed to vehicular traffic for periods of more than one year.* Only basic custodial maintenance is performed to keep resource damage to an acceptable level and perpetuate the road for future use.

- Maintenance level 2 roads are maintained to a low standard for *high-clearance vehicles* such as sport-utility vehicles, pickups, and jeeps. Traffic is normally minor and they usually have a native (dirt) surface. Design and maintenance standards require control of accelerated erosion and water runoff.
- Maintenance levels 3, 4, and 5 are designed at a higher standard to accommodate *low-clearance passenger vehicles*. These roads may be single or double lane and usually have gravel or paved surface.

The current distribution of NFS road maintenance levels in Colorado is shown in figure 5.

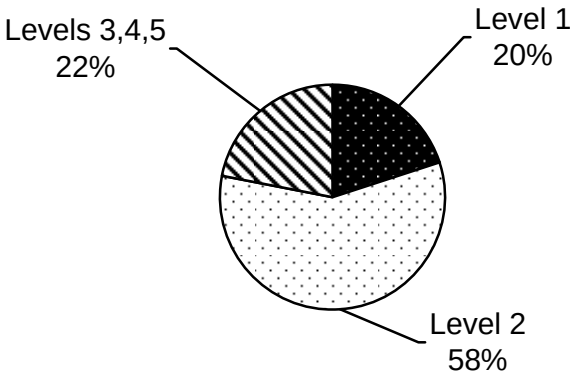

Figure 5. Current distribution of NFS road maintenance levels in Colorado

Annual maintenance averages $500 to $6,500 per mile depending on the road maintenance level and other factors (based on the Forest Service Region 2 cost guide, forest planning cost estimates and a 2008 inflation rate). Road maintenance costs have been exceeding funding levels for at least the past several decades. Thus, there is a backlog of road maintenance needs on NFS land, and the agency has increasingly emphasized the decommissioning of unnecessary roads. For every mile of new road constructed over the past 10 years on NFS lands in Colorado, more than 10 miles of roads on NFS lands have been decommissioned or closed (USDA Forest Service 2008a). It is expected that the trend in closing and decommissioning more road miles than are constructed would continue. There will be a net reduction in road density in roadless areas as the Forest Service continues to decommission unauthorized roads or formerly authorized roads that are no longer needed.

In addition to maintaining roads on the system, the Forest Service may also authorize road reconstruction prior to using the road. Road reconstruction actions may include improving the road to increase the traffic service level or expand the capacity of the road, such as by surfacing or widening. Reconstruction may also include realigning or relocating road segments to a new location to reduce resource impacts.

There are approximately 18,700 miles of roads on NFS lands in Colorado (Forest Service Region 2 INFRA-GIS roads databases, April 2008). Approximately 1,400 miles occur within IRAs and 220 miles occur in CRAs. Of the 1,400 miles in IRAs, approximately 1,160 miles (83 percent) are in the substantially altered portions of the IRAs, which are not included in the CRAs. Roads in

the roadless areas are generally low-standard, low-volume roads that restrict public motor vehicle access and are mostly used for specific land use authorizations.

Table 13 displays the miles of NFS roads and other authorized roads on NFS lands in roadless areas by alternative. The other authorized road miles shown include state, county, local, and private roads. The table does not include unauthorized or non-system roads. Inventories indicate that there are at least 35 to 45 miles of unauthorized roads in the roadless areas, and it is suspected that additional unauthorized roads in roadless areas have not been identified (Forest Service Region 2 INFRA-Roads database, April 2008).

In addition, table 13 shows roads identified in the inventory as no longer needed and scheduled to be decommissioned and removed from the system, based on budget and other factors.

Table 13. Miles of existing authorized roads in roadless areas

	Roads in IRAs (alternatives 1 and 3)	Roads in CRAs (alternative 2)
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
Data source: Forest Service Region 2 INFRA-GIS roads databases, April 2008.

Projections

Each alternative analyzed includes a different set of management direction in which roads may be constructed or reconstructed in roadless areas (IRAs or CRAs). Based on this direction, resource specialists on each national forest made projections about the extent to which road construction or reconstruction (roading) may occur in each roadless area over the next 15 years. They considered the differences among alternatives that allow road construction and reconstruction, as well as any major topographic or economic constraints that would make road construction or reconstruction unfeasible (see table 15, and other details are contained in Appendix C and the EIS record).

Under alternative 2, roads built in CRAs for forest health or hazardous fuel reduction purposes must be temporary roads that remain closed to the general public and are decommissioned after the intended use has terminated. Under alternatives 1 and 3, where roads are allowed to be constructed for those purposes in IRAs, they would most often be temporary roads, based on agency road management policies and recent past trends for road building in IRAs. Recent past trends also indicate that roads built for energy operations (oil, gas, coal) would likewise be closed to public vehicle traffic and decommissioned after use, although those roads would be maintained on the system and typically used for a longer period of time (several decades or longer).

Table 14 projects the reasonably foreseeable yearly average road construction and reconstruction by alternative to occur in roadless areas in the next 15 years. The table does not show roads that may be needed in response to emergencies that cannot reasonably be predicted. While these are projections, there is no way to predict when (or even if) construction would occur. The average annual miles shown in the table do not reflect the high degree of variability in the miles of road expected each year over the 15-year time horizon.

Table 14. Average annual road construction and reconstruction miles projected by alternative

Type of projected roading activity	Average annual road construction and reconstruction		
	Alternative 1: 2001 Rule IRAs	Alternative 2: Colorado Rule CRAs	Alternative 3: Forest Plans IRAs
	---------- miles ----------		
Road construction	5	21	28
Road reconstruction	1	0	2
Total construction/reconstruction	**6**	**21**	**30**

Note: As explained in chapter 2, the 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.

Miles are rounded to the nearest mile.

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

Table 15 shows the distribution of road building, in terms of the anticipated need for the road. The table shows that most road miles projected to be constructed or reconstructed in roadless areas would be for energy resource development, followed by utility and water conveyances. The roads built for energy resource operations, fuels, and forest health purposes would be expected to be eventually decommissioned. The assumptions used to project new roads needed in support of oil, gas, and coal operations in roadless areas are summarized in the narrative following the table. More detailed descriptions of energy resource operations in roadless areas are contained in the Leasable Minerals (Energy Resources) section. Further detail on the likelihood of projected roading in each roadless area is in Appendix C and the EIS record.

Table 15. Distribution of average annual road construction and reconstruction projections in roadless areas for each alternative, by purpose for the road

Purpose for projected road construction or reconstruction	Average annual road construction and reconstruction		
	Alternative 1: 2001 Rule IRAs	Alternative 2: Colorado Rule CRAs	Alternative 3: Forest Plans IRAs
	---------- miles ----------		
Fuels or forest health	0	5.9	10.6
Existing special use authorizations (ski areas, recreation residences, etc.)	0.7	0.3	1.2
Utility and water conveyances	1.0	0.9	1.5
Hard rock minerals	0.2	0.2	0.2
Other roads (health and safety, Federal Highway, CERCLA)	0.3	0.3	0.7
Recreation management	0	0	0.1
Grazing administration	0	0	0
Oil or gas	3.7	10.2	11.1
Coal operations	0.4	3.0	4.4
Total road construction	**6.3**	**20.8**	**29.8**

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

Table 16 shows the projections of oil and gas wells and associated well drilling pads, and acres of coal reserves, where supporting roads would be allowed and expected under each alternative. The projections shown in the table were used in part to estimate the miles of new roads projected for each alternative. Oil and gas pads refer to sites cleared of vegetation for well-drilling operations; these sites average 1 to 6 acres each depending on whether the pad supports single or multiple wells.

New roads needed to support oil and gas resource operations would be most likely to occur on portions of the San Juan; White River; and Grand Mesa, Uncompahgre, and Gunnison National Forests that have underlying oil and gas basins with a high potential for production. Within those areas, new roads in roadless areas would be most likely to occur where the roadless area is leased and where surface occupancy and road building are allowed. No oil or gas wells or new roads are projected for the Routt, Pike and San Isabel, and Manti-La Sal National Forests, which have very few leases.

New roads in roadless areas that would foreseeably be built in the next 15 years to support coal operations (exploration and development) would be limited to the North Fork coal mining area on the Grand Mesa, Uncompahgre, and Gunnison National Forests. Forest plans acknowledge the presence of coal resources in other locations on those national forests, as well as on four other national forests; however, no coal activity would be expected to occur on those forests. New roads in roadless areas for underground coal mining would likely be needed to support surface facilities such as ventilation shafts, methane drainage wells, and monitoring facilities. New roads in roadless areas for coal operations would be limited to areas where surface use is consistent with lease stipulations and road building is allowed. Road building projections for roadless areas were made by estimating that about four exploration holes per 640-acre section would be needed, based on recent experience with coal lease developments on NFS land. In addition, it was estimated that over the next 15 years, approximately six or seven coal exploration licenses may be brought forward into the North Fork coal mining areas that overlap roadless areas, and four new coal leases may be issued for those areas.

No geothermal or other energy resource developments are anticipated to occur in the roadless areas over the next 15 years.

See the Leasable Minerals (Energy Resources) section for further detail regarding oil, gas, coal, and geothermal resources.

Table 16. Average annual projections of oil and gas wells and pads, and total coal reserve acres where roading is allowed in roadless areas, by alternative

	Projected amount		
	Alternative 1 (IRAs)	Alternative 2 (CRAs)	Alternative 3 (IRAs)
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 leaseable minerals databases (April 2008).

Tree-cutting and Removal

Assumptions

Tree-cutting anticipated to occur in roadless areas may or may not result in removal of wood products. Tree-cutting in roadless areas, with or without wood product removal, would primarily be used for hazardous fuel reduction and forest health improvement purposes. The most prevalent treatments would be to reduce hazardous fuels near at-risk communities and municipal water supplies from adverse wildfire-related impacts. The second most prevalent need for tree-cutting in roadless areas is to reduce forest insect and disease levels (that is, to improve forest health). Tree-cutting would also continue to occur at previous levels under any of the alternatives in localized areas for incidental purposes such as mineral operations, special use permits, hazard tree removal, and trails.

Most of the treatments would occur in lodgepole pine forest cover types, as well as in ponderosa pine and pinyon-juniper. Tree-cutting in lodgepole pine, much of which has been affected by bark beetles, is expected to include commercial timber harvest. Tree-cutting in the pinyon-juniper and ponderosa pine cover types for fuel reduction purposes is projected to entail tree-cutting of mostly smaller size trees rather than larger, commercial size trees. Tree-cutting treatments without wood product removal may involve masticating (using machines that effectively shred standing trees), chipping, or slashing methods. Wood product removals may also be non-commercial, such as for personal use firewood or fence posts.

Timber sales are often the least-cost method for meeting vegetation management objectives by offsetting some operating costs through commercial sales.

Activities related to tree-cutting or timber harvesting may include: road construction, reconstruction, 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.

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. None of the alternatives preclude the use of prescribed burning in roadless areas, and prescribed burning may in some situations occur without first thinning the trees. Also, none of the alternatives preclude the manipulation of shrubs or grasslands. All alternatives differ in the extent to which tree-cutting and/or harvest is allowed.

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.

All tree-cutting and removal treatments in roadless areas would incorporate applicable forest plan standards and guidelines and other environmental protection requirements. For example, ground-disturbing activities would not likely occur in wetlands, riparian areas, rare plant populations, heritage resource sites, or on very steep erodible slopes. In addition, tree-cutting and removal activities would be specifically designed to protect roadless characteristics.

Other assumptions used in projecting tree-cutting activities include the fact that budgets for vegetation management and fuel reduction would likely remain flat. Flat budgets, the low market value of small-diameter trees, and high cost of treatments, would limit the amount of tree-cutting treatments in roadless areas. The steep, rugged terrain within many roadless areas; the lack of existing roads; and the high costs associated with either helicopter logging or road building, further limit the amount of tree-cutting activity that would be economically feasible.

Projections

Table 17 projects the total tree-cutting acres and merchantable wood removal volumes foreseeable in the next 15 years in roadless areas for each alternative. All estimates shown are annual averages and would be expected to vary from year to year. For alternatives 1 and 3, projections considered the total 4.25 million acres included in IRAs, and for alternative 2 the projections considered the total 4.03 million acres included in CRAs. For each alternative, projections are based on the circumstances where tree-cutting may occur in roadless areas (outlined in chapter 2), along with the other assumptions just described. The projected harvest volumes shown in the table include both commercial and non-commercial wood product removals. Details about the likelihood of tree-cutting activities within each roadless area are contained in Appendix C and the EIS record.

Table 17. Projected average annual tree-cutting acres and harvest volumes in roadless areas by alternative

	Average annual projections		
Type of activity	Alternative 1: 2001 Rule (IRAs)	Alternative 2: Colorado Rule (CRAs)	Alternative 3: Forest Plans (IRAs)
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.

WATER RESOURCE

This analysis evaluates potential effects of the alternatives on water resources, focusing on key differences in foreseeable activities under each rulemaking alternative. Cumulative effects are particularly relevant to addressing water quality, and those potential cumulative effects are described at the end of this report. Changes in water resources are typically interrelated with effects on vegetation and soil, which are described in more detail in separate sections of the EIS.

Affected Environment

Colorado is a headwaters state. Four of the great rivers in the United States have their origins in the Rocky Mountains of Colorado: the Colorado, Platte, Arkansas, and Rio Grande. Each major river basin contains many distinct watersheds, which are mapped by the U.S. Geological Survey and referenced with 8-digit hydrologic unit codes (maps available at www.water.usgs.gov). The 5th–level (hydrologic unit code) watersheds range from 40,000 to 250,000 acres in size and 6th-level sub-watersheds typically range from 5,000 to 40,000 acres. Changes to water quality or quantity from activities that occur within a roadless area would be most evident at the 6th-level sub-watershed scale and may not be evident at the 5th-level watershed scale or river basin scale because of the interaction of pollutants coming from other activities in the larger watershed.

The major river basins in Colorado (Arkansas, Rio Grande, San Juan, Colorado, Green, Platte, and Republican) contain approximately 252,300 acres of lakes, reservoirs, and ponds. Of the total acreage of lakes, reservoirs, and ponds (that is, waterbodies) in Colorado, approximately 43,400 acres (17 percent) are listed as impaired lake acres in the state's 305(b) report (Colorado CDPHE Water Quality Control Division 2008). Nearly half the impaired lakes are in the Arkansas River basin. When a waterbody or stream is listed as impaired, it means it does not meet state or federal water quality standards for one or more critical pollutants.

Colorado contains approximately 95,500 miles of rivers and streams (table 18), of which 12,800 miles (13 percent) are listed in the 305(b) report as impaired stream miles (Colorado CDPHE Water Quality Control Division 2008). Based on the relatively low percentage of impaired streams and waterbodies in Colorado, the water quality of streams and waterbodies in Colorado is considered to be very good.

Table 18 shows the distribution of stream miles in Colorado within the major river basins, along with the stream miles listed as impaired in Colorado and in roadless areas (Colorado CDPHE Water Quality Control Division 2008). There is not a substantial difference in the number of impaired stream miles in inventoried roadless areas (IRAs) or Colorado roadless areas (CRAs), so they are shown in the same column (as a range of miles where they differ slightly). As mentioned above, only 13 percent of the stream miles in Colorado are listed as impaired, and only 1 percent of those impaired stream miles occur within roadless areas (IRAs or CRAs). Classified uses of water in streams that are impaired are predominantly aquatic life, followed by recreation, agriculture, and drinking water supply (Colorado CDPHE Water Quality Control Division 2008).

Table 18. Streams and impaired streams in Colorado, and impaired stream miles in roadless areas, by river basin

River basin	Total stream miles[1]	Impaired stream miles[1]	Impaired stream miles in roadless areas[2]
Arkansas	22,100	3,100	105–110
Rio Grande	10,100	300	0-5
San Juan	5,800	200	5–10
Colorado	19,300	4,100	20–25
Green	13,400	2,300	5
Platte	19,000	2,800	10
Republican	5,800	40	0
Total	**95,500**	**12,840**	**150–155**

Totals may not add due to rounding.

[1] State of Colorado 2008 305(b) report (Colorado CDPHE Water Quality Control Division 2008).

[2] State of Colorado 2006 303(d)-listed streams (Colorado CDPHE Water Quality Control Division 2006) overlaid with GIS maps of IRAs and CRAs (Roadless Area GIS Database 2008).

Table 19 displays the same total miles of streams in Colorado and impaired streams in the roadless areas (IRAs or CRAs) as displayed in table 18, distributed by national forest rather than by river basin. Table 19 also includes the cause for the impaired stream miles in the roadless areas. The major pollutants causing impairments in Colorado streams are selenium; other metals such as iron, zinc and copper; pathogens (fecal coliform and E. coli); and sediment. Pollutants causing impairments to aquatic life in lakes and reservoirs are unknown biologic stressors, mercury, selenium, pH, and dissolved oxygen saturation. Lake or reservoir acres are not shown in the table because there are only 3,700 lake or reservoir acres on National Forest System (NFS) lands in Colorado, or less than 1 percent of the 252,300 acres of lakes and reservoirs in Colorado, and a much smaller fraction of those occur in the roadless areas.

Table 19. Streams in Colorado and impaired streams in roadless areas by national forest, and the cause for impairment

National forest	Total stream miles[1]	Impaired stream miles in roadless areas	Cause of impairment[2]
Arapaho and Roosevelt	500	5	Metals
Grand Mesa, Uncompahgre, and Gunnison	1,500	10-15	Selenium
Manti-La Sal	10	0	---
Pike and San Isabel	800	105-110	Selenium, pathogens, metals
Rio Grande	700	05	Metals
Routt	700	10	Iron, pathogens
San Juan	700	510	Metals
White River	900	10	Selenium, sediment, metals
TOTAL	**5,810**	**150-155**	

Totals may not add due to rounding.

[1] State of Colorado 2008 305(b) report and 2006 303(d) listed streams (Colorado CDPHE Water Quality Control Division 2008; Roadless Areas GIS database, April 2008).

[2] State of Colorado 2006 303(d) listed streams (Colorado CDPHE Water Quality Control Division 2008; Roadless Areas GIS Database, April 2008).

As shown in tables 18 and 19, very few miles of streams in roadless areas (IRAs or CRAs) are listed as impaired. The roadless areas on the Pike and San Isabel National Forests have the greatest number of impaired stream miles. These miles are primarily in the Spanish Peaks, St. Charles Peak, and Pikes Peak East roadless areas and are impaired by either selenium or pathogens. A major source of selenium in streams is from irrigation of high selenium soils. Sources of pathogens can be wildlife, livestock, and/or humans—from dispersed recreation, from stormwater discharges in developed areas, or from poorly functioning sanitation facilities such as failing septic tanks. The segment on the White River National Forest that is listed for sediment is Black Gore Creek in the East Vail roadless area. The primary source of sediment to Black Gore Creek is road de-icing sand from Interstate 70. A draft total maximum daily load (TMDL) analysis has been completed for Black Gore Creek. The primary sources of metals causing stream impairments in the roadless areas are most likely historical mining activities.

The most common sources of potential water quality impacts in the roadless areas are: road construction/reconstruction, mining, oil-gas or coal development and operations, off-highway vehicle use, livestock grazing, dispersed camping, and activities related to tree-cutting (such as log skidding), especially if these activities occur near streams or lakes. Where activities result in soil compaction, erosion, loss of vegetation cover, and excess water runoff, excess sediment and other pollutants can more easily enter waterbodies and degrade water quality. Research has found that 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).

Despite the potential for water quality degradation from management activities in roadless areas, the streams and lakes within roadless areas in Colorado generally have good to excellent water quality, as previously described. This is partly because potential impacts from management activities on NFS lands are mitigated (avoided, reduced, or minimized) by following best management practices (BMPs) designed to control nonpoint sources of pollutants and meet Clean Water Act standards for water quality (Forest Service Manual 2532). Water quality impacts are also mitigated through application of the Forest Service regional watershed conservation practices handbook (FSH 2509.25). That handbook is recognized in Colorado's nonpoint source management program as a technical reference and guidance document for planning and implementation of Colorado's BMPs (Colorado CDPHE Water Quality Control Division 2005). The good water quality in roadless areas is also due in part to the relatively low density of roads and other constructed features (refer to the Analysis Framework for road density figures). In addition, many roadless areas are located either in the headwaters of stream systems or immediately downslope of relatively undisturbed areas such as wilderness. Streams and lakes are better protected in large, relatively undeveloped roadless areas where management activities are much more limited compared to surrounding public and private lands.

Some activities authorized in roadless areas have been subject to permit requirements under the Clean Water Act, usually requirements outlined in sections 401, 402, and 404 of the act. For example, discharge of dredge or fill material into waters of the United States requires a section 404 permit from the U.S. Army Corps of Engineers. Any road construction or other construction exceeding 1 acre of disturbance, with the exception of roads for forestry purposes and construction for oil and gas development, is subject to stormwater permit requirements from section 402. In addition, construction for oil and gas operations—including roads, well pads, and pipelines—is subject to state stormwater permit requirements (5 CCR 1002-61, Regulation

61 Colorado Discharge Permit System Regulations). Other activities, such as hard-rock mining, are also sometimes subject to state permits. All these permits mandate use of BMPs and monitoring to minimize discharge of pollutants to waters of the United States or waters of the state. Disposal of produced water from oil and gas development would also be regulated by the state to protect water quality.

Roadless areas in Colorado make an important contribution to the quality and quantity of public water supplies. Water is used for a variety of purposes including public water supply, agriculture, industrial uses (including mining), recreation, and support of aquatic life. Roadless areas are composed mostly of mountainous terrain that receives the highest amounts of precipitation in the state. Approximately 68 percent of the water yield in Colorado originates on NFS lands and much of this is from within the roadless and wilderness areas (Brown et al. 2005). More than 95 percent of the roadless areas (IRAs and CRAs) in Colorado overlap one or more source water assessment areas, which are watersheds identified by the state around public surface and groundwater supply sources (Colorado CDPHE Water Quality Control Division 2004 and 2008). The Forest Service is required to manage those public supply watersheds for multiple uses while recognizing the domestic water supply needs, and to use only proven techniques in managing these watersheds (Forest Service Manual 2542). In addition, there are numerous reservoirs, diversions, ditches, tunnels, and other water conveyance facilities located in roadless areas. These facilities are important for storing and delivering water supplies to downstream users.

Water yield in Colorado is not being measurably altered by ongoing activities in the roadless areas. Water yield can be affected by large-scale changes in vegetation cover within a watershed. At least 20 to 30 percent of the basal area in a watershed needs to be removed to generate a measurable increase in water yield (MacDonald and Stednick 2003). The hydrologic recovery following large-scale removals of vegetation to pre-disturbance water yield levels can take as long as 60 years (MacDonald and Stednick 2003). 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. The Rocky Mountain regional entomologist estimates that the majority of the lodgepole pine forests in Colorado will be killed by the beetles within the next 5 years (Robert Cain, personal communication, April 2008). 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.

Large, high-severity, stand-replacing wildfires are known to cause temporary increases in water yield and peak flows on NFS lands in Colorado. High-severity fires typically 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. The short-duration, high-intensity rainstorms that frequently follow 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. In addition, during these post-fire rainstorms, a large quantity of rainwater is carried rapidly down burned slopes, carrying ash, topsoil, and small woody material into stream drainages. The risk of post-fire floods during summer convective storms is greatest in the first 2 or 3 years following the fire (MacDonald and Stednick 2003).

Environmental Consequences – Direct/Indirect Effects

Alternative 1 – 2001 Rule (No Action)

The vegetation removals projected to occur in roadless areas from roading, tree-cutting, and other activities would not be of sufficient magnitude or extent to cause a measurable change in water yield. This is primarily because the geographic extent of the tree-cutting in the roadless areas in a watershed would not be great enough to exceed the 20 percent basal area threshold needed to generate a noticeable increase in water yield over current conditions, as discussed in the affected environment section. Projected changes in road construction or reconstruction and projected tree-cutting activities from current allowable land uses are described in the Analysis Framework section at the beginning of this chapter. Also, much of the projected tree-cutting would be salvage of dead or nearly dead trees related to forest health or fuels treatments. In this case, the effect on water yield would have happened when the tree died, not when it was cut down. The potential for large-scale catastrophic wildfires in the roadless areas would be slightly higher under this alternative, and could therefore increase the risk of flash floods and increased sedimentation in water bodies. However, the difference in the potential for large wildfires occurring in one or more of the roadless areas does not substantially differ between alternatives (see Fire and Fuels section).

This alternative generally prohibits new roads and tree-cutting, and would therefore have the least risk of potential adverse effects on water quality. Where new ground-disturbing activities occur in the IRAs—including construction of new roads, skid trails, log landings, oil-gas well pads, mining sites, communications sites, or other constructed features—these ground-disturbing activities would increase the potential for adverse impacts on water quality. However, with the expected application of mitigation measures and BMPs to each project, as described earlier, the potential would be very low for exceeding water quality standards as a result of authorized activities in roadless areas. For example, all projects proposed in the IRAs would be subject to the NEPA process and site-specific analysis to determine appropriate mitigation measures to protect water quality. Mitigation measures from the watershed conservation practices handbook or BMPs would be applied as appropriate to protect hydrologic function, stream health, soil quality, and water purity.

Thus, overall the potential for adverse effects would be minimized by use of these practices because sensitive areas—such as the water influence zone, wetlands, steep slopes, or highly erosive soils—would be avoided, protective ground cover would be maintained where needed, connected disturbed areas would be minimized, appropriate road drainage and erosion control techniques would be applied, and the areas would be restored following use. Activities that could occur in the IRAs are unlikely to contribute to further impairment of streams currently listed on the state 303(d) list. Roads, tree-cutting, and other ground-disturbing activities would not significantly increase discharge of selenium, pathogens, or metals to the waterbodies, with the use of the applicable mitigation measures.

In addition, most of the projected roading, where allowed in roadless areas under this alternative, would be scattered among many different roadless areas and watersheds, and limited to relatively small, localized areas. Potential impacts from tree-cutting and removal would likewise be scattered over different roadless areas and watersheds. Water quality impacts from tree-cutting activities typically come from the associated skidding (log dragging) and creation of log landings (storage areas cleared of vegetation) where log removal is

prescribed. However, site-specific analysis would prescribe appropriate conservation and mitigation measures to protect water quality associated with tree-cutting and removal activities, and thereby prevent any serious adverse water quality impacts. In project areas where vegetation is removed and soil is exposed, those areas would be eventually restored to natural vegetation cover after the project is completed.

The projected decommissioning of roads would 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 outslope roadbeds, pull drainage crossing structures, restore stream crossings, scarify the roadbed to reduce compaction, and revegetate slopes, help disperse surface water runoff and eliminate the road as a source of stream sedimentation. Where slope re-contouring is used to decommission the road, subsurface water flow paths would also be restored, further erasing the effect of the road.

Although mitigation measures including conservation measures and BMPs would be applied equally under all the alternatives, the potential for increases in surface runoff and stream sedimentation in roadless area watersheds would remain slightly less under alternative 1 than under the other two alternatives. This is because alternative 1 allows for the least amount of new road construction and reconstruction in roadless areas. Thus, this alternative poses a slightly lower risk of localized areas of excess runoff and short-term sediment increases into waterbodies compared to the other two alternatives, regardless of the mitigation measures expected to be applied.

Maintaining the substantially altered areas within IRAs along with the general prohibition on new roads in these areas would further help to maintain desirable soil and water quality conditions in the roadless areas. Tree-cutting would continue to occur along existing roads in those areas, but it would not be expected to result in adverse impacts on water quality for the same reasons described in the preceding paragraph.

In ski areas within IRAs, alternative 1 would have the same effect on water quality as the other alternatives, as a result of allowing new roads, facilities, and ski runs to be built where already authorized in permitted ski area boundaries. The extent of new ski area roads and facilities in IRAs is projected to be minimal over the next 15 years (see Developed Ski Areas section). Any proposed developments in substantially altered areas or ski areas in IRAs would continue to be subject to site-specific analysis and associated conservation and mitigation measures previously described. Those measures would be expected to continue to adequately protect water quality and stream health.

On the 309,000 acres of unroaded area outside IRAs, there would be no change in potential impacts on water quality from ongoing or future land use activities. Unlike alternative 2, alternative 1 does not include those unroaded areas in the IRAs, so those areas would remain subject to new road construction, facility development, and other ground-disturbing activities that would otherwise be generally prohibited in IRAs.

New roads and other activities related to energy resource operations (oil, gas, and coal) allowed under this alternative in leased areas (prior to 2001) would continue to potentially affect water quality in several ways. First, increases in ground disturbance for new mine sites, well pads, roads, and pipelines would increase the potential for accelerated erosion and sedimentation to affect nearby waterbodies; BMPs for erosion control would mitigate these impacts. Secondly, in

some mining operations there may be large volumes of water generated throughout the life of the project. This water may or may not be of sufficient quality to be disposed of on the surface and may need to be re-injected into deep aquifers. Water produced by the project that is discharged into waterbodies would be regulated by state discharge permits to ensure that water quality standards would be met. Lastly, there would be increased potential for chemical contamination of surface and groundwater by hydrocarbons or other substances (fracking compounds) used in oil and gas production, although BMPs would be used to prevent chemical contamination from areas like drilling pits. The most likely potential for chemical contamination would be through accidental spills, and the risk of spills increases with the amount of energy development activity. Because alternative 1 projects the least amount of new road construction and oil-, gas-, or coal-drilling activity in roadless areas, it would have the lowest risk of accidental spills or other water quality impacts compared to the other two alternatives. Site-specific mitigation measures and regulatory requirements such as Clean Water Act permit requirements would be used to adequately protect water quality during these activities.

Other allowable activities expected to continue in roadless areas that could potentially continue to affect water quality include: prescribed burning, some hard-rock mining, livestock grazing, camping, hiking, biking, off-highway motor vehicle uses, and many other ongoing land use activities. These 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 BMPs. The extent and effect of activities would not be measurably different under any of the alternatives.

This alternative would pose a very low risk of adverse impacts on municipal water supplies from the few, scattered activities that would be expected to occur in the IRAs and the mitigation measures that would be applied to those activities. Different from the other two alternatives, alternative 1 poses a slightly increased risk of experiencing a large, high-severity wildfire in an IRA, because of the low amount of fuel reduction projected to occur in IRAs (see Fire and Fuels section). This would result in a slightly elevated risk of water quality impacts on municipal water supplies from a high-severity wildfire, compared to the other two alternatives.

Alternative 2 – Colorado Rule (Proposed Action)

Alternative 2 would have a slightly greater risk of adverse impacts on water quality in roadless areas compared to what was described for alternative 1. This is because more new roads, vegetation removal, and ground disturbance would be allowed within the roadless areas under this alternative compared to alternative 1, as described in the Analysis Framework section. However, the potential for water quality impacts would be effectively mitigated through the site-specific application of watershed conservation measures, alternative BMPs, and regulatory requirements. Thus, even with an increased potential for adverse impacts from ground-disturbing activities expected to occur in the roadless areas under this alternative compared to baseline conditions, future activities authorized in the roadless areas would not be expected to cause water quality standards in the affected waterbodies to be exceeded.

The potential water quality impacts from new roads, tree-cutting and removal activities, and energy-development activities described for alternative 1 would essentially be the same under alternative 2. This is because under all the alternatives, the impacts would be localized and geographically scattered across across millions of acres of roadless areas, so the impact on any one drainage or watershed in a given year would be small. In addition, the activities allowed in

the roadless areas would continue to be site-specifically mitigated as needed to protect water quality. Thus, like alternative 1, water quality effects would be expected to be small in magnitude.

The beneficial effects on water quality associated with the projected road decommissioning under alternative 2 would be the same as the effects described for alternative 1. This is because the amount of existing roads projected to be decommissioned would be approximately the same under any of the alternatives.

By not including substantially altered areas in the CRAs, more new roads would likely be constructed on those NFS land acres outside the CRAs. This would slightly increase the potential for road-related water quality impacts on those lands. However, mitigation measures would effectively mitigate these potential effects as previously described.

Potential water quality impacts from ski area developments would not differ from those described for alternative 1, because the projected level of development in ski areas in the next 15 years would not be substantially different whether they are included or not included in the CRAs.

On the 309,000 acres of unroaded area that are included in CRAs under this alternative, there would be a slightly reduced risk of experiencing adverse water quality impacts compared to alternative 1. Those acres would likely have fewer new roads on them under alternative 2, because of the general road-building prohibitions in CRAs. However, with the application of conservation and mitigation measures on newly authorized roads, there would be only a slightly reduced risk of water quality impacts in those areas compared to impacts expected under alternative 1.

Under alternative 2, the increased projections for coal mining and associated new roads in the North Fork coal mining area would increase the potential for adverse water quality impacts in those roadless areas (refer to Analysis Framework). The watershed conservation, mitigation measures, and regulatory requirements would continue to minimize potential water quality impacts in those North Fork coal mining areas to within acceptable levels. However, there would be an increased risk of higher sediment and chemical contamination levels and/or accidental chemical spills in streams within the North Fork coal mining areas that are developed in CRAs, compared to the water quality conditions anticipated under alternative 1.

The effects on water quality from other ongoing land use activities in roadless areas would be the same as those previously described for alternative 1.

Alternative 2 would pose a slightly greater risk to municipal water supplies from authorized activities compared to alternative 1, simply because of the increase in projected ground-disturbing activities under alternative 2. 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, and 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 in a roadless area would be increased under alternative 2 compared to alternative 1. This is because under alternative 2 more acreage would be treated to abate wildfire hazards in roadless areas.

Alternative 3 – Forest Plans

Alternative 3 would have a slightly greater risk of adverse impacts on water quality in roadless areas compared to what was described for alternatives 1 and 2. This is because more new roads, tree-cutting and removal, and other ground disturbances would be allowed within the roadless areas under alternative 3 compared to the other two alternatives, as described in the Analysis Framework section. However, the potential for water quality impacts would be effectively mitigated through the site-specific application of watershed conservation measures, alternative BMPs, and regulatory requirements. Thus, even with a greater potential for adverse water quality impacts expected to occur in the roadless areas under alternative 3, future roading and tree-cutting and removal activities in the roadless areas would not be expected to cause water quality standards to be exceeded (that is, would not be expected to increase the number of impaired stream miles) in roadless areas.

The potential water quality impacts from new roads, tree-cutting and removal activities, and energy-development activities described for alternative 1 would essentially be the same under all alternatives. The additional acres of tree-cutting projected under alternative 3 would not measurably alter the expected impacts on water quality. Under all the alternatives the impacts would be localized and geographically scattered across millions of acres of roadless area, so the impact on any one drainage or watershed in a given year would be small. Disturbed soils would be rehabilitated after the project is completed, and impacts from authorized activities in the roadless areas would be mitigated as needed to protect water quality.

The beneficial effects on water quality associated with the projected road decommissioning under alternative 3 would be the same as the effects described for the other two alternatives.

Alternative 3 has the greatest amount of projected energy development operations and therefore has the greatest potential risk of adverse effects on water quality from those activities. The type of impacts would be the same as described for alternatives 1 and 2. Site-specific mitigation measures and regulatory requirements would be expected to adequately protect water quality during these activities. However, the risk of accidental chemical spills or increased sediment or chemical levels in roadless area streams would be the highest under this alternative.

The same amount of road construction and tree-cutting is projected in the substantially altered areas as in alternative 2, with the same potential for effects.

The amount of ski area development would not substantially differ among the alternatives; therefore, the effects from ski area developments on water quality would essentially be the same for all alternatives.

The 309,000 acres of unroaded area that are not included in roadless areas under this alternative would have a slightly higher risk of experiencing adverse water quality impacts, as more roads would likely be built in those areas. However, with the application of conservation and mitigation measures on newly authorized roads, there would be a negligible to slightly elevated risk of water quality effects in those areas compared to effects expected under alternative 2.

The effects on water quality from other ongoing land use activities in roadless areas would be the same as previously described for alternative 1.

Alternative 3 would pose the greater risk to municipal water supplies from authorized activities compared to the other two alternatives, because of the increase in projected ground-disturbing

activities under this 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, and 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 causing water quality impacts on a municipal water supply in a roadless area would be reduced under alternative 3 compared to either of the other two alternatives. This is because under this alternative the most acreage would probably be treated to abate wildfire hazards in roadless areas (see Fire and Fuels section for details).

Summary of Direct and Indirect Effects

The relative differences in potential water quality impacts in roadless areas under any of the alternatives would be negligible. Alternative 1 would have the least risk of adverse effects on water quality, and alternative 2 would have a slightly higher risk, followed by alternative 3 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.

Environmental Consequences - Cumulative Effects

This cumulative effects analysis considered the effects from past, ongoing, and reasonably foreseeable future activities that could cumulatively affect water quality within roadless areas when combined with effects described for each alternative, including the activities and effects listed in Appendix D. The primary activities that would have ongoing or future effects on water quality within roadless area watersheds include tree-cutting or removal, livestock grazing, off-highway vehicle use, energy resource development, residential development and agricultural uses adjacent to roadless areas, mining, and the associated roads that support these activities. Natural events that may also continue to occasionally affect water quality in roadless area watersheds include wildfires, floods, windstorms, and insect and disease outbreaks.

Climate change also has occurred and is continuing to occur (USDA Global Change Program Office 2001). Climate change is expected to result in a gradual warming trend that would affect hydrologic systems within Colorado. There would continue to be less precipitation and more drought anticipated in the future (Saunders et al. 2008). Climate change is expected to result in decreased winter snowpacks, more winter precipitation as rain rather than snow, earlier snowmelt, and reduced summer low flows (Saunders et al. 2008). These climatic trends would be expected to increase the size and magnitude of wildfire events, and the magnitude of insect-disease outbreaks, which would affect hydrologic functions, water yield, and water quality in roadless area watersheds.

The anticipated continued increases in population growth and associated human developments in Colorado would affect water quality in the watersheds that overlap roadless areas. The demand is increasing for greater amounts of high-quality water for municipal, agricultural, and other purposes. Coupled with the increased demand for water supplies is an increased demand for water storage and conveyance facilities. As roadless areas are generally located high in the

watershed, these areas are attractive for future new development or expansion of existing facilities to take advantage of low evaporation rates and gravity distribution. Also, as the population growth increases, the demand for raw materials—including timber, minerals, and energy—and for recreational and residential opportunities also goes up, increasing the potential for adverse effects on water quality by creating land use changes and disturbances.

Water yield within roadless area watersheds was described in the Affected Environment section, and is not anticipated to change as a result of any of the roadless rulemaking alternatives analyzed in this EIS. Thus, with no direct or indirect effects from the alternatives on water yield, there would be no cumulative effect on water yield. The large insect-disease outbreaks and wildfires that cause large-scale tree mortality would continue to contribute to alterations in water yield in the affected watersheds.

The potential for cumulative effects on water quality is based primarily on the amount of activity that would be projected to occur. As described in the previous Environmental Consequences section, the direct and indirect effects on water quality from projected activities in the roadless areas are unlikely to be detected beyond the sub-watershed scale because BMPs and other mitigation measures would be used to mitigate effects. Downstream changes in water quality at the watershed scale would be more likely to result from activities downstream outside the roadless areas than from activities within the roadless areas. Alternative 1 would have the least potential for cumulative effects at the watershed scale, and alternative 3 would have the greatest potential, because of differences in the magnitude and extent of activities allowed in roadless areas under each alternative. However, for reasons previously articulated, the contributions from activities associated with the alternatives would not result in any significant cumulative effect when added to the water quality impacts from other past, ongoing, or foreseeable future activities in the same roadless area watersheds.

SOIL RESOURCE

This analysis evaluates potential effects of the alternatives on the soil resource, focusing on key differences in foreseeable activities under each rulemaking alternative. Changes in soil conditions typically have interrelated effects on vegetative productivity and water quality; however, the analyses of effects on these other resources are described in separate sections of the EIS.

Affected Environment

Soil is a fundamental component of the environment. It is the growing medium for most plants. Soil absorbs and stores water, releasing it slowly over time. All renewable resources depend on soils. Soil is considered a nonrenewable resource because of the length of time required for its formation. 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 within the potentially affected roadless areas in Colorado is generally in satisfactory condition. There do not appear to be large acreages of excessive soil erosion, detrimental soil disturbance, or landslides attributed to management activities. Localized areas devoid of vegetation and subject to accelerated soil erosion occur on relatively small, scattered acreages where human activities have routinely occurred.

Soil formation depends on five factors: parent material, topography, climate, organisms, and time. Roadless areas in Colorado have many different soil types because of the wide ranges in: geologic parent material, elevation, precipitation, topographic variation, and geologic time during which soil formation has been taking place. At high elevations, vegetative growth and microbial activity are restricted because of the short growing season and high snow pack. Under these conditions, the rate of soil formation is much slower than in the more temperate lower elevations. High-elevation soils are generally not as well-developed or as fertile as those occurring at lower elevations.

Some soil types are relatively more prone to accelerated surface erosion, due primarily to inherent soil properties and terrain features such as slope. Erosion hazard is a rating of the inherent susceptibility of a soil to erosive forces such as raindrop impact or water flow over the surface. Erosion hazard depends on particle size distribution, organic matter content, soil structure, permeability, rock fragment content, slope gradient, and rainfall characteristics. Erosion hazard on most of the soils in the analysis area can be characterized as low to moderate, with the moderate rating being dominant. High erosion hazards are associated with soils on slopes greater than 40 percent.

A wide range of surface erosion and sediment control methods are suitable for use in the forest environment. During project-level analysis, areas sensitive to surface erosion are identified and appropriate mitigation measures are used to reduce surface erosion and sediment production. Erosion is a naturally occurring event; the objective is to retain erosion rates following project implementation that approximate pre-existing background rates. Implementation of a well-

prepared surface erosion and sediment control program in conjunction with road building and forestry activities can mitigate the potentially degrading impacts of surface erosion.

Figure 6 shows the relative percentage of each erosion hazard class for soil types within the roadless areas (IRAs and CRAs) under all alternatives. This includes all forested and non-forested lands within roadless areas in Colorado. This information is based on soil survey information for NFS lands in Colorado (Cleland et al 2007).

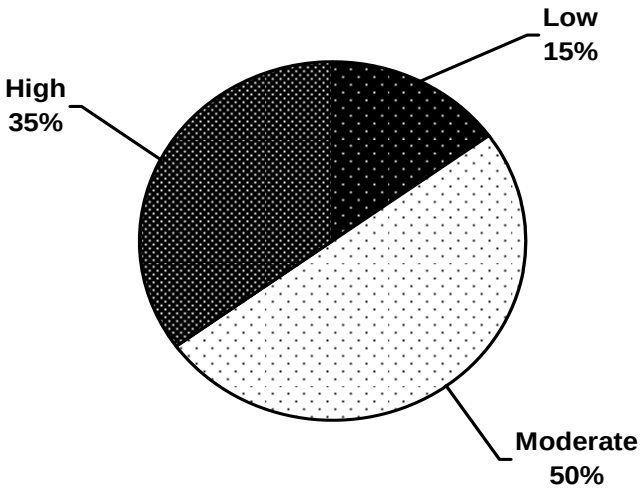

Figure 6. Percentage of erosion hazard classes in roadless areas in Colorado
(Source: Cleland et al 2007, soil survey data)

Environment Consequences – direct/indirect effects

Alternative 1 – 2001 Rule (No Action)

This alternative would have the least potential for accelerated rates of erosion in roadless areas because of the general prohibitions on road construction, reconstruction, and tree-cutting activities. When new ground-disturbing activities occur in the roadless areas—such as creation of new roads, tree-cutting activities, energy resource development, mining, or other construction—there would be some localized soil erosion, soil compaction, and changes in soil properties on the disturbed sites. Most of the changes in soil conditions would be limited to relatively small, localized areas. For those areas that need ground cover, the disturbed sites would be revegetated after the project is completed.

Construction of permanent roads or other long-term infrastructure such as communication sites is considered a dedicated use, and the occupied land is removed from production. However, under this alternative, very few permanent roads or major facilities would be expected to be built in the roadless areas. Thus, there would be little to no permanent loss of the productive capacity of the land.

There would be little risk of significant amounts of soil movement or loss of soil quality from increases in soil erosion or landslides. This is mostly because there are very few circumstances where new road construction is allowed or projected to occur in the roadless areas. During project planning, new road location or facility construction would be done to minimize

placement on highly sensitive soil. Roads would typically not be located on steep slopes (over 40 percent) because some areas are more prone to landslides on steep slopes. Resource protection measures, such as those in the Forest Service regional watershed conservation practices handbook, would be applied during construction of new roads to minimize soil loss. The limited miles of new road projected to be constructed or reconstructed in IRAs under this alternative would be scattered among many different roadless areas, and only a fraction of these miles would occur on highly erosive soils (refer to Analysis Framework section for road mile details). Thus, the likelihood would be low that project road construction would occur on highly sensitive soils and result in a substantial increase in soil erosion.

The 15-year projections for potential future tree cutting and energy resource development activities as described in the Analysis Framework section would pose a low risk of significantly increasing the current soil erosion rates under this alternative. This low risk is due to many factors, such as the relatively small proportion of the roadless areas on which these ground-disturbing activities would occur, the fact that these activities would not likely occur on steep slopes, and the mitigation measures that would be implemented to minimize soil erosion.

Under alternative 1 and other alternatives, the miles of road decommissioning projected to occur within the roadless areas would have a beneficial effect on soil resources by restoring infiltration and vegetative cover, thus reducing soil erosion.

Maintaining the restrictions on new road construction in the substantially altered areas would further help to maintain desirable soil conditions in the roadless areas, even though tree-cutting activities would continue to occur along existing roads in those areas.

Like other alternatives, alternative 1 allows for additional roads and facilities to be built where authorized within existing permitted ski areas within IRA boundaries. However, the extent of new ski area roads and facilities in roadless areas is projected to be minimal over the next 15 years, and is projected to be the same for all alternatives. Thus no major long-term impacts on soil resources would be anticipated to occur as a result of projected new development in those ski areas.

Under this alternative, the general prohibitions on roading and tree-cutting activities in roadless areas would not apply to the 309,000 acres of unroaded areas outside the IRAs. Those unroaded areas outside IRAs would continue to incur the same soil effects that are currently occurring, and potential soil impacts may increase if roads are built in those areas in the future.

The number of roadless area acres vulnerable to a large-scale, high-intensity wildfire would remain about the same as current conditions under this alternative, as described in the Fire and Fuels section. Therefore, the potential for post-fire erosion and other wildfire-related impacts on soil quality in roadless areas would remain high under this alternative.

Other ongoing activities in roadless areas that would continue to affect soil resource conditions include: prescribed fire and wildfire use, some hard-rock mining, livestock grazing, recreational use, and many other ongoing activities. These activities are known to contribute to localized impacts on soil quality. However, these activities would not be measurably different under any of the alternatives.

Alternative 2 – Colorado Rule (Proposed Action)

Compared to Alternative 1, alternative 2 would result in slightly higher risk of affecting the soil resource. The main sources expected to contribute to an increase in soil erosion and compaction

would be the same as described for alternative 1, including the creation of new roads, well pads, or other constructed features. Like alternative 1, changes in soil conditions would be limited to relatively small acreages, geographically scattered over millions of acres of roadless areas. Temporary roads and other disturbed areas would be revegetated after a project is completed.

Like alternative 1, the soil resource in the roadless areas would remain in a functioning condition, with no significant loss of long-term soil productivity. This is based on the limited geographic extent of projected ground-disturbing activities within a given roadless area, the mitigation measures typically applied to road construction and other ground-disturbing activities to avoid soil quality impacts, the rehabilitation measures required after project activities are complete, and other reasons described under alternative 1.

Under alternative 2, the permanent roads projected to be built annually in the roadless areas in the next 15 years would result in a permanent loss of soil productivity on those acres converted to permanent roads (see Analysis Framework section for road mile projections).

The new roads projected to be constructed under this alternative would cause a slightly higher increase in soil erosion and disturbance in roadless areas compared to alternative 1. While the roads remain in place, prior to decommissioning, there would be a temporary loss of soil productivity on those affected acres. Because nearly all the future roads in CRAs would be decommissioned, there would be very little permanent loss of soil productivity in the roadless areas. A temporary but long-term loss of productivity would occur on roadless acres devoted to new oil, gas, and coal drilling pads and associated roads because the life of these commitments would be expected to continue for many decades. However, because of the mitigation measures anticipated to protect soil quality, the post-project rehabilitation of disturbed soils, and the localized nature of projected activities, the activities projected under alternative 2 that would differ from alternative 1 would not be expected to result in significant increases in soil erosion rates that would reduce long-term soil productivity in the roadless areas.

The roads projected to be decommissioned within the roadless areas would reduce current road-related impacts on soil and improve soil quality in the same way that was described for alternative 1.

The 15-year projection for potential future tree-cutting and energy resource development activities (oil, gas, coal) would be greater in roadless areas under this alternative. The increase in those permissible activities would increase the potential amount of soil erosion, compaction, and impacts to other soil properties in the affected areas. As these activities are completed, these areas would be reclaimed and returned to a more productive condition. Overall, there would not be a significant reduction in long-term soil productivity in the roadless areas resulting from higher levels of tree-cutting activities or energy resource development activities in roadless areas.

No including the substantially altered areas in CRAs under alternative 2 is projected to result in about 3 miles of new road construction annually in those areas over the next 15 years, which would not be allowed to occur under alternative 1. This would result in a slightly higher risk of road-related soil erosion compared to alternative 1, although those impacts would be mitigated to a large extent. The new roads in those substantially altered areas would be removed from soil productivity while they remain as roads, prior to decommissioning.

Not including ski areas within the CRAs under alternative 2 would not be anticipated to result in more or less soil resource impacts on those ski area acres. This is because the level of ground-

disturbing activity projected to occur over the next 15 years in those ski areas would not significantly differ by alternative.

The addition of 309,000 acres of unroaded areas into CRAs under this alternative would reduce the potential for road-related impacts on soil quality in those areas. This is because the potential for new roads would be higher on those acres under the other alternatives where they remain outside the roadless area protections of the Colorado Rule.

The number of roadless area acres vulnerable to a large-scale, high-intensity wildfire would be slightly reduced under this alternative, as described in the Fire and Fuels section. Therefore, the potential for wildfire-related impacts on soil quality in roadless areas would be lower under alternative 2 compared to alternative 1.

Other ongoing land use activities in roadless areas and their associated impacts to soil resources would be the same as previously described for alternative 1.

Alternative 3 – Forest Plans

This alternative would result in a noticeably higher risk of adversely affecting soil quality in roadless areas compared to alternatives 1 and 2. This is because of the additional acreage in IRAs projected to be used for road construction, tree-cutting and removal activities, and energy resource development activities. The overall soil resource impacts would not substantially differ from the other alternatives, and long-term soil productivity in IRAs would be expected to be maintained at a satisfactory level. Soil impacts would be minimized for the reasons previously described for the other alternatives, including mitigation measures, post-project rehabilitation requirements, and the limited geographic extent and scattered distribution of anticipated ground-disturbing activities in IRAs.

Like the other alternatives, the soil resources on a landscape scale in the roadless areas would remain in satisfactory condition under alternative 3, with no significant loss of long-term soil productivity. However, there would be an increased risk of localized and short-term soil impacts because there would be more acres of soil disturbance in this alternative. Like all the alternatives, areas of steep slopes and sensitive soils would be avoided during project planning and layout.

Under alternative 3, the permanent roads projected to be built in the CRAs would result in those acres being permanently converted to a non-vegetated state, with an associated loss in soil productivity on those acres. The projected temporary roads would have the same effects described for all alternatives—that is, soil erosion would be increased in the short term.

The road miles anticipated to be decommissioned within the roadless areas under alternative 3 would reduce current road-related impacts on soil resources and improve soil quality, as described for other alternatives.

The 15-year projections for potential tree-cutting and energy resource development activities would result in soil impacts similar to what was described for the other alternatives (see Analysis Framework section for projections). Because of the greater amount of roadless area acreage projected to be disturbed, the potential risk of detrimental impacts would occur on more IRA acres under this alternative than the other two alternatives. However, with the anticipated mitigation measures, rehabilitation requirements, and limited geographic extent and distribution of soil disturbances, adverse impacts on soil quality would be minimized.

Soil quality impacts within the substantially altered areas of IRAs would primarily be related to the projections of the new road construction in those areas over the next 15 years (see Analysis Framework section). This would pose a higher risk of road-related soil erosion within those areas under alternative 3 compared to alternative 1, and would be essentially the same as impacts previously described for alternative 2.

Impacts on soil quality within ski areas in IRAs would be essentially the same as described for the other two alternatives because the level of development in ski areas is not expected to substantially differ based on whether those areas are included or excluded from the roadless areas.

Soil quality impacts on the 309,000 acres of unroaded areas not included in IRAs under alternative 3 would be the same as described for alternative 1. Like alternative 1, there would be a higher potential for adverse soil quality impacts from future roading and other development activities in these unroaded areas.

The roadless area acreage vulnerable to a large-scale high-intensity wildfire would be reduced under alternative 3 to essentially the same extent as alternative 2, as described in the Fire and Fuels section. The potential for post-fire accelerated erosion and other wildfire-related impacts to soil quality in roadless areas would be slightly reduced under this alternative compared to alternative 1.

Other ongoing land use activities in roadless areas and their associated effects on soil quality would be the same as described for the other alternatives.

Summary of Direct and Indirect Effects

Soil disturbance from road construction and other ground-disturbing activities can affect the soil resource by increasing erosion, compaction, and other soil quality conditions. The potential for adverse impacts on the soil resource in roadless areas would differ slightly among the alternatives based on different levels of projected roading, tree removal, and energy resource development activities. Alternative 1 would have the least potential for adverse impacts and alternative 3 would have the greatest potential for adverse soil impacts. However, the 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. Impacts would also be limited in geographic extent and would be distributed over many different roadless areas. Thus, the actual effects on soil quality would be minor and of short duration.

Environmental Consequences – Cumulative Effects

This cumulative effects analysis considered the effects from past, ongoing and reasonably foreseeable future activities that could cumulatively affect soil quality within roadless areas when combined with effects described for each alternative, including the activities and effects listed in Appendix D. The primary activities that could affect soil resources in roadless areas include the 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 in related research.

There is a wide body of knowledge about the effects of logging and forest roads on soil erosion. Those studies indicate that "... most erosion occurring on timber harvest areas was due to large

mass wasting events found on a small fraction of the harvest sites (Rice and Lewis 1991). However, researchers acknowledge that only a few of the logging or road-building sites accounted for most of the erosion, and avoiding or mitigating impacts on steep slopes and other erosive sites would be a key to reducing erosion on a cumulative basis. This type of avoidance or mitigation of highly erosive soils occurs in Forest Service authorized activities. The studies also found that repeated entry onto the same site for harvest can lead to detrimental loss of topsoil or excessive compaction and displacement. Harvested stands in roadless areas would not be re-entered for 20 years or more, thereby minimizing the potential for cumulative compaction or displacement.

Overall, considering the relatively limited extent, magnitude, and duration of potential soil quality impacts under any of the roadless area alternatives, and the additional mitigation measures that occur on projects on federal lands surrounding the roadless areas, ground-disturbing activities are not likely to overlap and combine to create any significant adverse impacts on the soil resource.

AIR RESOURCE

This analysis evaluates potential effects of the alternatives on air quality, focusing on key differences in foreseeable activities under each rulemaking alternative.

Affected Environment

The Forest Service coordinates with the State of Colorado to help prevent air quality impacts on Forest Service administered lands, in accordance with Clean Air Act, the Wilderness Act, and the Organic Act. Of the airsheds that overlap portions of roadless areas in Colorado, no areas are currently designated as "non-attainment" for particulate matter (http://apcd.state.co.us; also www.epa.gov/oar/oaqps/greenbk/mapnpoll), which means they are in compliance with state and federal Clean Air Act standards for air quality and do not exceed thresholds for specific pollutants. Thus, in all the roadless areas in Colorado, the overlapping airsheds meet all air quality standards.

According to the Forest Service Rocky Mountain Region's GIS database of class I areas, there are 11 class I areas located within a 10-mile radius of roadless areas. Class I areas are typically large wilderness areas and other large congressionally designated areas. Most of the roadless areas lie adjacent to wilderness areas, many of which are class I areas. Class I areas must be managed to meet more stringent air quality levels compared to other areas. Currently, air quality within those potentially affected class I areas meets all state and federal air quality standards. All class I areas, however, do have existing visibility impairment and do not meet the national visibility goal of having no anthropogenic (human) caused visibility impairment (www.cdphe.state.co.us/ap/regionalhaze). The Forest Service cooperates with the State of Colorado in monitoring potential impacts on air quality to prevent any future and remedy any existing visibility impairment.

Methane gas (CH_4) is not an air quality pollutant governed by state and federal air quality standards. However, it is a greenhouse gas that contributes to global warming trends, though to a lesser degree than carbon dioxide (CO_2) and other high global warming potential gasses. Methane is emitted into the atmosphere from a variety of human-related and natural sources, the most prominent being from waste, energy, and agriculture (USEPA Office of Air and Radiation 2001). It is emitted from natural gas and coal production activities, as well as from the natural digestive processes in livestock. It is estimated that 60 percent of global methane emissions are related to human-related activities (Intergovernmental Panel on Climate Change 2001). Approximately 8 percent of all methane emissions are from coal mines (Intergovernmental Panel on Climate Change 2007). Methane is emitted from underground mines through a venting system, which is required for safety purposes. Natural sources of methane include wetlands, gas hydrates, permafrost, termites, oceans, freshwater bodies, and non-wetland soils.

Environmental Consequences – Direct/Indirect Effects

All Alternatives

Differences in effects on air quality do not substantially differ among alternatives. Therefore, the effects of all alternatives are discussed collectively.

Air pollution sources from management activities on NFS lands typically include: fine particulate (dust) emissions from road construction and use of unsurfaced roads; volatile organic compounds from gasoline or soot from diesel engines; various pollutant emissions from open pit mining and oil and gas extraction operations; and particulates and noxious compounds from smoke generated from prescribed burning. The management activities that differ among alternatives evaluated in this effects analysis are: road construction or reconstruction, tree-cutting and removals, and energy resource development activities such as coal mining. The levels of these projected activities that differ among alternatives are described in detail in the Analysis Framework section.

Based on the projected land management activities that differ among alternatives, as described in the Analysis Framework, atmospheric emissions within roadless areas are not anticipated to directly, indirectly, or cumulatively increase to a level that would be likely to exceed state or federal air quality standards. This estimate of potential impact is based on the estimated magnitude, extent, and duration of atmospheric emissions from those activities, as projected for each alternative. Prescribed burning, timber harvesting, road and facility construction and use, and energy resource development activities have been ongoing on NFS lands in Colorado and have not resulted in impacts that exceeded air quality standards.

All alternatives limit those authorized activities within roadless areas to some extent. Alternative 1 would allow for the least amount of road construction and ground-disturbing activities, and alternative 3 would allow the most road construction and other activities. The amount and geographic extent of dust particulates, volatile organic compounds, and other emissions from projected activities in roadless areas would be relatively low and of short duration. They would not likely accumulate in the lower atmosphere in significant concentrations or linger for long periods of time. Those infrequent or short-duration emissions would not likely create visibility impairment or public health hazards in high-sensitivity areas such as schools, hospitals, airports, or residential areas. Thus, it is unlikely that the particulate matter, carbon dioxide, or other noxious emissions that may result from those projected activities would result in a significant contribution to violations of air quality standards or resource threshold levels.

The alternatives do not differ in the amount of prescribed burning that is allowed in roadless areas, so there would be little to no difference in effects from prescribed burning among alternatives. Prescribed burning in the roadless areas would continue to produce short-duration increases in particulates, carbon monoxide, nitrogen oxides (NOx), organics, and hydrocarbons. Smoke from prescribed burning would be carefully controlled to encourage good smoke dispersion and minimize smoke accumulations that could otherwise affect visibility and scenic quality in roadless areas, or affect public health and safety. To minimize adverse air quality effects, the Forest Service would continue to consult the Colorado Department of Public Health and Environment and obtain the state's authorization prior to conducting prescribed burns. Prescribed burns would be conducted under very specific fuel moisture and weather parameters to facilitate good smoke dispersal and minimize adverse air quality impacts.

Methane (CH_4) emissions would occur as a result of the projected natural gas operations and underground coal mining operations, particularly in certain roadless areas on the Grand Mesa, Uncompahgre, and Gunnison National Forests. As projections are for more of these activities to occur under alternatives 2 and 3 compared to alternative 1, it is likely that more methane would be emitted under alternatives 2 and 3.

High-severity wildfires would be expected to continue to occur in roadless areas, producing larger quantities of smoke that last for longer periods of time than prescribed burns. Smoke from wildfires in roadless areas may result in serious air quality impacts on class I airsheds and other sensitive receptors located down-wind from the fire. Alternative 3 would provide for the most hazardous fuel reduction treatment, followed by alternative 2, and then alternative 1. By restricting the amount of hazardous fuel reduction treatments likely to occur in roadless areas, alternative 1 would result in a slightly higher probability of experiencing a wildfire that could adversely affect air quality and public health and safety. However, the difference among alternatives is relatively minor in terms of the potential for smoke from large wildfires in roadless areas.

Air quality impacts from dust emissions would be negligible and would not vary significantly by alternative. There would continue to be a very low density of unsurfaced roads and exposed soil areas in roadless areas, and the permitted roads in roadless areas would receive infrequent use. The level of development in roadless areas would remain low under all alternatives and would not be expected to produce a significant quantity of airborn dust. Authorized activities in roadless areas would be designed to mitigate the magnitude and extent of airborn dust. Road use associated with mining, timber harvest, and other authorized activities under any alternative would require dust abatement measures where necessary. Implementation of dust abatement measures, such as watering down dry roads, would minimize adverse impacts to air quality.

Differences in the roadless area boundaries (IRAs and CRAs) between alternatives 1 and 3 compared to alternative 2 would not result in any noticeably different impacts to air quality in the roadless area airsheds.

Summary of Effects

There is no major difference in the effects on air quality among the alternatives. One minor difference is related to potential smoke-related impacts from wildfires, which would be more likely to occur in roadless areas under alternative 1, and least likely to occur under alternative 3.

Environmental Consequences – Cumulative Effects

All Alternatives

This cumulative effects analysis considered the effects from past, ongoing, and reasonably foreseeable future activities that could cumulatively affect soil quality within roadless areas when combined with effects described for each alternative, including the activities and effects listed in appendix D. The primary activities that would have ongoing or future effects on air quality within roadless area airsheds include smoke from prescribed burning and residential woodburning stoves, dust emissions such as from driving unsurfaced forest roads, increases in greenhouse gasses from numerous sources that are changing regional climate patterns,

powerplant emissions from nearby powerplants, oil and gas development emissions, and increases in other emissions caused by increasing population trends.

Smoke. Wildfires would continue to occur within and outside roadless areas and would have the greatest potential to produce smoke and associated pollutants that would affect public health and safety, and scenic quality in roadless areas and adjacent class I areas. Smoke from wildfires would be expected to adversely affect sensitive smoke receptors such as nursing homes, hospitals, schools, and smoke-sensitive residents in communities just outside roadless areas. Smoke from prescribed burning on NFS lands around the roadless areas would not likely accumulate in large amounts in smoke-sensitive areas, and adverse impacts would be minimized to the extent that the health and safety of the general public would not be affected. Prescribed burning in and adjacent to roadless areas, in conjunction with thinning treatments, would reduce hazardous fuel loads in those airsheds and thus the potential for very large smoke emissions from high-intensity wildfires.

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

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

Carbon dioxide, methane, and other greenhouse gasses. The assessment of effects of greenhouse gas emissions on climate change is in its formative phase. However, the Intergovernmental Panel on Climate Change recently concluded that "warming of the climate system is unequivocal" and "most of the observed increase in globally average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic (human caused) greenhouse gas concentrations" (Intergovernmental Panel on Climate Changte 2007).

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

Neither of the "action" alternatives (alternatives 2 or 3) would be expected to cause a measurable change in the amount of carbon dioxide or other greenhouse gas emissions compared to current conditions and trends in the roadless areas under the no-action alternative (alternative 1). The difference in potentially thinning out trees from primarily dense forest areas on 10,000 to 16,000 acres per year (alternatives 1 and 3 respectively) compared to 1,000 acres per

year (alternative 1) would not result in any real difference in the increasing accumulation of greenhouse gasses in our atmosphere, or regional or global warming trends. As there would be no meaningful direct or indirect effects of the alternative on CO2 emissions or climate change, there would be no potential for cumulative effects.

Under all alternatives, methane gas that must be vented from coal mines for safety purposes would release methane into the atmosphere. The amount would be expected to be slightly lower under alternative 1 compared to alternatives 2 and 3 based on the differences in coal mining activity and production anticipated, as described in the Leasable Minerals section. Rapid dispersion of methane emissions would be expected to result in no localized air quality impacts. However, there could be an insignificant incremental (cumulative) effect on global climate change. Methane emissions measured from the two existing coal mines in the Somerset coalfield that occur in roadless areas under any of the alternatives have ranged from 12 to 16 million cubic feet per day of methane, based on quarterly reports submitted to BLM by the coal companies, for 2001 to 2007 (personal communication with Dusty Dyer, Bureau of Land Management, Montrose, CO, June 2008). This is estimated to be 0.00000003 percent of the total U.S. greenhouse gas emissions, and is therefore considered to be negligible (USDA Forest Service 2002). Emissions from coal mining activities are expected to decrease in the U.S. through 2010 because production is shifting from underground coal mines to surface mines. Additionally, coal mines in the U.S. are increasingly capturing and recovering methane. Methane emissions are highly variable, with no direct correlation to the number of methane drainage wells or other factors. There is no way to reasonably forecast future methane emissions for the roadless area alternatives subject to this EIS. Additionally, there is conflicting scientific research on sources and consequences of the effects of methane gas on global warming trends, and insufficient reliable data to make predictions of global climate change consequences from the coal mining activities that vary by alternative. Greenhouse gas emissions are integrated across the global atmosphere, so it is difficult to determine the incremental impact on global climate from emissions associated with these alternatives.

Power plant emissions. Although no coal-fired power plants exist on the roadless areas, there are several power plants that exist or are planned for construction within atmospheric transport distance of the roadless areas. Coal-burning power plants are major long-term sources of NOx, sulfur dioxide (SO_2), mercury, particulates, greenhouse gases, and other pollutants that affect air quality-related values such as visibility, water quality, and high-elevation flora and fauna ecosystems. The Forest Service is an active participant in the permitting process for large emission sources, including power plant projects. Through this process, mitigation measures to prevent air quality impacts on roadless areas would be implemented where indicated through site-specific analysis. Thus, no significant cumulative effects would be anticipated from the additional power plant emissions that may occur.

Oil and gas-related emissions. New wells are occurring on federal, state, and private lands near many of the roadless areas. The cumulative effects of existing emission sources are evaluated through air quality modeling for specific oil and gas projects, but would be the same for all alternatives. Cumulatively, oil and gas development near roadless areas and other large sources of air pollution close to roadless areas could potentially increase air quality degradation. Mitigation measures and project design criteria for Forest Service-authorized projects would continue to minimize adverse air pollution emissions generated from authorized activities. Overall, the additional amount of oil-gas related pollutants would not create any

long-lasting or geographically extensive cumulative impacts when combined with the effects under any of the alternatives.

Methane emissions that would be released during natural gas operations would contribute to greenhouse gasses that add to global warming trends (USEPA Office of Air and Radiation. 2001). However, the amount would be negligible- smaller than the fractional amount previously estimated in relation to coal operations.

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

Summary of cumulative effects. With respect to effects on air quality, there is no substantial difference among the alternatives. None of the alternatives is likely to have a measurable adverse impact on air quality compared to current conditions and trends, as previously described under direct and indirect effects. Air quality in the class I areas and airsheds that overlap roadless areas would remain in compliance with all state and federal Clean Air Act standards. Other sources of emissions and air quality pollution sources described in this cumulative effects section would be the dominant air quality issues in and around NFS lands in Colorado. The roadless area management alternatives would not make any noticeable contribution to the overall regional haze situation or air quality trends in Colorado.

GEOLOGICAL AND PALEONTOLOGICAL RESOURCES

This section briefly addresses the effects of the alternatives on geological and paleontological resources. Geological resources are the physical landscape features created by events such as landslides, earthquakes, or volcanic events; they include such features as large rock formations, craters, and caves. To enhance public understanding and appreciation of significant geologic processes and features, the Forest Service often develops geologic interpretive sites or designates special areas based on outstanding geologic features.

Paleontological resources are fossils of plants, animals, and other organisms that lived in former geologic (prehistoric) times. Paleontological resources are recognized as important both for their scientific value to current and future generations, and for their intrinsic natural resource value. Paleontological resources on NFS lands are protected by laws, regulations, and policies, which include restrictions on the collection and disposition of significant fossils.

Affected Environment

Karst and cave resources are examples of unique geological resources that occur in portions of roadless areas that are underlain by limestone or marble. Values associated with karst and cave resources include their ability to store and transmit groundwater, their importance as subterranean wildlife habitats, their importance as cultural (historic or prehistoric) or paleontological (fossil) sites, and their ability to provide educational and recreational opportunities for spelunkers or cavers. They can also present public safety hazards and resource management constraints, such as locations where sinkholes occur.

Rocks and minerals are also geologic resources that are commonly valued and collected by the public on NFS lands, including lands within roadless areas.

Vertebrate fossils are considered significant paleontological resources, whereas invertebrate or plant fossils generally are not unless they are of usual rarity or quality. The Forest Service uses a fossil yield potential classification (FYPC) system to assist the management of fossil resources. FYPC is a planning tool wherein geological units, usually at the rock formation or member level, are classified according to the probability of yielding paleontological resources that are of concern to land managers. There are five potential levels ranging from not likely to contain recognizable fossil remains (class 1), to highly fossiliferous geologic units at low risk of degradation (class 4) and at high risk of degradation (class 5).

Forest Service data show that highly fossiliferous class 5 rock units occur in the roadless areas in Colorado. (Class 4 units are not identified on a regional scale.) Based on 2006 FYPC data, there are an estimated 1,277,000 acres of class 5 rock units in IRAs (alternatives 1 and 3) and 1,172,000 acres of class 5 rock units in CRAs (alternative 2). Of the approximately 4,135,000 total acres of class 5 rock units on NFS lands in Colorado, 31 percent and 28 percent of those acres occur in IRAs and CRAs (respectively).

Environmental Consequences – Direct, Indirect, and Cumulative

All Alternatives

The estimated effects on geological and paleontological resources described in the Affected Environment section are not expected to vary by alternative. None of the projected roading, tree-cutting, and energy resource operations in roadless areas that vary by alternative would be likely to adversely affect these geological or paleontological resources (see Analysis Framework and appendix C). Those projected activities would not likely occur on highly valued karst or cave sites, unique rock formations, or at significant fossil sites. Fossil sites would continue to receive protection through avoidance of ground-disturbing activities in accordance with applicable regulations and agency policies. Accordingly, none of the alternatives would result in direct or indirect impacts on these resource values. As no direct or indirect impacts would be expected, there would be no cumulative effects.

LEASEABLE MINERALS (ENERGY RESOURCES)

This section addresses the effects of the alternatives on the exploration and development of leaseable minerals (energy resources) in the roadless areas in Colorado. The leaseable minerals that occur in roadless areas in Colorado are natural gas[10], oil, coal, and geothermal resources, where geologic conditions are conducive to their occurrence. These leaseable minerals are collectively referred to throughout this EIS as energy resources.

A separate section of this chapter addresses locatable and saleable mineral resources.

Affected Environment

Natural gas, oil, and coal have been and will continue to be a significant source of energy for Colorado and other parts of the country in the context of projected increases in demand for all of these resources (USDOE Energy Information Administration 2007). Geothermal resources are also a potentially significant source of energy in Colorado, but this resource has not been developed on NFS lands in Colorado.

Oil and gas leases and coal leases currently are effective in portions of the Colorado roadless areas (CRAs) and inventoried roadless areas (IRAs). Refer to the existing oil-gas and coal lease maps associated with the roadless areas available in the map packet. There are no geothermal leases in any of the roadless areas. Leases for energy resources on NFS land are offered, sold, and issued by the U.S. Bureau of Land Management (BLM); BLM has the primary authority in managing leaseable energy resources on all federal land. The Forest Service and BLM work together in managing leaseable energy resources on NFS lands under the Mineral Leasing Act (for oil, gas, and coal) and Geothermal Steam Act (for geothermal resources), along with various other applicable laws such as the National Forest Management Act, Endangered Species Act, Energy Policy Act, and others. The Office of Surface Mining Reclamation and Enforcement (OSM) also has authority and responsibility for coal mining activities under the Surface Mining Control and Reclamation Act. In the case of coal, the State of Colorado has the final authority for authorizing operations on coal leases.

The lease holders (lessees) have exclusive rights to development of the federal mineral estate covered by their lease, subject to standard lease terms, lease stipulations, and applicable regulations at the time of lease issuance. Under the referenced statutes, the Forest Service provides BLM with stipulations (operating constraints) to be included as needed for surface resource protection in leases on NFS lands. The Forest Service determines whether lease stipulations are needed during the environmental analysis that is completed for leasing.

The Forest Service cannot prohibit operations on an oil and gas lease that was issued with standard lease terms, but can place conditions on an application for a Permit to Drill and the associated Surface Use Plan of Operations, in order to mitigate effects on surface re s, consistent with the Code of Federal Regulations [36 CFR 228.107-108]. Generally, changes to the location or

[10] *Natural gas is a combustible mixture of hydrocarbon gases. While natural gas is formed primarily of methane, it can also include ethane, propane, butane and pentane. The composition of natural gas can vary widely. (www.naturalgas.org/overview, May 2008)*

timing of oil and gas operations under standard lease terms must be limited to moving operations up to 200 meters and delaying operations up to 60 days.

While some of the oil and gas leases covering roadless areas have standard lease terms, others have stipulations that were included as part of a lease when it was sold and issued. These stipulations include: timing limitations, controlled surface use, and no surface occupancy. Timing limitations prohibit drilling operations during specified time periods to protect identified resource values. Controlled surface use stipulations include other operational constraints that must be applied to protect identified resource values. No surface occupancy stipulations prohibit use or occupancy of the land surface in order to protect identified resource values. Oil and gas lessees may request a waiver, exception, or modification to a lease stipulation at the time they propose operations on a lease. The Forest Service and BLM must consider such requests, but have the discretion to accept or reject such requests. [11]

Where natural gas, oil, and coal resources occur in the roadless areas, they do not generally occur in the same locations as locatable (hard rock) minerals. Geothermal resources may overlap with the occurrence of locatable (hard rock) minerals and other leaseable energy minerals (natural gas, oil, and coal). A relatively small number of roadless areas in Colorado are covered by oil and gas and coal leases (refer to maps of existing leases and wells in the map packet). There are no geothermal leases in any roadless areas in Colorado.

Oil and gas

All national forests in Colorado have some areas with potential for oil and/or natural gas occurrence. At least 17 IRAs on the Grand Mesa, Uncompahgre, and Gunnison (GMUG); White River; and San Juan National Forests have high potential for development of natural gas resources in the next 15 years, with potential for minor quantities of oil associated with the natural gas on the GMUG National Forests. The roadless areas identified in this EIS analysis as having a high potential for oil or gas development are those that are in nationally significant oil and gas basins, are adjacent or close to producing wells, and are extensively leased. Several of these roadless areas are 100 percent leased. See table 20 along with the maps of existing oil and gas leases and wells in relation to roadless areas in alternatives 1, 2, and 3, available in the map packet.

Relatively small parts of IRAs have existing leases on the GMUG and Manti-La Sal National Forests in the Paradox Basin, on the White River and Routt National Forests in the Sand Wash Basin, on the Pike and San Isabel National Forests on the Rocky Mountain Front, and on the San Juan National Forest in the San Juan Sag. Relative to the other areas, these leases are considered to have low potential for development in the next 15 years due to less favorable positions in oil and gas basins, relatively small lease areas, distance from ongoing development, restrictive lease stipulations, and expiration dates within a few years.

Table 20 lists IRAs with a high potential for development of natural gas on existing leases. The potential would be the same in CRAs, although roadless area names and acres differ (refer to appendix A, IRA and CRA acres and names). The extent to which each roadless area is leased

[11] *Description of standard oil and gas lease terms, stipulations, and waivers; exceptions; and modification to lease stipulations are based on the standard federal onshore oil and gas lease direction at 36 CFR 228.104 and 43 CFR 3101.1-3 and 3101.1-4, and guidance in BLM form 3100-uniform format for oil and gas lease stipulations (USDA Forest Service and USDI Bureau of Land Management 1989)*

provides some indication of the extent to which the area may be developed. The IRAs with less than 640 acres leased are not included. Also, the Front Range IRA on the Pike and San Isabel National Forests is not included because leases in that roadless area are suspended and not likely to be developed in the next 15 years. Refer to the oil and gas lease maps in map packet.

Table 20. Leases in roadless areas (IRAs) with a high potential for development of natural gas resources

National forest and oil & gas basin	Inventoried roadless area	Acres leased	Percent of IRA leased
GMUG – Piceance Basin	Battlement Mesa	8,754	24%
	Clear Creek	22,794	53%
	Drift Creek	4,149	44%
	Hightower	1,867	41%
	Nick Mountain	886	9%
	Priest Mountain	3,991	4%
	Raggeds	2,088	8%
	Salt Creek	1,017	9%
	Springhouse Creek	17,594	100%
Manti-La Sal – Piceance Basin	Roc Creek	2,758	25%
San Juan – San Juan Basin	HD Mountains	13,514	68%
White River – Piceance Basin	Baldy Mountain	6,030	100%
	East Divide/Four Mile Park	8,700	100%
	East Willow	5,666	80%
	Housetop Mountain	8,308	65%
	Mamm Peak	11,905	47%
	Reno Mountain	9,702	78%
	Thompson Creek	15,960	86%

Source – Based on applicable BLM-issued oil and gas leases and Roadless Areas GIS database, April 2008.

In addition to leases, there are five existing oil and gas wells in the Clear Creek IRA on the GMUG National Forests, and four existing wells in the HD Mountains IRA on the San Juan National Forest.

Development of natural gas has been growing rapidly adjacent to the national forests in Colorado over the past five years. Oil and gas companies have only recently (in the last two years) embarked on full-scale development on NFS land. With demand and prices for oil and natural gas at all-time highs, oil and gas companies are now submitting more drilling proposals for their leases on NFS lands. Natural gas produced from wells on NFS lands in Colorado contributes to meeting local, regional, and national energy demands.

Coal

Based on the forest plans and their associated EISs, five national forests in Colorado acknowledge the presence of coal resources within their boundaries: the GMUG; Pike and San Isabel; San Juan; Routt; and White River. Of these national forests, only the GMUG have existing coal leases. About 13,000 acres are leased for coal, including about 6,000 acres leased in

parts of the West Elk and Springhouse Park IRAs. Refer to the map of coal leases in IRAs in the map packet.

The Forest Service does not currently have sufficient site-specific information to estimate the amount of coal resources that may occur in roadless areas on the Pike and San Isabel, Routt, or White River National Forests. On the San Juan National Forest, an estimated 1.5 billion tons of coal reserves may exist in the Durango Known Recoverable Coal Resource Area (overlaps with the Pagosa Springs coalfield) in both roadless and non-roadless lands according to the forest plan for the San Juan National Forest. On the GMUG National Forests, there is currently insufficient site-specific information to estimate the amount of coal resources in the Carbondale, Crested Butte and Tongue Mesa coalfields. In the Somerset and Grand Mesa coalfields, including the North Fork coal mining area, it is estimated that recoverable coal resources have the potential to occur on about 58,000 acres of both roadless and non-roadless lands (USDA Forest Service 2006). More details on coal reserves estimations in these coalfields are provided in the subsequent section. See the maps of existing coal leases and potential coal mining areas in relation to alternatives 1, 2, and 3, available in the map packet.

Coal exploration and development has occurred in the North Fork coal mining area (Somerset coalfield) on the GMUG National Forests since the 1960s. Coal exploration licenses may be issued by BLM for unleased areas for a two year period. There are currently no existing coal exploration licenses in any roadless areas in Colorado (as of March 2008). Three underground mines currently produce coal from federal leases in the North Fork coal mining area (Somerset coalfield) on the GMUG National Forests. Projected coal activity would likely occur in the Grand Mesa and Somerset coalfields, as shown in table 21, and on the map in the map packet showing the potential coal reserve areas.

Table 21 summarizes the coalfields or regions with potentially mineable coal resources, existing coal leases, and foreseeable coal activity in roadless areas (IRAs). Refer to appendix A, IRA and CRA ares and names, to see the cross-walk between IRA and CRA names and acres.

Table 21. Summary of coalfields/region coal leases and exploration licenses, and foreseeable future coal activity in roadless areas

National forest	Coalfield/Region [1]	IRA(s)	Existing leases	Foreseeable coal activity[2]
Pike and San Isabel	Trinidad	Spanish Peaks	No	None
San Juan	Pagosa Springs	HD Mountains	No	None
White River	Carbondale	Assignation Ridge	No	None
		Gallo Hill	No	None
		McClure Pass	No	None
Routt	Green River Region	Pagoda Peak, Morapos A, Morapos B, Chatfield, Nipple Peak South	No	None
GMUG	Carbondale	Drift Creek, Raggeds	No	None
	Crested Butte	Beaver Castle and Whetstone Mountain	No	None
	Tongue Mesa	Cimarron	No	None
	Grand Mesa	Priest Mountain and Kannah Creek	No	Yes
	Somerset	West Elk, Springhouse Creek, Priest Mountain	Yes	Yes

[1] *Information on coalfields or coal region from Carroll (2005). Information on locations of potentially mineable coal resources from Colorado DNR Geological Survey (2001) and individual forest plans.*

[2] *Information on existing coal leases and exploration licenses provided by BLM.*

Coal mining in the North Fork coal mining area is conducted exclusively with underground mining methods. The coal is transported by conveyers to the surface and to processing facilities, generally located outside NFS lands. Coal is often transported to markets by train, and most of Colorado's coal is processed in the mid-western, southern, and eastern U.S.

The three existing mines in the North Fork coal mining area collectively produce about 17 million tons per year, which accounts for about 40 percent of the coal production in Colorado (Colorado DNR Division of Reclamation, Mining, and Safety 2008). Given the current leasing situation, the three existing mines have a combined life of 29 years, with a range of 4 to 15 years based on the current leased reserves and mining rate. Some increase in coal production could occur, as demand for western coal is expected to continue on an increasing trend (USDOE Energy Information Administration 2007). A 5 percent per year increase may occur at mines in the North Fork coal mining area over the analysis timeframe.

The coal resources in the Somerset and Grand Mesa coalfields that include the North Fork coal mining area meet the definition of compliant and super-compliant coal reserves according to the Clean Air Act. The coal has high energy value (Btu), and low sulphur, ash, and mercury content, and is thus desirable for use in electricity generation plants. The bulk of the coal produced from that area is shipped to the Eastern U.S. (Carroll 2005).

Typical surface uses over the three underground mines on the GMUG National Forests include construction of ventilation shafts, exploration drilling, methane drainage well[12] installations, resource monitoring activities, and road construction needed to gain access for these activities. Since the 1960s, about 70 miles of coal-related road construction has occurred in roadless areas. Much of this road construction, both in and out of roadless areas, has occurred since January 12, 2001 and has been needed for installation and operation of methane drainage wells as allowed by existing permits.

Methane drainage (vent) wells are often part of a mine operator's Mining Safety and Health Administration (MSHA) approved ventilation plan. They are expected to be required as part of the coal mining operations in roadless areas in order to meet MSHA requirements for safe methane levels in underground mines to ensure worker safety. The methane vent wells consist of a valve assembly and blower on the surface, providing a means of extracting methane from the mine and releasing it to the atmosphere.

The vent wells are installed on pads about 0.33 acres in size. Locations and numbers of methane drainage wells are based on site-specific mine plans, topographic conditions, and amounts of gas reasonably anticipated to be encountered. Recent experience in the area suggests that the amounts of methane gas vary between individual mines and individual coal seams. In general, between 10 and 20 methane drainage well locations per 640-acre section have been constructed at the existing mines. Generally, there can be 5 to 15 methane drainage wells operating at one time.

To date, capture and use of coal mine methane[13] from the mines on the GMUG National Forests has not occurred, as capture can be accomplished only under a federal oil and gas lease. The methane is part of the oil and gas mineral estate, not the coal mineral estate. The BLM has been

[12] *Methane drainage refers to removal of methane gas from coal mine air, in this case through wells drilled from the surface above the mine into the mine workings.*

[13] *Capture and use of coal mine methane gas is not the same as coal bed methane development, which is unlikely to occur on any of the national forests in Colorado.*

working with the Forest Service to offer oil and gas leases for sale to facilitate capture and use of the methane being vented from the underground mines on the GMUG National Forests. Capturing, processing, and transporting coal mine methane may be proposed on oil and gas leases once they are sold and issued in roadless areas. However, economic and technological feasibility of necessary infrastructure (such as wells, pipelines, and collection and processing facilities), as well as the prohibition of road construction, may temper the extent and nature of any such proposals for methane gas capture and use in the roadless areas.

As of March 2008, approximately 25 miles of roads have been constructed for the purpose of methane drainage, and approximately half of those miles have been decommissioned and reclaimed. Coal-related road construction that has occurred since 2001 in roadless areas has been consistent with applicable forest plan direction, rules, and regulations, including the 2001 Rule.

Decommissioning roads has been effective in restoring vegetation to lands disturbed by mining roads, and is conducted according to Forest Service conditions incorporated in the state-issued coal mining permit. Based on experience in the West Elk IRA, the decommissioning and subsequent reclamation usually becomes well established two to three years after reclamation.

Geothermal

Geothermal resources are underground reservoirs of hot water or steam created by heat from the earth. Geothermal steam and hot water can be utilized when they occur naturally on the surface of the earth in the form of hot springs, geysers, mud pots, or steam vents. Geothermal resources also can be accessed through the drilling of wells, and the heat energy produced from wells can be used for generating electricity or heat (e.g. for greenhouses, homes, commercial buildings, aquaculture operations, or dehydrating vegetables). Geothermal is considered a clean source of energy in that its utilization does not result in greenhouse gas or other undesirable emissions.

Geologic indicators of geothermal resource potential – heat flow, volcanism, recent faulting, and continental rifting – are present in Colorado (Colorado Geothermal State Working Group 2007; Farhar and Helmiller 2003). Some of these geologic indicators overlap with some roadless areas. However, the extent of Colorado's geothermal resource potential has yet to be assessed fully, and there is no definitive data indicating where and to what extent geothermal resources might occur in the roadless areas.

Currently, there are no geothermal leases, lease applications, operations, or applications for operations on NFS lands in Colorado, nor has there been any expressed interest in leasing or developing this resource. A national BLM-Forest Service programmatic EIS currently underway will address NFS lands that have potential for geothermal resources, and provide the basis for future geothermal leasing availability analyses and decisions on NFS lands in Colorado and other states.

Environmental Consequences – Direct/Indirect Effects

Alternative 1- 2001 Rule (No Action)

Oil and natural gas

Under alternative 1, road construction and reconstruction (roading) would be allowed in IRAs on oil and gas leases that were issued (became effective) before January 12, 2001. This alternative prohibits roading on leases in IRAs issued after January 12, 2001. Thus, IRA acres leased after that date, along with IRA acres with lease stipulations that prohibit surface occupancy or roads, are not considered feasible for oil or gas operations. Roads are considered necessary for exploration and development of oil and gas, as previously described under affected environment. Based on those road-related constraints, alternative 1 would result in lower levels of oil and gas development in IRAs compared to the other two alternatives.

There are 21 IRAs in Colorado with over 640 acres leased for oil and gas, as shown in table 21. These 21 IRAs contain a total of approximately 158,500 leased acres; 43 percent (68,700 acres) were leased before 2001, and 57 percent (89,800 acres) were leased after 2001. Consequently, under current roadless area management (2001 Rule), road building is allowed on 68,400 acres leased in IRAs and prohibited on 90,100 acres leased in IRAs. Approximately 300 acres (in Housetop Mountain IRA) leased prior to January 12, 2001 has a no surface occupancy stipulation.

Of the 89,817 acres shown in table 22 as leased after January 12, 2001, approximately 78,500 acres were issued between January 12, 2001 and September 19, 2006. During much of that timeframe between 2001 and 2006, a court ruling enjoined the 2001 Rule, making it ineffective.[14] Consequently, those leases were issued under direction in forest plans and leasing availability decisions, unaffected by any roadless area rule. Of those acres leased between January 12, 2001 and September 19, 2006 while the 2001 Rule was not in effect, surface occupancy (including roads) was allowed on about 74 percent of those leased acres (57,700 acres), while lease stipulations prohibited surface occupancy (including roads) on the remaining 26 percent of those acres (20,800 acres).

On September 19, 2006, the United States District Court for the Northern District of California reinstated the 2001 Rule, and made it retroactive for the time period in which it had been enjoined. In a subsequent clarification (final injunction order) on February 7, 2007 the Court ruled specifically that the 2001 Rule prohibitions on new roads would apply retroactively to all leases in IRAs issued after January 12, 2001, regardless of terms on those leases that allowed roads. Thus, that ruling affects about 73 percent (57,700 acres) of leases issued between January 12, 2001 and September 19, 2006 that had terms allowing surface occupancy and roads. All leases (approximately 11,300 acres) in IRAs issued after the September 2006 ruling were issued with stipulations prohibiting roading as long as the 2001 Rule is in effect.

Table 22 shows acres of existing oil and gas leases in IRAs (those with over 640 acres leased). The table also displays whether roading would be allowed or prohibited on those lease acres

[14] *The 2001 Rule was not immediately effective upon publication on January 12, 2001. Due to administrative and judicial orders, the 2001 Rule was not in effect during the following time periods: January 12, 2001 to April 14, 2003 and July 14, 2003 to Sept. 19, 2006, when the District Court for the Northern District of California reinstated the rule.*

under alternative 1 (refer to the map of existing leases and wells in IRAs in the map packet). Table 22 distinguishes between IRA acres leased before or after January 12, 2001; alternative 1 prohibits new roads in IRAs where the lease was issued after that date (refer to chapter 2-Alternatives).

Table 22. Roadless area (IRA) acres under oil and gas leases before and after January 12, 2001, and lease acres in IRAs where new roads are allowed or prohibited under alternative 1

National forest	Roadless area (IRA)	Acres leased	Acres leased before 1/12/01	Acres leased after 1/12/01	Acres with roads allowed	Acres with roads prohibited[1]
GMUG	Battlement Mesa	8,754	0	8754	0	8,754
	Clear Creek	22,794	15,943	6,851	15,943	6,851
	Drift Creek	4,149	3,436	712	3,436	712
	Hightower	1,867	935	933	935	933
	Nick Mountain	886	886	0	886	0
	Priest Mountain	3,991	1,281	2,711	1,281	2,711
	Raggeds	2,088	0	2,088	0	2,088
	Salt Creek	1,017	1,017	0	1,017	0
	Springhouse Creek	17,594	1,270	16,325	1,270	16,325
Manti-La Sal	Roc Creek	2,758	0	2,758	0	2,758
Pike and San Isabel	Front Range	8,116	8,116	0	8,116	0
Routt	Black Mountain	1,222	1,222	0	1,222	0
San Juan	HD Mountains	13,514	11,968	1,547	11,968	1,547
	South San Juan	3,303	3,303	0	3,303	0
White River	Baldy Mountain	6,030	5,599	431	5,599	431
	East Divide/Four Mile Park	8,909	418	8,491	418	8,491
	East Willow	5,666	4,779	886	4,779	886
	Housetop Mountain	8,308	307	8,001	0	8,308
	Mamm Peak	11,905	4,969	6,935	4,969	6,935
	Reno Mountain	9,702	2,004	7,698	2,004	7,698
	Thompson Creek	15,960	1,265	14,696	1,265	14,696
Totals		158,533	68,718	89,817	68,411	**90,124**

GMUG: Grand Mesa, Uncompahgre, and Gunnison

[1] Acres with roads prohibited (89,817 acres) = 20,792 acres with no surface occupancy stipulations + 11,336 acres with stipulations prohibiting roads as long as the 2001 Rule is in effect + 57,692 acres that do not have specific stipulations prohibiting roads but are subject to the 2001 Rule road prohibitions based on the 2006 court ruling.

Of those 21 IRAs containing oil and gas leases, the Front Range IRA leases (Pike and San Isabel National Forests) are in suspension and the Black Mountain IRA leases (Routt National Forest) will expire in October 2008. The potential for drilling to occur on these leases so that they would be extended is very low, therefore these leases are not included in estimates of future oil and

gas activities and production in IRAs. Additionally, potential activity and production in the Roc Creek IRA (Manti-La Sal National Forest) were not projected due to unavailability of reasonably foreseeable development scenario information. However, under alternative 1, no activity is projected due to all leases being issued after January 12, 2001. Thus, as previously stated and shown in table 20, the GMUG; San Juan; and White River National Forests are the only national forests in Colorado within which oil or gas development in roadless areas would likely occur.

Under this and other alternatives, projections were made for foreseeable oil or gas wells and associated road miles in IRAs, as well as oil and gas production. These projections are speculative and intended for general comparisons among alternatives, not as absolute values. Proposals for oil and gas development come from outside the agency and are difficult to predict. It is not certain when, where, or if all projected wells may be drilled.

Projections of oil and gas road miles, wells, and production that could occur in IRAs in the next 15 years under this alternative are based on the following information: BLM reasonably foreseeable development scenarios (Conrath and O'Mara in preparation, Fowler and Gallagher 2004, Spencer 2006); personal communications with W.Brown of the BLM/San Juan Public Lands office in May 2008; the distribution of roadless areas in geologic environments with high potential for natural gas and/or oil occurrence; current acres leased where surface occupancy (including roads) are allowed; locations in prolific oil and gas basins; and the success of oil and gas development in adjacent areas. Road mile projections are based on projected oil and gas production sites (well pads). It is assumed that projected road miles represent an estimation of miles of pipeline (production lines or flowlines) necessary for transporting natural gas from producing wells to collection or gathering lines, because generally the production lines would be laid in wellsite access road right-of-ways.

Natural gas and associated oil production estimates are based on average daily life-of-well production for various natural gas reservoirs identified in BLM's reasonably foreseeable development scenarios (GMUG and San Juan National Forests) and proposed development (San Juan National Forest), multiplied by the number of estimated wells for each alternative. Roads, well pads and other facilities would be presumed to remain in place during the 15-year analysis timeframe because the wells are assumed to be producers with an average life of 30 years.

Table 23 shows the cumulative 15-year projections of wells, well pads, roads and production in IRAs under this alternative. It also displays the amount that would occur in CRAs under alternative 2 and IRAs under alternative 3, for ease of comparison among alternatives. Most roads and other infrastructure would be built in the first few years after development is authorized. New roads and wells for oil and gas operations in IRAs are projected to occur on the leased portions of the GMUG, San Juan; and White River National Forests with a high potential for production (table 20) where surface occupancy and roads are allowed (table 21). Road miles represent an estimation of miles of pipeline (production lines) necessary for transporting natural gas from producing wells.

Table 23. Estimated 15-year projections of oil and gas-related road miles, pads, wells, and production in inventoried roadless areas under alternative 1

	GMUG[1]	San Juan[2]	White River[3]	Totals
Number of wells	16 wells	36 wells	200 wells	252 wells
Number of well pads	8 well pads	22 well pads	29 well pads	59 well pads
Pad acres	13 acres	22 acres	174 acres	209 acres
Miles of road	8 miles	11 miles	35 miles	54 miles
Projected production (billion cubic feet of gas, barrels of oil) [4]	59 bcfg, 38,500 bo	129.6 bcfg	230 bcfg	418.6 bcfg 38,500 bo

[1] GMUG: Grand Mesa, Uncompahgre, and Gunnison: six wells on single-well pads, 10 wells on five-well pads of 3.5 acres each, average estimated ultimate per-well recovery of 0.8 bcf and 3,500 bo from Mesaverde sandstones and 5 bcfg from Mesaverde coals

[2] San Juan: all wells on single-well pads, average estimated ultimate per-well recovery of 3.6 bcfg

[3] White River: all wells on seven-well pads of 6 acres each, average estimated per-well recovery of 1.15 bcfg

[4] Average estimated well life = 30 years

The effects on the development of oil and gas resources under alternative 1 are summarized as follows:

- Oil and gas development and production would be limited to 18 IRAs covering portions of the GMUG, San Juan; and White River National Forests. Projected development and production would be on leases that have terms and stipulations allowing roads and that were effective before January 12, 2001. The IRAs where oil and gas activities are projected are those with more than 640 acres currently under lease as of March 2008.
- Access to an estimated ultimate recovery of 418.6 billion cubic feet of gas and 38,500 barrels of associated oil on leases issued before January 12, 2001 would be allowed. This is approximately 587 billion cubic feet of gas and 38,500 barrels of oil less than could be accessed under alternative 2 and 605 million cubic feet of gas and 49,000 barrels of oil less than could be accessed under alternative 3.
- Lost opportunities for exploration and development of oil and gas resources would occur in all IRA acres with a high potential for oil and gas development that were not leased prior to January 12, 2001 (table 20). The extent of potential oil and gas resources in IRAs that are not leased cannot be reasonably estimated at this time. Consequently, the quantities of oil and gas that road prohibitions might preclude from development in unleased IRAs are unknown.
- Lessees of approximately 57,500 acres of leases issued between January 12, 2001 and September 19, 2006, when the 2001 Rule was not in effect, and which did not have lease stipulations prohibiting surface occupancy or road construction, would be prohibited from establishing road access to develop oil and gas resources on their leases. Based on the 2006 court ruling, current stipulations on those leases may prohibit new roads in IRAs for oil or gas operations as long as the 2001 Rule is in effect.

Coal

Under alternative 1, roading in IRAs would be allowed on coal leases issued prior to January 12, 2001 and prohibited on coal leases issued after that date. As of March 2008, only the West Elk IRA on the GMUG National Forests had coal leases. About 3,700 acres of these leases were effective prior to January 12, 2001 in the West Elk IRA, so roading would continue to be allowed on those acres for coal-related purposes. Another 2,300 acres of coal leases became effective

after January 12, 2001, therefore roading associated with the development of rights under coal leases is prohibited on those leased acres. Refer to the map showing coal mining lease areas in relation to IRAs in the map packet.

Effects of alternative 1 on coal leasing and development include the following estimated projections of activities in the West Elk IRA on the GMUG National Forests over the 15-year analysis period:

- About 6.5 miles over the 15-year analysis period on the 3,700 acres of leased land in the West Elk IRA where such activity would be allowed. This includes projected roads to 13 methane drainage well sites over the next 15-year period. The methane drainage wells and associated road would result in approximately 15 acres total of ground-disturbance for those activities.
- Roading and mining activities would be done in a manner that minimizes effects to surface resources, prevents unnecessary or unreasonable surface disturbance, and complies with lease stipulations, forest plan direction, regulations, and laws. Roads and methane drainage wells would be in place for approximately three to five years, and would then be decommissioned (reclaimed).

Effects of road prohibitions on development of coal resources under alternative 1 include the following:

- Lost opportunities for exploration and development of federal coal resources and potential bypassing of economic federal coal resources in areas not leased as of January 12, 2001. These areas include all identified coalfields/regions identified in table 21, except the areas of leases effective prior to January 12, 2001. The extent of these coal resources are unknown, therefore the quantity of coal affected by road prohibitions cannot be estimated.
- An estimated 84 million tons of leased coal reserves could be foregone due to restricted construction of methane drainage wells on about 2,300 acres of existing leases effective after January 12, 2001. Because mining is dependent on methane drainage for safety purposes, restrictions on methane drainage wells could render reserves unmineable, or create the situation where mining could be impeded to the extent that it would not be economically feasible. About 2.5 years of overall production could be lost, based on current production rates and estimated coal recovery of 50 percent of in-place reserves.[15]
- Lost opportunity for exploration of unleased federal coal resources on about 31,000 acres of the GMUG National Forests in IRAs that overlap with the Somerset and Grand Mesa coalfields (see table 21). Restrictions on exploration would greatly limit the ability of the coal industry to meet BLM coal data requirements when coal lease applications in and outside of (adjacent to) roadless areas are submitted to the BLM.
- Limits on the overall life of the existing mines operating on the GMUG National Forests and bypassing of federal coal resources due to prohibitions on road construction that may be needed to support mining. Estimated effects on longevity of existing mining operations are discussed in chapter 3 - Economic Values.

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[15] *In-place coal reserve estimations by alternative are only for the lands in roadless areas, and do not include reserve estimates for lands outside of roadless areas, since this analysis is focused on activity in roadless areas. The estimates were made using methodology recommended by BLM. For alternative 1, reserve estimations were made based on the acreage of lands in roadless areas under lease prior to 2001.*

- Continued or additional venting of methane to the atmosphere and/or limitations on coal production. Capture and use of federal coal mine methane can occur only under a federal oil and gas lease. Therefore, the capture and use of coal mine methane would not be able to be approved pursuant to any oil and gas leases effective after January 12, 2001 because roads to methane capture wells on those leases would be prohibited under the 2001 Rule. Consequently, methane needing to be removed from any of the mines underlying roadless areas could only be vented under alternative 1.

Geothermal

Because roading in IRAs would be prohibited under alternative 1, and roads are assumed to be necessary for the development of geothermal resources, these resources would not be developed under this alternative.

Alternative 2 – Colorado Rule (Proposed Action)

Oil and natural gas

Under alternative 2, roading would be allowed on oil and gas leases that allow surface occupancy and are issued before the proposed Colorado Rule becomes effective. Road construction and reconstruction would be prohibited on oil and gas leases that are or were issued with stipulations prohibiting surface occupancy and/or roads on leases that are issued after the effective date of the Colorado Rule. Future leasing would be allowed under alternative 2, but roads on those leases would be prohibited. Waivers, exceptions, or modifications to lease stipulations prohibiting surface occupancy or roads on existing leases would also be prohibited.

As shown in table 24, there are 22 CRAs that have current oil and gas leases (excluding those with less than 640 acres under lease). These existing leases total about 152,500 acres in the CRAs. Of these leased CRA acres, roads would be allowed on about 129,200 acres (85 percent), and roads would be prohibited on about 23,200 acres (15 percent), due to lease stipulations prohibiting surface occupancy or roads.

Table 24 shows the extent of current oil and gas leases in CRAs (as of March 2008). It includes only those CRAs with leases on over 640 acres. The table distinguishes between acres on which roads would be allowed and acres on which roads would be prohibited under alternative 2 based on lease stipulations.

Table 24. Roadless area (CRA) acres under oil and gas leases as of March 2008, and lease acres in CRAs where new roads are allowed or prohibited under alternative 2

National forest	Colorado roadless area	Acres leased	Acres with roads allowed	Acres with roads prohibited[1]
GMUG	Battlements	4,176	0	4,176
	Clear Fork	14,519	14,519	0
	Cottonwoods	886	886	0
	Currant Creek	792	792	0
	Flat Tops/Elk	1,475	1,475	0
	Horsefly Canyon	2,043	2,043	0
	Huntsman Ridge	4,596	4,596	0
	Pilot Knob	16,207	16,207	0
	Sunnyside	4,236	0	4,236
	Tomahawk	1,916	1,916	0
	Turner Creek	6,865	6,865	0
Manti-La Sal[2]	Roc Creek	2,766	2,766	0
Pike and San Isabel[2]	Rampart East	7,535	7,535	0
Routt[2]	Black Mountain	1,225	1,225	0
San Juan	HD Mountains	17,218	14,749	2,469
White River	Baldy Mountain	5,988	5,988	0
	East Divide/Four Mile Park	8,587	8,587	0
	East Willow	5,657	5,657	0
	Housetop Mountain	8,308	0	8,308
	Mamm Peak	11,902	7,869	4,033
	Reno Mountain	9,698	9,698	0
	Thompson Creek	15,864	15,864	0
Totals		152,459	129,238	23,222

GMUG: Grand Mesa, Uncompahgre, and Gunnison

[1] Acres with roads prohibited = acres in leases on which surface occupancy is prohibited on 100 percent of the lease area.

[2] The Roc Creek CRA leases are represented in this table, but potential activity and production are not projected due to unavailability of reasonably foreseeable development scenario information. The Rampart East CRA leases are represented in this table, but potential activity and production are not projected because the leases are in suspension. The Black Mountain leases are included in this table, but potential activity and production are not projected because the leases will expire in October 2008.

Alternative 2 would result in limited levels of oil and gas development and production from the CRAs that have a high potential for oil and gas development. Limitations are related to prohibitions on roading in CRAs pursuant to oil or gas leases that are issued after the proposed rule becomes effective.

Table 25 shows the 15-year projections of wells, well pads, pad acres, and road miles, as well as production. Alternative 2 would result in nearly three times as many road miles, wells and well pads compared to alternative 1, including building an average of 9.1 miles of road per year in the CRAs. On the other hand, projections show this alternative would result in approximately the same amount of oil and gas infrastructure development in roadless areas as alternative 3.

Table 25. Estimated 15-year projections of oil and gas road miles, pads, wells, and production in CRAs under alternative 2

	GMUG[1]	San Juan[2]	White River[3]	Totals
Number of wells	33 wells	61 wells	580 wells	674wells
Number of well pads	13 well pads	47 well pads	83 well pads	143 well pads
Pad acres	25.5 acres	47 acres	498 acres	570.5 acres
Miles of road	13 miles	23.5 miles	100 miles	136.5 miles
Projected production (billion cubic feet of gas, barrels of oil)	119 bcfg 77,000 bo	219.6 bcfg	667 bcfg	1,005.6 bcfg 77,000 bo

[1] *GMUG: six wells on single-well pads, 10 wells on five-well pads of 3.5 acres each, average estimated ultimate per-well recovery of 0.8 bcf and 3,500 bo from Mesaverde sandstones and 5 bcfg from Mesaverde coals*

[2] *San Juan: all wells on single-well pads, average estimated ultimate per-well recovery of 3.6 bcfg*

[3] *White River: all wells on seven-well pads of 6 acres each, average estimated per-well recovery of 1.15 bcfg*

In addition to oil and gas activities projected in CRAs, there are acres not included in CRAs under alternative 2 that are included in IRAs under alternative 1. Within those IRA acres not included in CRAs under alternative 2, there are 17,299 acres leased for oil and gas development. Oil and gas development in those IRA acres not included in CRAs could result in seven wells on three pads covering 5.5 acres with three miles of road, with wells potentially producing 22.4 billion cubic feet of gas and 10,500 barrels of oil.

Effects of alternative 2 on the development of oil and gas resources are summarized as follows:

- Based on the descriptions just provided, oil and gas development and production would be likely to be limited to 19 CRAs on the GMUG; San Juan; and White River National Forests. Projected development and production would be on leases that are already issued (or issued before the Colorado Rule becomes effective) and have terms and stipulations allowing road construction.
- Lost opportunities for exploration and production of oil and gas resources would occur in CRAs with potential for oil and gas resource occurrence that are not under lease as of the effective date of the Colorado Rule. The potential for future oil and gas leases and production in unleased CRA acres cannot be reasonably quantified at this time.
- Lessees of approximately 57,500 CRA acres that were issued between January 12, 2001 and September 19, 2006, and that do not have lease stipulations prohibiting surface occupancy or road construction would be allowed to establish road access to their leases.
- Lessees of approximately 10,100 CRA acres that were issued since September 20, 2006, and that have road prohibitions in stipulations directly linked to the 2001 Rule, could potentially be allowed to establish road access to their leases, because the Colorado Rule would replace the 2001 Rule.
- Access to an estimated ultimate recovery of 1,006 billion cubic feet of gas and 77,000 barrels of associated oil. This is approximately 587 billion cubic feet of gas and 38,500 barrels of oil more than could be accessed under alternative 1, and 18 billion cubic feet of gas and 10,500 barrels of oil less than under alternative 3.
- Oil and gas development is projected to occur in substantially altered areas and other IRA acres that are not included in CRAs in areas leased prior to January 12, 2001 where roading is allowed, same as under the other alternatives.

Coal

Under alternative 2, roading could be approved only pursuant to existing and future coal leases, and on coal exploration licenses, in CRAs in the North Fork coal mining area on the GMUG National Forests. A map in the map packet shows the North fork coal mining areas in relation to the CRAs.

Roading needed to support coal exploration or development pursuant to a current or future coal lease in the North Fork coal mining area could occur on about 29,000 acres of CRAs.

Effects of alternative 2 on coal leasing and development include the following projected activities in the North Fork coal mining area over the 15-year analysis period based on roading allowed in CRAs under this alternative:

- A total 15-year projection of 45 miles of roading would occur for coal mining-related purposes, primarily to access methane drainage wells.
- A total 15-year projection of 390 methane drainage wells would be installed in the CRAs, involving clearing a total of 195 acres on lands not currently under lease, but in IRAs in the North Fork mining area. These wells would be accessed by roads projected above.
- Roads and other surface structures would be constructed in a manner that minimizes effects to surface resources, prevents unnecessary or unreasonable surface disturbance, and complies with lease stipulations, forest plan direction, regulations, and laws. These coal lease roads would be closed to public vehicular access, and open only to use for coal-related operations and administrative use. When no longer needed, the roads and coal related surface facilities would be reclaimed (roads decommissioned).
- Access to an estimated total of 1 billion tons of in-place coal resources. [16] This could represent 29 additional years of coal production. All existing leased reserves could be mined. Coal resources are expected to have similar quality to those currently being mined in the Somerset field, although coal quality is generally known to decrease in the Grand Mesa coalfield (personal communication with Desty Dyer, mining engineer, Montrose field office, USDI Bureau of Land Management, March 2008).
- Lost opportunities for exploration and development of federal coal resources in any potential coal resources outside the North Fork coal mining area, because roading in support of coal mining outside that area is prohibited. The potential for development and production on lands outside that area cannot be reasonably estimated at this time.
- Coal resources in substantially altered and other IRA acres not included in CRAs would be managed according to applicable forest plan direction under this alternative, and would not differ from projected coal mining activities under alternative 3.

Geothermal

Alternative 2 would have the same effect on potential geothermal resource development in roadless areas as alternative 1. Both alternatives prohibit roading in roadless areas for geothermal development, which would restrict geothermal development in the roadless areas.

[16] *In-place coal reserve estimations for alternative 2 were made based on the acreage of lands with coal resource potential that is coincident with roadless areas.*

Alternative 3 – Forest Plans

Oil and natural gas

Under alternative 3, roading would be allowed on existing and future oil and gas leases where roads are allowed under lease terms and stipulations. Future oil and gas leases would be offered, sold, and issued under the applicable forest plan direction and leasing availability decisions.[17] Roading in IRAs would be prohibited on existing and future leases where lease stipulations prohibit surface occupancy or roads. Waivers, exceptions, or modifications to stipulations prohibiting surface occupancy on existing leases would be considered (not necessarily granted) at the time operations are proposed, if such is requested.

Approximately 372,546 acres are leased or available for leasing in 21 IRAs (with over 640 acres under lease) on the GMUG; San Juan; and White River National Forests. Of those acres, 158,533 acres are currently leased (as of March 2008). Of the 372,546 acres of those IRAs leased or available for leasing, new roads would be allowed on 219,417 acres (59 percent) and new roads would be prohibited on 153,129 acres (41 percent).

Table 26 shows the extent of current oil and gas leases in IRAs (as of March 2008). It includes only IRAs with leases covering over 640 acres. The table distinguishes between acres on which roads would be allowed and acres on which roads would be prohibited under alternative 3 based on lease stipulations and leasing availability decisions.

[17] *The Forest Service is required to analyze NFS lands for oil and gas leasing and make decisions designating specific lands available to be leased and stipulations that would apply to leasing before authorizing BLM to offer NFS lands for lease (36 CFR 228.102).*

Table 26. Roadless area (IRA) acres under oil and gas leases as of March 2008, and lease acres in IRAs where roads are allowed or prohibited under alternative 3

National forest	Inventoried roadless area	Acres leased	Acres available (includes leased acres)	Acres leased + acres available roads allowed	Acres leased + acres available roads prohibited
GMUG	Battlement Mesa	8,754	35,993	480	35,515
	Clear Creek	22,794	42,756	37,458	5,298
	Drift Creek	4,149	9,299	8,682	616
	Hightower	1,867	4,556	3,967	489
	Nick Mountain	886	10,399	3,939	6,460
	Priest Mountain[1]	3,991	43,177	32,640	10,537
	Raggeds[2]	2,088	13,338	12,251	1,087
	Salt Creek	1,017	11,026	1,391	9,635
	Springhouse Creek	17,594	17,487	17,594	0
Manti-La Sal	Roc Creek	2,758	0	0	0
Pike and San Isabel	Front Range	8,116	0	0	0
Routt	Black Mountain	1,222	22,594	12,239	10,355
San Juan	HD Mountains	13,514	20,018	11,968	8,051
	South San Juan	3,303	51,070	17,863	33,160
White River	Baldy Mountain	6,030	6,030	6,030	0
	East Divide/Four Mile Park	8,909	8,909	8,909	0
	East Willow	5,666	7,118	7,070	48
	Housetop Mountain	8,308	12,651	0	12,651
	Mamm Peak	11,905	25,340	8,126	17,214
	Reno Mountain	9,702	12,425	12,361	64
	Thompson Creek	15,960	18,398	16,142	2,256
Totals		158,533	372,584	219,110	153,436

[1] *51,658 acres of Priest Mountain IRA is designated not available for leasing*

[2] *3,091 acres of Raggeds IRA is designated not available for leasing*

Alternative 3 could result in oil and gas development and production from IRAs with high potential for oil and gas occurrence and development, at levels slightly higher than those under alternative 2.

Table 27 shows the 15-year total projections of wells, well pads, pad acres, road miles, and production. Alternative 3 would result in over three times as many road miles, wells and well pads compared to alternative 1. This alternative would result in slightly higher oil and gas infrastructure development in roadless areas than alternative 2. Road miles represent a rough estimation of miles of pipeline (production lines) necessary for transporting natural gas from producing wells.

Table 27. Estimated 15-year projections of oil and gas road miles, pads, wells, and production in inventoried roadless areas under alternative 3

	GMUG[1]	San Juan[2]	White River[3]	Totals
Number of wells	40 wells	36 wells	655 wells	731 wells
Number of well pads	16 well pads	22 well pads	94 well pads	132 well pads
Pad acres	31 acres	22 acres	564 acres	617 acres
Miles of road	16 miles	11 miles	113 miles	140 miles
Projected Production (billion cubic feet of gas, barrels of oil)	141.2 bcfg 87,500 bo	129.6 bcfg	753 bcfg	1,023.6 bcfg 87,500 bo

[1] GMUG:: six wells on single-well pads, 10 wells on five-well pads of 3.5 acres each, average estimated ultimate per-well recovery of 0.8 bcf and 3,500 bo from Mesaverde sandstones and 5 bcfg from Mesaverde coals

[2] San Juan: all wells on single-well pads, average estimated ultimate per-well recovery of 3.6 bcfg

[3] White River: all wells on seven-well pads of 6 acres each, average estimated per-well recovery of 1.15 bcfg

Effects of alternative 3 on the development of oil and gas resources are summarized as follows:

- Based on the descriptions just provided, oil and gas development and production would be likely to occur in at least 21 IRAs (with over 640 acres under lease as of March 2008), and in an undetermined number of other IRAs identified as available for leasing under forest plans and oil and gas leasing decisions. This oil and gas development would occur where roading is allowed in the IRAs under forest plan direction. Appendix B of this EIS describes how forest plan management direction affects roading in the IRAs, along with the alternative 3 map in the map packet.
- Access to an estimated 1,023.6 billion cubic feet of gas and 87,500 barrels of associated oil. This is approximately 605 billion cubic feet of gas and 49,000 barrels of oil more than could be accessed under alternative 1 and 18 billion cubic feet of gas and 10,500 barrels of oil more than under alternative 2.
- Lost opportunities for exploration and development of oil and gas resources in IRAs with potential for oil and gas resource occurrence would be minimal under this alternative. Forest plan direction and leasing availability decisions prohibit roading for oil and gas operations in a limited number of IRAs in areas with potential for oil and gas resource occurrence.

Coal

Under alternative 3, roading could be approved on existing and future coal leases and coal exploration licenses in IRAs with coal resource potential according to forest plan direction. Prior to coal leasing or exploratory activity, the Forest Service would review specific lands for consistency with direction in forest plans.

Roads built in conjunction with coal related activities would be constructed and decommissioned (after their coal-related use has ended), consistent with direction in forest plans, regulations, and agency policies, and to support post-mining land use. This includes constructing roads to the minimum standard road needed to support projected traffic, closing roads to public traffic, decommissioning roads, and reclaiming disturbed lands after cessation of the coal-related activities.

Effects of alternative 3 on coal leasing and development include the following projected activities and expectations in IRAs during the 15-year analysis period:

- Consideration of about 46,000 acres of land in the Pagosa Springs coalfield on the San Juan National Forest for coal leasing. These lands are in a variety of management area prescriptions, which allow for leasing with protections for specific resources. The management area direction varies in terms of roading prohibitions or restrictions on those acres, and on some of those IRA acres, no surface occupancy is allowed.
- Consideration of lands in the Trinidad coalfield on the Pike and San Isabel National Forests for coal leasing. Based on applicable forest plan direction, the lands in this coalfield would be accessible and road construction would be allowed.
- Consideration of lands in the Carbondale coalfield on the White River National Forest for leasing. The lands in this coalfield are in a variety of management areas, some of which allow roading and others that do not. Some management area direction in this coalfield restricts mineral development (including coal).
- Consideration of lands in the Green River coal region on the Routt National Forest. The lands in this coal region are in a variety of management areas, some of which allow road construction and others that do not. Some management area direction in this coal region restricts mineral development (including coal).
- Various coal exploration and development activities would be likely to occur on the GMUG National Forests, as follows:
    - Approximately 66 miles total of roading on about 31,000 acres of IRAs in the Somerset and Grand Mesa coalfields. This roading would be needed principally for coal exploration and/or methane drainage for mining pursuant to a coal lease. These lands are in a variety of management areas, all of which allow road construction. One of these management areas specifically calls for obliterating temporary roads within one season after use. Another management area calls for minimizing mineral disturbance in riparian areas and reclaiming disturbed lands to restore productivity comparable to that before disturbance.
    - A 15-year total of 420 methane drainage wells would be installed in IRAs, involving clearing a total of 210 acres on lands not currently under lease. These wells would be accessed by the roads projected above.
    - Access to an estimated 1.1 billion tons of in-place coal resources. All existing leased reserves could be mined. Coal quality would be the same as for alternative 2.[18]
    - Access to lands in the Carbondale, Crested Butte and Tongue Mesa coalfields. These lands are in a variety of management areas, all of which allow road construction. One management area specifically calls for obliterating temporary roads within one season after use, and another calls for minimizing mineral disturbance in riparian areas and reclaiming disturbed sites to restore productivity comparable to that before disturbance.

[18] *In-place coal reserve estimations for this alternative were made based on the acreage of lands in roadless areas in the Somerset and Grand Mesa coal fields where there is less than 3,500 feet of overburden.*

Geothermal

Alternative 3 would allow development of geothermal resources in IRAs to the extent that forest plans would provide for such activities in IRAs. Specific geothermal assessment information is insufficient to quantify or even qualify the extent and location of possible development.

Summary of Effects

Oil and natural gas

Based on projections displayed in table 23, alternative 3 could have the most roads, oil and gas wells, and related infrastructure in roadless areas, and alternative 1 could have the least. Alternative 2 would have slightly fewer road miles and wells than alternative 3, but slightly more well pads than alternative 3. Alternative 3 would provide the most opportunity for oil and natural gas development and production, and alternative 1 would provide the least. Activities that could occur under alternative 3 would result in the most natural gas and oil provided for public use, and alternative 1 would result in the least.

Table 28 compares the total 15-year projections of wells, well pads, pad acres, miles of road, and production in roadless areas under each alternative. The same assumptions apply as were displayed in the previous projected activity tables for each alternative. The average estimated well life is assumed to be 30 years.

Table 28. Total 15-year projections of wells, well pads, roads and production on oil and gas leases in roadless areas (IRAs and CRAs) under each alternative

15-year estimates	Alternative 1 (in IRAs)	Alternative 2 (in CRAs)	Alternative 3 (in IRAs)
Number of wells	252 wells	674 wells	731 wells
Number of well pads	59 well pads	143 well pads	132 well pads
Pad acres	209 acres	570.5 acres	617 acres
Miles of road	54 miles	136.5 miles	140 miles
Projected production (billion cubic feet of gas, barrels of oil)	418.6 bcfg 38,500 bo	1,0005.6 bcfg 77,000 bo	1,023.6 bcfg 87,500 bo

Coal

Table 29 summarizes estimated projections of coal development activity that could occur under each of the alternatives. All activity would be on the GMUG National Forests administrative unit. Alternative 3 would allow access to the greatest amount of coal reserves in roadless areas, and would require the most roads and other surface infrastructure. Alternative 1 would allow access to the least amount of coal reserves and would require the least amount of roads and other surface infrastructure. Alternative 3 is the only alternative that would allow access to much of the unexplored and unleased coal resources on the Pike and San Isabel, Routt, San Juan, and White River National Forests. This includes up to 1.5 billion tons of coal on 46,000 acres in the Pagosa Springs coalfield on the San Juan National Forest.

Table 29. Comparison of projected coal development activity and production in roadless areas among the three alternatives

	Alternative 1 (IRAs)	Alternative 2 (CRAs)	Alternative 3 (IRAs)
Acres of coal reserves in roadless areas	31, 000 ac.	29, 000 ac.	31, 000 ac.
Acres of road-accessible coal reserves in roadless areas	3, 700 ac.	29,000 ac.	31,000 ac.
Tons of road-accessible coal reserves in roadless areas	135 million tons	1 billion tons	1.1 billion tons
15-year projected road miles for coal operations in roadless areas	6.5 mi.	45 mi.	66 mi.

Geothermal

Alternative 3 would have the highest potential for geothermal resource development in roadless areas because most of the forest plans do not prohibit roading in the roadless areas for such development. Geothermal development would not occur in roadless areas under alternatives 1 and 2 because roading for this purpose would be prohibited, and it is assumed that roads would be needed for geothermal development.

Environmental Consequences - Cumulative Effects

Oil and natural gas

Demand (consumption) for natural gas is projected to increase slightly through 2016 and then taper off to 2030 (USDOE Energy Information Administration 2008). Demand for liquid hydrocarbons (oil) is projected to grow steadily to 2030. Production of oil and natural gas from NFS lands would continue to contribute to supply needed to meet demand, regardless of the alternative selected.

Areas of road prohibitions under alternative 1 would combine with other NFS lands where roads are prohibited, such as areas designated as not available for leasing, and areas designated with no surface occupancy lease stipulations. Cumulatively on all those lands, access to known natural gas resources would be restricted and contribute to less overall availability of energy resources to meet demand.

Populations in Colorado are anticipated to increase, which would increase the demand for oil and gas energy resources. Alternative 1 could result in an estimated 695.2 billion cubic feet of natural gas and 49,000 barrels of oil contributing to unavailable supply needed to meet increasing demand. Road prohibitions under alternative 2 would have the same cumulative effect when combined with access prohibitions in areas with oil and gas potential outside roadless areas, although to a lesser extent than alternative 1. Alternative 2 could result in an estimated 108.2 billion cubic feet of natural gas and 10,500 barrels of oil contributing to the amount of supply needed to meet demand. Alternative 3 could result in the highest contribution of oil and natural gas to local, regional, and national markets, with estimated ultimate recoveries of 1,113.8 billion cubic feet of gas and 87,500 barrels of oil coming from wells projected under that alternative. Under all alternatives, but particularly under alternatives 2 and 3, the oil and gas supply from roadless areas would contribute to supplies from other surrounding lands to meet local, regional, and national demand. However, that supply contribution would be limited to some extent by road prohibitions under alternative 2 and to a great extent under alternative 1.

Coal

Continued population growth will continue to drive demand for coal resources for use in electric power generation. Road prohibitions under alternative 1 will combine with other lands with access prohibitions to restrict access to known reserves of compliant and super-compliant coal, contributing to less overall availability of "clean" coal to meet demand. Under alternative 1, coal production from existing mines could dissipate in 15 years because remaining unleased reserves would be inaccessible for exploration and surface uses related to mining. Approximately 84 million tons of leased coal reserves would add to known reserves that are unavailable to meet demand. Under alternative 2, roads allowed for developing known coal reserves in the North Fork coal mining area would allow an estimated potential one billion tons of in-place coal resources to be developed and contribute to supply needed to meet the growing demand. However, road prohibitions in CRAs outside the North Fork coal mining area would contribute to an undetermined quantity of coal not being explored or developed, contributing to a known resource base being unavailable to meet demand. Under all alternatives, but particularly under alternatives 2 and 3, the coal resource produced from roadless areas would contribute to coal supplied from other surrounding lands to meet the local, regional, and national demand. However, that supply contribution would be severely limited by road prohibitions under alternative 1 and to some extent under alternative 2.

Geothermal

Restrictions on access to geothermal resources would preclude development of any geothermal resources that might be in roadless areas under alternatives 1 and 2. The lack of opportunity for development of these resources in roadless areas under alternatives 1 and 2 would consequently contribute to other limitations on geothermal resource development on other surrounding lands. This would result in less total supply available to meet local, regional, and national need for energy. Depending on applicable forest plan direction, access to these resources under alternative 3 would allow some development that could contribute to the energy supply.

LOCATABLE AND SALEABLE MINERAL RESOURCES

This section addresses effects of the alternatives on locatable and saleable minerals and associated mining activities in the roadless areas. Alternatives do not vary in restrictions or permissions for either of these lands uses, and do not vary in the amount of projected mining for these mineral resources in roadless areas. Therefore, these land uses are only briefly analyzed in this EIS.

A separate section of this chapter addresses leaseable minerals (energy resources), because the amount of oil, gas, and coal-related activities in roadless areas is projected to vary more substantially by alternative.

Locatable minerals generally consist of hard-rock metals such as gold, silver, lead, zinc, molybdenum, and uranium; they also include non-metallic minerals such as fluorspar, feldspar, and gem stones, and uncommon varieties of sand, stone, gravel, pumice, pumicite, and cinders such as high-calcium limestone used for cement.

Saleable minerals are common variety mineral materials such as sand, gravel, stone, cinders, and clay. Generally, they are widespread and of low value, used primarily for construction, building, or landscaping materials.

Affected Environment

Locatable Minerals

Locatable minerals are appropriated through the location of mining claims under the General Mining Law of 1872, as amended (Mining Law). This law provides U.S. citizens a possessory right to these minerals, use of the surface reasonably incident to mining, and a right to reasonable access to these minerals across federal land.

Base and precious metals usually occur in varying proportions in Colorado and include mainly gold, silver, lead, zinc, and molybdenum. Most major Colorado mining districts for these locatable minerals lie in a zone called the Colorado mineral belt that extends from Boulder County southwest almost to the corner of the state (USDI Bureau of Mines 1984). There are a few scattered, well-known districts and mineral deposits occurring to the southeast of the Colorado mineral belt including Creede, Cripple Creek, and Summitville. Another important mineral belt is the Uravan mineral belt containing deposits of uranium and vanadium. It is an eastward convex mineral belt occurring near the lower western border of Colorado.

Valuable deposits of locatable mineral resources potentially exist in roadless areas in Colorado. Mineral-related activities and valid mining claims occur and are expected to continue to occur in roadless areas where valuable deposits exist. While it is not possible to predict where and when development would occur, the existence of active mining claims within a given roadless area is an indicator of both potential for a valuable mineral deposit and for future mining activity. Based on a point count of 2005 mining claim data extracted by the USGS from BLM's 2000 database, approximately 25 percent of IRAs in Colorado contain an estimated 1,730 active mining claims of potentially valuable deposits of locatable minerals (Causey 2007). This is 18 percent of the total 9,445 active mining claims in Colorado in 2005. These active claims occur in only 2 percent of the total IRA acres. Of those 1,730 active mining claims, approximately 30

percent are within the Whetstone IRA and another 11 percent are within the Hermosa IRA. No other IRA contains more than 5 percent of the remaining mining claims. The number of claims within roadless areas is subject to change as new claims are staked and others are allowed to lapse by claimholders.

The existence of these claims in a roadless area would indicate where there is some potential for new roads and other development to occur in support of the mining claim. Developing roads for locatable mineral exploration or development is part of the reasonable right of access provided under the Mining Law, which also gives claimants the right to timber from mining claims for mining purposes on those claims; therefore, it is reasonable to assume that exploration, mining, and mineral processing activities would continue in roadless areas where these deposits exist regardless of alternative.

Locatable mineral activity inside or outside roadless areas would continue to generally fluctuate with the rise and fall of metal prices. The recent rise in metal prices has already resulted in increased interest in Colorado's mineral resources. However, most renewed development and production occurs in areas of past mineral production. In many cases these areas contain roads and private patented land, and are located outside the roadless areas. Thus, a significant increase in mineral development and production in the roadless areas is not in the foreseeable future. If the price of metals continues to rise, there could be a corresponding increase in prospecting and exploration activity in roadless areas; however, an increase in prospecting and exploration would not necessarily result in a similar increase in development and production because most exploration efforts rarely result in the discovery of a mineable deposit. Furthermore, road construction and tree-cutting are not as necessary for locatable mineral prospecting and exploration as for development and production activities.

Although the Forest Service cannot prohibit this activity on these NFS lands, the agency has the authority and obligation to regulate locatable mineral operations in order to minimize and limit damage to surface resources on NFS lands, where limitations are determined to be reasonable and necessary. Rules and procedures for the use of the surface of NFS lands in connection with locatable mineral operations are provided in regulations at 36 CFR 228, subpart A. All proposals for locatable mineral exploration or development would be subject to the planning and design requirements in accordance with 36 CFR 228, subpart A; NEPA regulations at 40 CFR 1500 to 1508; forest plan requirements; and other applicable laws and regulations. The responsible official having jurisdiction over the proposed mining area would determine whether the proposed activity would result in significant disturbance and therefore require a plan of operations, which would specify the terms and conditions of the mining operation.

Saleable Minerals

Saleable minerals (common variety) are generally abundant and widespread throughout Colorado. These minerals are of relatively low value compared to locatable or leaseable minerals, and are used primarily for construction, building, or landscaping materials. Their value depends on market factors, quality of the material, and availability of transportation. Allowing mining of these minerals on NFS lands is at the discretion of the Forest Service and is subject to provisions of 36 CFR 228, subpart C. Under these regulations, the Forest Service may either: (1) sell material for commercial use; (2) allow free use of material to the public and to non-profit organizations for non-commercial purposes or for public projects by federal, state, or local agencies; (3) use material itself for Forest Service projects on NFS lands; or (4) not permit

this use on NFS land. The regulations also require that disturbance associated with mineral material sites is approved by the Forest Service in an operating plan that includes provisions to protect the environment and reclaim the surface in a timely manner.

Saleable minerals can be derived from glacial moraines, alluvium, talus, river benches, and other natural sources of loose material; or it can be quarried from rock outcrop. Because of the high cost of transportation, which often represents most of the cost for the material delivered to the project site, the largest sources with the most production are close to highways and major markets. Private lands more often meet these conditions than do NFS lands, or at least sources on private lands are usually available so that production from NFS lands is not necessary.

The largest amount of mineral material use is driven by two distinctly different markets. Building, construction, and landscaping materials are needed for developing communities. To meet these needs, typically one or more mineral material sites with large reserves are developed, usually around the periphery of the community. Sites next to already existing highways and railroads are preferable but construction of transportation infrastructure solely for the purpose of developing good mineral material sites is not uncommon. The other major need for mineral materials is for the construction and maintenance of roads and highways. Under this situation, mineral material sites are developed along and in close proximity to the road corridor. They are generally smaller in size and there are more of them, strung out along the course of the road. In this case, mineral materials are developed as the result of the need for the road rather than a road being constructed for the need of the mineral material deposit.

Production of saleable mineral materials in Colorado was reported at approximately 84 million tons for the year 2006 (Cappa et al. 2007), of which only 525,800 tons (0.6 percent) came from NFS lands. An even smaller fraction, if any, is estimated to have come from NFS lands in the roadless areas (although a specific spatial breakdown of amounts of mineral materials generated from IRAs is not available). Most saleable minerals in roadless areas would likely have been for surfacing public roads, or for local Forest Service use on NFS roads.

There has been a lack of commercial interest in saleable mineral extraction from roadless areas, likely due to several factors: roadless areas are generally remote compared to where mineral materials are needed; the terrain in some roadless areas is too rugged for developing a low value commodity; and there is widespread availability of other mineral material sources outside IRAs. Additionally, the Forest Service encourages commercial operators working on NFS land to obtain their mineral materials from private sources whenever possible. The projected amount of common mineral materials that would come from within roadless areas during the next 15 years is assumed to be little to none, and no roads would likely be constructed or reconstructed for the purpose of developing saleable minerals.

Environmental Consequences – Direct, Indirect, and Cumulative Effects

All Alternatives

None of the alternatives differ in projections for road construction or reconstruction related to future locatable or saleable mineral activity in roadless areas. Under all alternatives, less than ¼ mile per year of road construction or reconstruction is projected by the forests to occur in the roadless areas during the next 15 years for the purposes of locatable mineral exploration or development, and none for saleable mineral activity. The amount of roading needed for locatable mineral operations would be the same regardless of the alternative because mining claimants have the same statutory right to reasonable access.

In addition, alternatives 1 and 2 both prohibit road construction or reconstruction associated with developing new saleable mineral material sites within roadless areas, which effectively precludes the sale and disposal of mineral materials from sites well within roadless areas. It is possible that new mineral material sites or expansion of existing sites could occur within roadless areas without additional roads, to provide material for road surfacing. In some cases, mineral materials could feasibly be extracted from within a few hundred feet of an existing road in a roadless area, if sources of mineral materials outside of the roadless areas are not feasible. However, this would be unlikely to occur.

The projections for road construction or reconstruction and tree-cutting activities that vary by alternative would not likely affect current or future saleable minerals operations. As previously described, mineral materials are abundant and widespread outside roadless areas. Because there is likely to be little interest in the use of mineral materials from Colorado roadless areas, the effects on the production of this resource under any alternative should be minimal.

Even under alternative 3 (forest plans), where there is no rule-related prohibition on roading in roadless areas, no roads are projected to occur in roadless areas for purposes of supporting common mineral material extraction. There also is no anticipated commercial need to acquire these mineral materials from within the roadless areas, so this use in roadless areas is not anticipated; however, low volumes of mineral materials could be produced from roadless areas for surfacing the longer-term roads to be constructed in the roadless areas (such as for oil, gas, or coal roads).

Overall, the alternatives do not differ in permissions or prohibitions related to extraction of locatable or saleable minerals from the roadless areas in Colorado. The limitations on roading and tree-cutting activities that differ by alternative are not anticipated to substantially alter the amount of locatable or saleable mineral resource operations in roadless areas. Thus, the alternatives would have no direct or indirect effects on this land use activity in roadless areas.

With no direct or indirect effects anticipated for any of the alternatives, there would be no potential for cumulative effects.

VEGETATION AND FOREST HEALTH

This section briefly describes vegetation and evaluates the effects of each alternative on changes to vegetation and forest health. The Forest Service defines forest health protection as a responsibility for minimizing the spread of invasive plants and lessening damages caused by insects and diseases. The effects on vegetation analyzed in other sections include:

- Invasive Plants, which evaluates the risk and threats to native vegetation from the spread of invasive plant populations.
- Fire and Fuels, which evaluates the risk and threats from hazardous fuel conditions and high-intensity wildfires, which are interrelated with forest health and vegetative conditions
- Threatened, Endangered and Sensitive Plants, which evaluates the effects of alternatives to rare plant populations
- Terrestrial Species and Habitat, Reference Landscapes, and other sections, which further describe interrelationships of other resources with vegetation.

Affected Environment

Vegetation

Roadless areas provide a diverse array of vegetation types, ranging from warm, dry pinyon-juniper woodlands to cold, moist subalpine forests. While large expanses of grasslands, shrublands, croplands, rangelands, and other vegetation types dominate portions of Colorado outside roadless areas, the roadless areas in the state are predominantly coniferous forest types occupying mountainous terrain.

Vegetation cover types in Colorado are based on information in the Forest Service's Region 2 vegetation database (R2Veg), which is primarily developed from aerial photography. The term vegetation cover type refers to the most dominant species in the overstory canopy. Overstory species composition in roadless areas is generally correlated with elevation and aspect.

Table 30 displays the vegetation cover type distribution in roadless areas under each alternative. It was based on IRAs common to alternatives 1 and 3; however, the differences in roadless area boundaries in alternative 2 would not yield significant differences in the relative cover type distribution. Approximately 28 percent of roadless areas consist of non-forest cover types, composed of grasslands and meadows, shrublands, areas devoid of vegetation (such as exposed bedrock), and a minor amount of surface water. The remaining 72 percent is forest, dominated by various species of trees.

Rangeland vegetation is defined as plant communities containing a preponderance of herbaceous species (grasses and similar non-woody plants) or shrub species (woody plants like oak brush). Rangeland vegetation may also be found as an understory component on the forest floor, such as in the conifer, aspen and pinyon-juniper forest types. Rangeland vegetation in the roadless areas mostly consists of native plant species, but in some places, introduction of non-native grasses and forbs has occurred. Rangeland vegetation in the roadless areas is most often

intermixed with other forest types, and is discussed together with forest vegetation in this analysis.

Table 30. Vegetation cover type distribution in roadless areas

Vegetation cover types	Roadless areas (percent of total)
Spruce-fir	24
Aspen	20
Grass, forbs, rock, water	19
Lodgepole pine	13
Shrubs	9
Douglas-fir	8
Ponderosa pine	3
Pinyon-juniper	2
Other tree species	2

Source: Forest Service Region 2 vegetation database, April 2008

Species composition in the roadless areas of Colorado has changed somewhat since pre-European settlement as a result of natural disturbances and human interventions. The vegetation cover types shown in table 30 are similar to pre-European settlement; however, the proportion has changed as a result of human activities that modified fire regimes and natural fire disturbance patterns in the lower elevation areas. The historical fire regimes in Colorado's Rocky Mountains varied considerably. For example, the southwestern portion of Colorado, especially at the lowest elevations, typically had low-severity, surface-dominated fires that maintained more open ponderosa pine forests. As human settlements increased in these areas, tree species composition in those forests gradually shifted from ponderosa pine stands dominated by medium and larger diameter pines, to forests dominated by smaller size fir trees (Covington and Moore 1994, Fulé et al. 1997). The Colorado Front Range[19] generally had a mixed-severity and mixed-frequency fire pattern that likely resulted in a complex forest structure of openings, patches of pure ponderosa pine, and patches of mixed ponderosa pine and Douglas-fir (Kaufman et al. 2001). The emphasis on fire suppression throughout the 1900s limited tree mortality and resulted in today's forests having a much higher tree density than existed historically (Kaufman et al. 2000, Veblen et al. 2000). Forest structure in more moist upper elevation ponderosa pine and Douglas-fir forests, particularly in the northern Front Range, may not have been as severely altered (Baker et al. 2007).

Mature and old-growth forest stands are likely to be more prevalent within roadless areas than in areas where higher levels of harvesting and other human activities have occurred. An accurate inventory of all old-growth forests is not available for NFS lands in Colorado; however, interpretation of aerial photography provides estimates of the forest structural or size classes.

Livestock grazing is authorized by permit in portions of some roadless areas where there is sufficient rangeland vegetation and it is compatible with resource management objectives (see the Livestock Management section for details). Grazing is authorized and managed in a manner

[19] *Front Range refers to the first mountain range encountered as one journeys west from the Great Plains.*

designed to maintain or improve rangeland vegetation health. In most permitted grazing "allotments", the permit holders (permittees) are accustomed to managing their livestock in roadless areas with little or no road access. In most instances, they use pack and saddle stock to manage the livestock, and maintain fences and other range improvement structures. In specific instances, permittees may obtain authorization for vehicular access to a specific area for specific purposes. This could include cross-country vehicle travel to bring materials to a range improvement site, but grazing permits in roadless areas do not normally provide for new road construction.

Figure 7 shows the relative distribution of tree size classes on forested areas within Colorado's roadless areas, by alternative. Similar to forest cover types, differences in roadless area boundaries between IRAs and CRAs would not be measurably different.

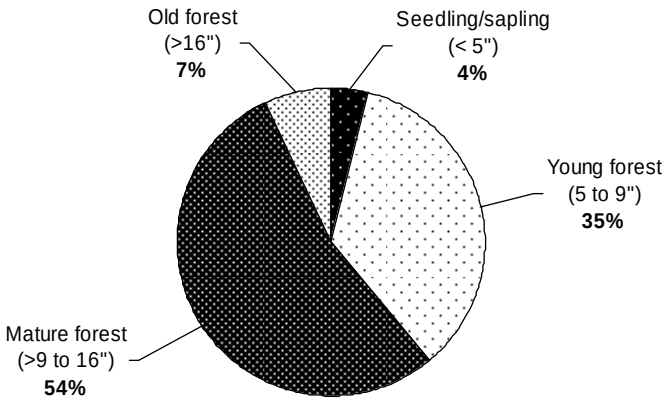

Figure 7. Average forest size class distribution in roadless areas
(Source: Forest Service Region 2 vegetation database, April 2008)

Starting in the late 1980s, the trend in forest management practices in Colorado shifted away from large clearcuts and similar even-aged stand management practices toward thinning, salvage, and uneven-aged management. These types of treatments often require multiple entries and adequate road access to accomplish management objectives. The trend has shifted to cutting smaller diameter and less commercially marketable tree species. This shift is due to a change in agency policy from an emphasis on timber production to an emphasis on fuel reduction and forest health. This trend often requires road access to make the treatment economically feasible. These trends are expected to continue into the future. One notable exception to this trend has been the salvage harvests in lodgepole pine that result in the clearcutting of large areas of dead and dying trees.

Most projects that include tree-cutting are intended primarily for improving forest health, reducing hazardous fuels, or improving other resource values. Timber volume is usually a secondary objective or by-product. The ability to offer commercial timber products can

influence the economic feasibility of conducting a forest health improvement and/or hazardous fuel reduction project.

Tree-cutting, sale, or removal projections associated with each alternative are described in the Analysis Framework section at the beginning of this chapter. The Analysis Framework section also describes current and foreseeable future forest management practices, and other underlying assumptions associated with projections of future tree-cutting for each alternative.

Forest Health: Insects and Diseases

Forest health describes the forest condition associated with its age, composition, structure, function, vigor, extent of insects and disease, and resilience to disturbances (Helms 1998). Forest health is framed by individual or societal perspectives, including land management objectives and spatial and temporal scales. Forest health includes the departure from the ecosystem's historic range of variability. For example, "fire regime condition class" is the degree of departure from a forest's range of variability in terms of fire disturbance, which is discussed in the Fire and Fuels section.

This section focuses on the aspect of forest health that is threatened by large-scale insect or disease outbreaks. Trees growing in dense forest stands are often weakened by the competition for light, nutrients, and moisture. Stand conditions are used to estimate the risk of mortality from damaging insects and disease organisms. Landscapes with high levels of stressed, dying, or dead trees are considered unhealthy for purposes of this analysis. Rangeland health is not typically influenced by major insect or disease outbreaks. However, management of forest vegetation can indirectly affect the abundance and diversity of rangeland vegetation such as the grasslands, meadows, and understory vegetation in forested environments.

Forest health conditions in roadless areas in Colorado are highly variable, with some areas considered healthier than others. Recent outbreaks have been among the largest in history, although a spruce beetle outbreak in the 1940s and 1950s.affected hundreds of thousands of acres on the White River Plateau In addition, recent outbreaks have been more synchronized than in the past, affecting different forest types. Recent outbreaks are attributable to stand conditions with high portions of susceptible, mature trees and a warmer climate (Colorado DNR State Forest Service 2007).

A report on the health of Colorado's forests describes how 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; the report outlines strategies to address those issues (Colorado DNR State Forest Service 2007). Aerial and field survey records and a Forest Service report led to two regional forester declarations of mountain pine beetle epidemics in northern Colorado lodgepole, limber pine, and Rocky Mountain bristlecone pine stands (USDA Forest Service 2007b, USDA Forest Service 2008b). The region subsequently completed a Bark Beetle Implementation Strategy, describing the need for forest treatments throughout those forest types in Colorado (USDA Forest Service 2007c).

Approximately 14 percent (600,000 acres) of roadless areas in Colorado are considered high risk for insect and disease mortality. This estimate is based on cover types and conditions in IRA boundaries, although this percentage would not be expected to substantially differ for forest lands within proposed CRA boundaries. Stands of mature lodgepole pine represent the vast majority of the high risk areas. As previously shown in Table 30, approximately 13 percent of the roadless areas are dominated by a lodgepole pine cover type.

The forest cover types described earlier in this section are susceptible to a suite of insects and diseases. The grasses, forbs, and shrubs are not usually impacted by insect or disease epidemics. The forest pests of highest concern in roadless areas are as follows, and roadless area acres affected are shown in table 31:

- Mountain pine beetle (*Dendroctonus ponderosae*) is considered the most destructive bark beetle in the West (Furniss and Carolin 1977). All western pines are susceptible to mountain pine beetle, but most of the mortality is in lodgepole pine and ponderosa pine. Studies in lodgepole pine show that trees exceeding 8 inches in diameter and 80 years of age, and growing in a suitable climate for beetle development, are most susceptible (Amman et al. 1977). Studies in ponderosa pine stands indicate that stand density contributes to stand susceptibility (Negron and Popp 2004, Schmid and Mata 1992) and there is evidence that this is true in lodgepole pine stands as well (McGregor et al. 1987). It is estimated that the bark beetle epidemic may kill most of the mature lodgepole pine in Colorado over the next 5 years (personnal communication with U.S. Forest Service entomologist Robert Cain, Rocky Mountain regional office, April 2008).
- Spruce beetle (*Dendroctonus rufipennis*) has infested Engelmann spruce and Colorado blue spruce (*Picea pungens*). Outbreaks generally occur following widespread blowdown of spruce trees. Areas most susceptible are dense stands with high portions of large spruce greater than 16 inches in diameter. Within a large spruce beetle epidemic area, spruce trees as small as 4 inches in diameter are killed.
- Douglas-fir beetle (*Dendroctonus pseudotsugae*) is often a secondary agent that attacks low-vigor or damaged trees. Outbreaks usually occur in areas of wind-thrown trees, at sites damaged by fire or during periods of extreme drought (Furniss and Carolin 1977). The beetle often attacks Douglas-fir trees that are infected with root disease or that have been defoliated by western spruce budworm (*Choristoneura occidentalis*) or Douglas-fir tussock moth (*Orgyia pseudotsugata*).
- Subalpine fir succumbs to a combination of western spruce budworm, western balsam bark beetle (*Dryocoetes confusus*), and Armillaria root disease (*Armillaria ostoyae*).
- Aspen throughout much of Colorado has been recently affected by sudden aspen decline. The recent sudden aspen mortality has not been attributed to agents that typically kill mature aspen. Severe drought combined with high temperatures during the growing season appear to be responsible (Worrall et al. 2008).
- White pine blister rust (*Cronartium ribicola*) is an exotic fungus that kills bristlecone pine (*Pinus aristata*) and limber pine (*Pinus flexilis*). Native five-needle pines have little resistance to this invasive disease but a small percentage of five-needle pines have been shown to have genetic resistance to white pine blister rust. Preserving genetic diversity in these stands is important for the species. Mountain pine beetles also kill the five-needle pines and could threaten genetic diversity. Protection of trees carrying genetic resistance using insecticide sprays or antiaggregation pheromones is an effective tool during mountain pine beetle outbreaks for treating small areas.
- White fir (*Abies concolor*) is primarily attacked by western spruce budworm and fir engraver bark beetle (*Scolytus ventralis*).

Table 31 displays the forest acres currently infested by damaging organisms in roadless areas.

Table 31. Principal insect and disease damaging agents in roadless areas

Damage agent	Acres affected (thousands) [1]				
	2003	2004	2005	2006	2007
Mountain pine beetle	54.6	119.5	131.2	174.0	187.5
Spruce beetle	18.7	14.2	23.9	16.1	22.8
Douglas-fir beetle	9.9	13.8	8.7	6.1	14.8
Subalpine fir decline	165.3	91.8	127.1	99.0	86.5
Sudden aspen decline[2]	1.5	2.8	6.3	25.6	91.8

[1] *Based on annual aerial detection surveys. Not all areas are surveyed every year, resulting in underestimates of areas affected.*

[2] *Aspen was not extensively sampled in 2003–2005. The aerial survey does not differentiate between sudden aspen decline, frost damage, and tent caterpillar damage.*

Source: Aerial and field survey data, Region 2 database, April 2008

Forest health treatment options vary by forest type, pest species, and other factors. Treatment methods may include: thinning, timber harvest (removal and sale of commercial products), reforestation (planting of non-host tree species), pesticide spraying, biological controls, trapping, pheromones, removing certain insect populations, or prescribed burning. Thinning to remove excessive forest fuels before using prescribed fire, or to treat diseased or insect-infested stands, is often economically feasible only if a road system is present. Management practices vary somewhat by elevation.

Lower elevation mountain forests, primarily composed of ponderosa pine and Douglas-fir, are generally considered outside their historical range of variation in terms of stand density. These forests are at risk of uncharacteristic, high-intensity fire and other forest health concerns. Management typically includes thinning of smaller trees and prescribed burning to reduce hazardous fuels, improve forest health, and restore ecological processes. Mastication is often used as a thinning method where there are no roads or no timber removal objective.

More moist forest ecosystems, primarily lodgepole pine and spruce-fir, generally have too much biomass to use mastication to achieve management objectives. The current mountain pine beetle epidemic exceeds the Forest Service's ability to control it. Management in these forest types is limited to reducing hazardous fuels and salvaging dead and dying trees to recover economic value. For example, the removal of large mature spruce trees within 2 years of being windthrown can prevent spruce beetle outbreaks.

Environmental Consequences – Direct and Indirect Effects

Alternative 1 – 2001 Rule (No Action)

Under this alternative, cutting generally small-diameter trees would be allowed where needed to restore ecosystem composition and structure at risk of uncharacteristic wildfire, or within areas that have already been substantially altered. New road construction is not allowed for these purposes, and any tree-cutting activities must be accomplished from existing roads. Refer to chapter 2 for details.

Treatment costs increase substantially and proportionally with distance of the project from the nearest road. Lands within one-quarter to one-half mile of existing roads would be the most

likely to have trees cut and/or removed consistent with the above tree-cutting limitations. Thus, most IRAs would not be expected to be treated for forest health purposes.

The 2001 Rule restricts tree-cutting on approximately 88 percent of the IRAs (all IRA acres except substantially altered areas). Based on 15-year projections described in the Analysis Framework section, approximately 800 acres annually would have tree-cutting activities for fuel management and/or forest health purposes. Treating 800 acres annually for forest health purposes would cumulatively total 12,000 acres over a 15-year period, or 2 percent of the 600,000 acres at high risk in IRAs. That 2 percent of the high-risk acres treated over 15 years would constitute improvement in forest health conditions. The remaining 98 percent of the high risk acres in IRAs would continue to decline in health and would become less resilient to large-scale insect and disease outbreaks and mortality.

Annual timber harvest would be approximately 800 ccf (hundred cubic feet). This is approximately 23,600 ccf less than what would be expected under alternative 3.

Roading and tree-cutting restrictions under this alternative would result in higher levels of standing and down dead trees remaining on site rather than being removed. This would indirectly cause higher accumulations of hazardous fuels in those untreated stands.

There would be no measurable effects on the potential to improve forest health; any differences in projected effects are directly tied to the boundary differences in designated roadless areas that vary by alternative. The lower acreage projected to be treated for forest health under alternative 1 compared to alternative 2 (such as in the substantially altered portions of IRAs that are not included in CRAs) is directly related to the general prohibition on road construction or reconstruction throughout IRAs under alternative 1. By allowing tree-cutting but not road construction or reconstruction in those substantially altered areas in IRAs, alternative 1 would continue to constrain the feasibility to treat large portions of the substantially altered areas for forest health improvement purposes.

Effects to rangeland health under this alternative are similarly related to the potential for ground disturbance through management activities and vehicular travel. This alternative would result in the least amount of active vegetation management compared to the other alternatives. Depending on the intensity and extent of actual activities implemented in the future, effects to rangeland would be expected to include an increase in native herbaceous and shrubby plant species in areas where the forest canopy cover is opened, or in areas where roads are decommissioned or disturbed sites are rehabilitated. Effects to rangeland health would also likely include some localized detrimental impacts from ground-disturbing actions that promote the spread of invasive plant species. Rangeland health may also be impacted where new roads or other ground-disturbing activities increase soil erosion or disrupt natural surface or subsurface waterflow patterns.

Alternative 2 – Colorado Rule (Proposed Action)

Under this alternative, tree-cutting is allowed for treating hazardous fuels or insect and disease outbreaks in areas under community wildfire protection plans (CWPPs) or in wildland-urban interface areas (WUIs); however, roads are often necessary to make such treatments economically feasible. Under this alternative, temporary roads may be built for these purposes.

Alternative 2 prohibits tree-cutting on approximately 17 percent of the CRAs, based on forest plan management area direction that is more restrictive than the Colorado Rule (management

areas coded as A1 and B1 in appendix B). This alternative allows tree-cutting to occur on the remaining 83 percent of the CRA acres, but only under specific circumstances related to forest health, wildfire hazard, and other purposes, as described in chapter 2.

Based on projections stated in the Analysis Framework section, approximately 7,600 acres would be treated annually for fuel management or forest health purposes. Under alternative 2, over 15 years, a total of 114,000 acres or 19 percent of the 600,000 acres at high risk of insect-disease outbreaks would be treated. Therefore, compared to alternative 1, alternative 2 would provide increased flexibility to achieve management objectives in critical insect and disease outbreak areas. The remaining 81 percent of the high-risk acres would remain untreated and continue to decline in forest health and would become less resilient to large-scale insect and disease outbreaks and mortality. The remaining untreated areas would also eventually add to the amount of dead trees and hazardous fuel load.

As described for alternative 1, there would be no expectation that the boundary differences in CRAs under alternative 2 would have a measurable impact on the opportunities to conduct treatments on NFS lands for forest health purposes. The only difference is that in the substantially altered areas that are not included in CRAs under this alternative, an additional 2,400 to 3,000 acres would likely be treated each year for either fuel reduction or forest health purposes. Thus, more of those acres would be treated for forest health under alternative 2 compared to alternative 1. There would be no other differences in the opportunity to improve forest health based on differences in the boundaries of IRAs and CRAs.

Annual timber harvest would be approximately 1,700 ccf. This is approximately 22,700 ccf less than what would be expected under alternative 3.

Effects to rangeland vegetation and health would be similar to those described for alternative 1, but covering more roadless area acreage affected by new roads or other ground-disturbing activities. Alternative 2 has more acres of tree-cutting and roading projected than alternative 1, but less than alternative 3. Treatments projected in the roadless areas would likely affect rangeland vegetation by opening the forest canopy in more places, thereby increasing the abundance and possibly the diversity of herbaceous or shrubby vegetation. The increased roading and tree-cutting activities may also in the short term reduce the amount of soil protection and ground cover, thereby increasing erosion and changing surface water flow patterns. These activities would also increase the likelihood of increases in invasive non-native plants that can detrimentally affect rangeland health.

Alternative 3 – Forest Plans

This alternative allows tree cutting for forest health or fuel reduction purposes on approximately 17 percent of the IRA acres, the same as alternative 2, based on the management direction in forest plans (management areas coded as A1 and B1 in appendix B).

Based on 15-year projections described earlier in the Analysis Framework section, approximately 16,300 acres in IRAs would be treated by tree-cutting practices, for fuel management and/or forest health purposes. Over 15 years, this would result in improving forest health on approximately 41 percent of the 600,000 acres at high risk for insect and disease outbreaks. Thus, alternative 3 would provide the highest likelihood of achieving forest management objectives in critical areas.

Annual timber harvest would be approximately 24,400 ccf.

Untreated areas in IRAs would continue to decline in forest health and would become less resilient to large-scale insect and disease outbreaks and mortality. They would continue to have accumulations of dead standing and down trees, which would indirectly add to hazardous fuels over time.

The effect on the opportunity to conduct forest health treatments related to differences in the IRA and CRA boundaries under each alternative would be the same as was described for alternative 2. Substantially altered acres would be projected to receive an additional 2,400 to 3,000 acres of treatment each year for fuel reduction or forest health purposes, which is more than under alternative 1 for those areas. And like alternative 2, there would be no other differences in the opportunity to improve forest health based on differences in the boundaries of IRAs and CRAs.

This alternative has the highest potential for both beneficial and detrimental effects to rangeland vegetation. This is because this alternative allows for the most additional roading and tree-cutting activities in roadless areas. However, any project-level activities would be consistent with forest plan management area prescriptions within the IRAs. The effects to rangeland vegetation and health would be the same as described for alternatives 1 and 2, although over more roadless area acres. These effects include beneficial increases in abundance and possibly diversity of native range vegetation where forest canopies become more open. Detrimental effects would potentially include some short-term and localized increases in soil erosion, changes in surface water flow patterns, and prevalence of invasive plants.

Summary of Effects

The differences in the cumulative acreage of high risk insect and disease areas that would be treated under each alternative over a 15-year period would be approximately:

- Alternative 1—2 percent of high risk areas would be treated.
- Alternative 2—19 percent of high risk areas would be treated.
- Alternative 3—41 percent of high risk would be treated.

Other potential changes to forest or rangeland vegetation in the roadless areas include short-term, localized changes in vegetation composition, structure and function related to increases in roads and tree-cutting activities. Minor, short-term degradation of soil productivity or increases in invasive plants would be least under alternative 1 and greatest under alternative 3, with alternative 2 somewhere in between. Long term, more widespread improvements in forest and rangeland health would be more pronounced under alternative 3, and least pronounced under alternative 1, with alternative 2 somewhere in between.

Environmental Consequences – Cumulative Effects

Cumulative effects on forest health were considered in terms of insect and disease outbreaks on forested lands in Colorado. Table 31 (earlier) displays the level of insect and disease outbreaks within roadless areas. Similar forest health concerns exist outside roadless areas with the potential to spread into adjacent roadless areas. Conversely, forest health concerns within roadless areas have the potential to expand to adjacent areas.

There are restrictions on road building in other areas outside roadless areas, such as congressionally designated areas, administratively designated areas, or in certain areas for

protection of Canada lynx. These areas would likely remain untreated for forest health purposes and add to the untreated areas remaining in roadless areas under each alternative.

Forest health projects continuing on lands outside roadless areas would add to projected forest health projects within the roadless areas. These would cumulatively add to forest health improvements and other management objectives expected to occur on surrounding areas over the next 15 years.

Climate change may cause warming and drying trends in the Front Range of Colorado that could eventually increase the magnitude, frequency, or extent of wildfires in and around the roadless areas. Those same climate trends may increase droughts, which result in greater insect and disease outbreaks. These effects would be exacerbated in the large portions of roadless areas that remain untreated. This cumulative effect would be slightly greater under alternative 1, followed by alternative 2 and then alternative 3. This impact would be slightly less under alternatives 2 or 3 because more forest health treatments would potentially occur under those alternatives.

FIRE AND FUELS

This analysis evaluates potential effects of each alternative on hazardous fuels, wildfire behavior, and flexibility in managing fire and fuels, particularly in a wildland-urban interface (WUI). A WUI refers to those areas where flammable wildland fuels are adjacent to homes and communities. This analysis focuses on the main differences in potential environmental consequences among the alternatives, based on the circumstances in which activities are permissible in roadless areas. This fire and fuels analysis is closely related to other vegetation and forest health topics, which are addressed in separate sections of the EIS. The Fuels and Fire report in the administrative record contains more detail than is summarized in this section.

Affected Environment

Fire and Fuels Management

In April 1999, the General Accounting Office (GAO) published a report titled Western National Forests: a Cohesive Strategy is Needed to Address Catastrophic Wildfire Threats (USGAO 1999). In the report, the GAO asserts, "The most extensive and serious problem related to the health of national forests in the interior West is the over-accumulation of vegetation."

In October 2000, the Forest Service responded to the GAO report by publishing Protecting People and Sustaining Resources in Fire-adapted Ecosystems: A Cohesive Strategy (cohesive strategy)(USDA Forest Service 2000b). The cohesive strategy establishes a framework to restore and maintain ecosystem health in fire-adapted, high priority ecosystems across the interior West. The cohesive strategy is intended to:

- Improve the resilience and sustainability of forests and grasslands at risk
- Conserve priority areas, which include: WUIs, municipal watersheds, threatened and endangered species habitat, and areas in a condition class that reflects greater susceptibility to uncharacteristic wildfires
- Reduce wildfire costs, losses, and damages
- Better ensure public and firefighter safety.

The cohesive strategy includes treatments such as thinning, some harvest, other mechanical biomass removal treatments, and prescribed burning. It also recognizes that reducing wildfire risk on a large enough scale to make a difference is potentially expensive and will take time and collaborative planning to implement.

The 2000 fire season also attracted national attention to the threats that wildfires pose to people, communities, and natural resources. In 2001, the USDA and USDI completed two key reports to address large and severe wildfire events- one is often called the 10-year comprehensive strategy and the other is the National Fire Plan (USDA and USDI 2001a and 2001b). The 10-year comprehensive strategy and National Fire Plan provides management direction for implementing fire management and forest health programs to reduce hazardous fuels within WUIs, municipal watersheds, threatened and endangered species habitat, and other priority areas. They describe actions that could restore healthy and resilient ecological systems to minimize the potential for uncharacteristically intense fires. They respond to the 1999 GAO

report, the 2000 cohesive strategy, the 2001 Interior and Related Agencies Appropriations Act, and other similarly approved strategies.

The National Fire Plan addresses five key points: firefighting resource availability, rehabilitation, hazardous fuels reduction, community assistance, and accountability. It established a long-term hazardous fuels reduction program to reduce the threat of catastrophic wildfire to people, communities, and natural resources, while restoring forest and rangeland ecosystems to closely match their historical structure, function, and dynamics (USDA and USDI 2001b). As a result, hazardous fuel reduction treatments on NFS lands became a national priority. These treatments on NFS lands in Colorado have primarily involved a combination of prescribed fire and mechanical thinning, with or without wood product removal (harvest), with treatments focused on the high risk wildland urban interface areas.

The goals of the 10-year strategy are to: (1) improve prevention and suppression, (2) reduce hazardous fuels, (3) restore fire adapted ecosystems, and (4) promote community assistance. Core principles of the 10-year strategy include priority setting, collaboration, and accountability (USDA and USDI 2001a). This 10-year strategy extends the concepts of the National Fire Plan into a broader, longer-term, collaborative effort. In May 2002, the 10-year strategy was followed up with a 10-year strategy implementation plan (USDA and USDI 2002), which was later revised in 2006 (USDA and USDI 2006). The 2006 10-year implementation plan emphasizes:

- Information sharing and monitoring of accomplishments and forest conditions
- A commitment to maintaining the essential resources for implementation
- A landscape-level vision for restoration of fire-adapted ecosystems
- The importance of using fire as a management tool and for continuing collaboration.

The Healthy Forests Restoration Act (HFRA; Public Law 108-148) was passed to equip land managers and communities with additional tools to achieve long-term objectives in the National Fire Plan and 10-year strategy. It is intended to help expedite the reduction of hazardous fuels and restoration of lands affected by wildfires. The HFRA defines WUIs and at-risk communities, encourages local communities to collaboratively develop community wildfire protection plans (CWPPs), and encourages establishing local priorities for wildfire preparedness and hazardous fuels reduction work.

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. If a wildfire starts in a roadless area that overlaps or is close to a WUI, the management response would typically be emergency wildfire suppression to protect lives and property. 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. Presently, six of the eight national forest units in Colorado have fire management plans that allow wildfire use: the Arapaho and Roosevelt; Grand Mesa, Uncompahgre, and Gunnison; Rio Grande; Routt; San Juan; and White River. The Pike and San Isabel National Forests are currently evaluating areas suitable for wildfire use. Currently, the low density of roads and

limited extent to which hazardous fuels have been treated in the roadless areas (IRAs or CRAs) are important considerations in selecting the appropriate management response to a wildfire that occurs in a roadless area.

At-Risk Communities and the Wildland-Urban Interface

At-risk communities are generally those with homes or other structures with basic infrastructure and services (such as utilities and roads), within or adjacent to federal land, in which conditions are conducive to a large-scale wildfire that may cause a significant threat to human life or property. There are 1,712 at-risk communities in Colorado, based on the list published in the Federal Register (Vol. 66, No. 160) titled Wildland Urban Interface Communities Within the Vicinity of Federal Lands That Are at High Risk From Wildfire. Of those 1,712 at-risk communities in Colorado, approximately 23 percent (392-396 communities) are within 1.5 miles of a roadless area (CRA or IRA respectively), as shown in table 32. The list of specific communities is available in the EIS record.

Based on the HFRA definition, a WUI refers to an area within or adjacent to an at-risk community that is identified in a CWPP, or if there is no CWPP, then a WUI is defined as: (i) an area 1/2-mile from an at-risk community; (ii) an area 1-1/2 miles from an at-risk community if the land (a) has a sustained steep slope; (b) has a geographic feature that aids in creating an effective fire break; or (c) is in condition class 3; and (iii) the area is adjacent to an evacuation route that requires hazardous fuel reduction to provide safer evacuation from the at-risk community.

Currently there are 82 approved CWPPs in Colorado (Colorado DNR State Forest Service 2008). Lands covered by a CWPP are those within the vicinity of an at-risk community, and CWPP boundaries are highly variable. For this EIS, fire management specialists included areas within 3 miles of an at-risk community, to encompass the "vicinity of an at-risk community" that may be included in a CWPP. For this analysis, lands within 1 mile, 1.5 miles, and 3 miles surrounding an at-risk community were considered as WUI. This allows the analysis to estimate the effects of the proposed Colorado Roadless Rule, which would allow road building and tree-cutting activities in portions of CRAs for lands identified in a CWPP or within a WUI.

Table 32 shows the proportion of roadless area acreage (IRAs or CRAs) located within 1, 1.5, and 3 miles of an at-risk community, as well as the number of at-risk communities located within 1, 1.5, and 3 miles of a roadless area. The boundary and acreage differences between IRAs and CRAs result in a minor variation in the number of at-risk communities near roadless areas. Of the 4.03 to 4.25 million acres of roadless areas under any alternative, 6 percent of the roadless area acres are located within a WUI as defined by the HFRA (within 1.5 miles of an at-risk community), , increasing to 23 percent when the WUI boundary is extended to 3 miles of an at-risk community, under any alternative.

Table 32. Percent of total roadless area acres in proximity to at-risk communities, and number of at-risk communities in proximity to roadless areas

Distance	Percent of total roadless areas within 1–3 miles of an at-risk community	Number of at-risk communities within 1–3 miles of a roadless area (CRA-IRA)
1 mile	2	291–308
1.5 miles	6	392–396
3 miles	24–25	601–619

Of the national forests in Colorado, the Arapaho and Roosevelt and Pike and San Isabel National Forests contain the most roadless area acres within 1 to 1.5 miles of an at-risk community, followed by the Grand Mesa, Uncompahgre, and Gunnison National Forests. The Routt National Forest has the fewest roadless acres within 1 to 1.5 miles of an at-risk community. The small portion of the Manti-La Sal National Forest that occurs in Colorado does not include any roadless area acreage within 1 to 3 miles of any at-risk communities.

Fire Regimes

Fire regime generally refers to the historical pattern of fire behavior that typically occurred in a given ecosystem, characterized by fire frequency (return intervals), size, and intensity, along with other fire characteristics. Historical fire regimes greatly influenced current conditions in roadless areas, and the degree of departure from the historical fire regimes continues to affect ecosystem sustainability and health. While fire regimes provide a general description of fire behavior in certain ecosystems, there was enormous variability that also occurred. The fire regime concept helps simplify a complicated and growing body of knowledge about fire behavior and ecology (Brown and Smith 2000, Rauscher and Hubbard 2008). Nonetheless, significant changes in the role of fire and its effect on ecological conditions from the pre-settlement era to present times can be better communicated and understood in terms of changes in fire regimes (Rauscher and Hubbard 2008).

The current fuel and fire hazard conditions in roadless areas (IRAs and CRAs) are considered in this analysis in relation to five fire regime groups and three fire regime condition classes. These five fire regime groups are defined mostly by fire frequency and severity characteristics, derived from the cohesive strategy (USGAO 1999) and other sources (USDA Forest Service 2000b, Brown and Smith 2000, Rauscher and Hubbard 2008).

Fire regime groups I and II. These groups are defined by relatively short fire return intervals, averaging every 5 to 35 years. These fires are usually of lower severity than other fire regimes. They burn mostly as understory or surface fires; generally 80 percent or more of the dominant trees survive the fire, although lower branches and smaller trees may be killed. Lower intensity surface fires generally perpetuate patches or stands of trees with more open understories. In gentle topography these fires may have been quite large, while in rugged mountainous terrain these fires were often confined to the drier south-facing slopes. These fire regime groups occur in roadless areas in Colorado on drier sites and at lower elevations, such as in the ponderosa pine, pinyon-juniper woodlands, drier Douglas-fir, and grassland and shrubland ecosystems.

Fire regime groups III and IV: These groups are defined by longer and more variable fire return intervals, averaging approximately every 35 to 200 years. The range of fire return intervals is broad because these fires depend on combinations of highly variable conditions, such as weather conditions (including drought and high winds), topographic conditions, fuels and fuel moistures, and chance of ignitions.

The group III fires are typically of mixed severity, including a mix of stand-replacement crown fire and lethal surface fire interwoven on a landscape, including some acres that burn lighter or not at all. Patchy burning patterns may be accentuated by rugged mountainous topography, while fires may burn as large stand-replacing fires on more level terrain such as large plateaus. Mixed severity fires cause selective mortality in the dominant vegetation. The larger tree species can survive where the fire remains in the understory and may be killed where the fire burns through the tree crowns. These mixed fire regimes may also consist of understory fires

occurring at shorter return intervals between infrequent stand-replacing fires. The mixed fire regime results in mosaic forest conditions that encourage subsequent mixed severity fire patterns.

Stand-replacement (high-severity crown) fires are more common in group IV and often occur at longer return intervals, ranging from about 70 years in some lower elevation lodgepole pine forests, to 300 to 400 years in some spruce-fir forests. The stand-replacement fire regime is also common in the aspen forest type. Stand-replacing fires typically burn through the crowns of trees, killing at least 80 percent of the dominant trees. More than 50 percent of the roadless areas in Colorado are composed of lodgepole pine, spruce-fir, and aspen forest types, dominated primarily by stand-replacement fires with some of mixed severity (see the Vegetation and Forest Health section). These fire regime groups also include some moist Douglas-fir and subalpine fir sites, and other vegetation types on higher elevation north-facing slopes.

Fire regime group V: This group is defined by very long, infrequent fire return intervals. Group V includes temperate rain forest, boreal forest, and very high elevation alpine ecosystems. Very few of the roadless area acres (8 percent) have vegetation cover types characterized by this fire regime.

Figure 8 shows the relative distribution of each fire regime group over all of the roadless area acreages in Colorado. The IRAs common to alternatives 1 and 3 cover approximately 4.25 million acres, and the CRAs under alternative 2 cover approximately 4.031 million acres. As shown in the chart, approximately 54 to 55 percent of the roadless areas are in fire regime group III, and an additional 24 to 29 percent are in group IV. Thus most roadless area acreage would naturally burn less frequently and at a mixed to high-severity, dominated by stand-replacing fire. The relative distribution of each fire regime group is virtually the same for the portions of roadless acres that lie within WUIs, or 1 to 3 miles of an at-risk community, with the over 70 percent of those WUI acres being in groups III and IV.

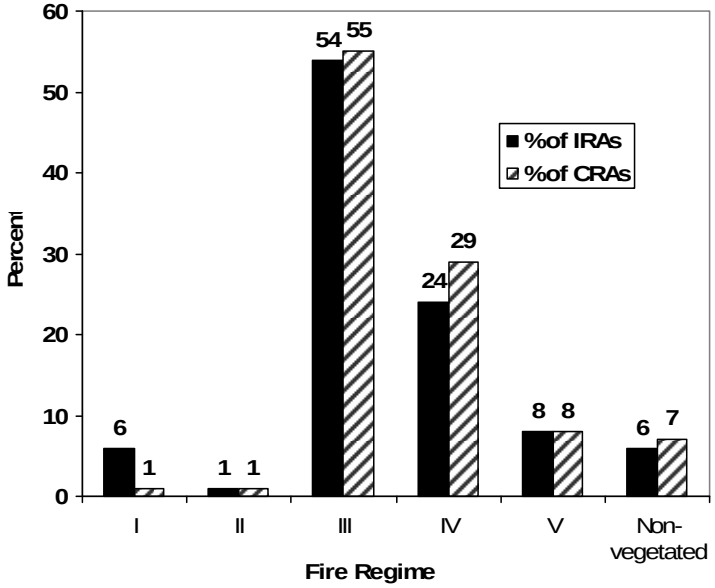

Figure 8. Distribution of fire regime groups in roadless areas in Colorado

**Totals do not total exactly 100 percent due to rounding.*
Source: Landfire database, April 2008; Landscape Fire and Resource Management Planning Tools (www.landfire.gov)

In conjunction with the fire regime groups, land management agencies use three fire regime condition classes to characterize fire regimes. Fire regime condition classes describe the current ecosystem condition in terms of the degree of departure from historical (pre-European settlement) conditions. It is well-known among forest ecologists that much of the forested land in the United States departs from historical fire regimes, primarily as a result of aggressive fire suppression in the 1900s, past timber harvesting and livestock grazing practices, and other causes.

Fire regime condition classes are defined as follows:

- Condition class 1 – Ecosystem conditions reflect a low (< 33 percent) departure from historical conditions and fire regimes. The risk of losing key ecosystem components is low.
- Condition class 2 – Ecosystem conditions reflect a moderate departure (33 to 66 percent) from historical conditions and fire regimes. The risk of losing key ecosystem components is moderate.
- Condition class 3 – Ecosystem conditions reflect a high (>66 percent) departure from historical conditions and fire regimes. The risk of losing key ecosystem components is high.

Figure 9 shows the distribution of fire regime condition classes in the roadless areas in Colorado, both IRAs and CRAs. In accordance with the fire and fuels management laws, regulations, and policies previously discussed, fire hazard abatement treatments are prioritized in areas of condition classes 2 and 3, which depart from historical conditions and constitute 54 to 55 percent of the roadless areas. It is also important to manage forest stands to maintain those in condition class 1. The relative distribution of condition class percentages in the roadless areas is virtually the same in the portions of the roadless areas within WUIs, or 1 to 3 miles from an at-risk community.

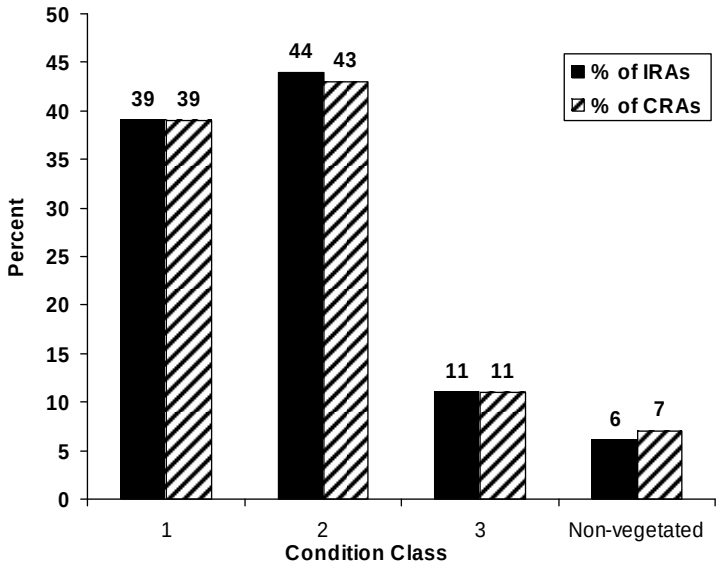

Figure 9. Distribution of fire regime condition classes in roadless areas in Colorado
**Totals do not total exactly 100 percent due to rounding.*
(Source: Landfire data, 2008)

Fire History

In the past 100 years, wildfires in forest ecosystems throughout the West have shown a trend toward being larger, more intense, and more destructive than the fires that historically occurred in those same ecosystems, particularly during long periods of drought. In the roadless areas in Colorado, seven wildfires more than 1,000 acres in size have occurred since 1980.

Table 33 shows the wildfire ignitions in roadless areas in Colorado from 1980 to 2006. There were 1,522 to 1,650 during that time period that ignited within roadless areas. Approximately 38 to 43 percent of these occurred within 3 miles of an at-risk community (table 33). Of those wildfires, approximately 75 percent were caused by lightning and 25 percent were caused by humans. Only about 1 percent of all roadless area acres have been burned by wildfires since 1980 (43,700 to 44,000 total acres, as shown in Table 33). Generally, human-caused fires have occurred less often in roadless areas compared to more heavily roaded or high recreation use areas outside the roadless areas. As the number of people living adjacent to roadless areas is expected to increase, the risk of human-caused fire ignitions in or near the roadless areas is expected to continue to increase.

Table 33. Number of wildfire ignitions and associated acres burned in roadless areas in Colorado

Distance to at-risk community	IRAs Alternatives 1 and 3		CRAs Alternative 2	
	Number of Ignitions	Acres burned	Number of Ignitions	Acres burned
1 mile	75	292	79	295
1.5 miles	214	4,761	214	4,764
3 miles	633	15,582	647	16,988
Roadless total	1,650	44,003	1,522	43,694

Source: FAMWEB database, April 2008, a U.S. Forest Service application for national fire information database systems
Based upon point of ignition and does not include fires that may have ignited outside of roadless areas and eventually burned inside roadless areas as fire perimeters grew.

Hazardous Fuels Treatment

Fuel reduction treatments on all NFS lands in Colorado average approximately 61,000 acres per year, based on fuel reduction treatments conducted from 2001 to 2007 (NFPORS database-national fire plan operations and reporting system, **www.nfpors.gov**, March 2008). About 50 percent were treated with prescribed fire only, and 50 percent included some tree-cutting (thinning) treatment. Of these total treated acres, approximately 4,340 to 5,830 acres per year (7 to 10 percent) were within roadless areas (CRA and IRA boundaries respectively). Of all the fuel reduction treatments in roadless areas over the past 7 years, approximately 68 percent in IRAs were in WUIs and 28 percent in CRAs were in WUIs. Most fuel reduction treatments on NFS lands occurred outside roadless areas or in the substantially altered areas within the IRAs where there are existing roads.

The term fuels refers to the live and dead vegetation that contribute to fires. Fuels include living grasses, shrubs, and trees, as well as dead standing trees (snags), down logs, and accumulations of smaller twigs, needles, and other organic matter on the forest floor. Generally, the greater the amount and density of live and dead fuel accumulations, the more intense (hotter and faster moving) the fire can become, and the more severe the consequences.

Because most roadless area acres have not experienced large wildfires over the past 40 or more years, the density of trees and number of dead trees have increased. As the pine beetle epidemic continues to kill lodgepole pine—which constitutes about 13 percent of roadless areas in Colorado—large areas will continue to experience increasing amounts of dead standing and fallen trees, thereby increasing the intensity of wildfire. In contrast, stands with few dead and fallen trees and with trees that are less densely spaced may resist a fire (Despain 1990).

Ladder fuels (small trees, shrubs, and low branches) occur in many of the roadless area stands that can easily carry a surface fire up into the crowns of overstory trees, promoting crown-fire behavior. Many stands in roadless areas have a high density of trees, which increases the crown bulk density in those stands (a measure of weight per volume of tree-canopy fuels). Studies have found that higher crown bulk densities contribute to sustaining crown fires (Fulé et al. 2003). Using thinning and prescribed burning treatments can reduce the amount of ladder fuels and crown bulk densities to encourage fires to remain on (or return to) the forest floor (Scott and Reinhardt 2001). Fire behavior responds to the type, density, and distribution of fuels; it also responds to weather factors such as wind speed and relative humidity, and to topographic features (Finney and Cohen 2003). Weather and topography cannot be controlled, but the agency can manage forest vegetation to modify fire behavior and reduce the severity of a fire's impact on people and natural resources. Thus, by reducing stand density and the accumulations of understory trees and other ladder fuels through thinning and prescribed burning, the Forest Service can reduce the probability of a large-scale high-intensity crown fire and its undesirable impacts, while improving firefighter and public safety during wildfire suppression efforts (Deeming 1990, Finney 2000, Graham et al. 1999).

Fuel treatments can be very effective even when treating only 20 percent of the landscape if conducted by using strategically placed patterns of overlapping treatments (Finney 2001). If it is not feasible to selectively locate treatments, then a significantly larger percentage of the landscape may have to be treated to achieve the same degree of alteration in landscape fire behavior (Finney 2001). Thus, effectiveness and efficiency depend in part on where treatments are strategically placed, which depends in part on locations of access roads and natural fuelbreaks. In most roadless areas, most of which are adjacent to wilderness areas, the limited

amount of roads, fuelbreaks, and fuel-treated areas makes them more difficult to treat and more vulnerable to high-severity fires. Roads on forested lands often serve as fuel breaks, suppression firelines, anchor points, and safety zones for firefighters. Roads provide more rapid access for firefighting crews and other suppression resources such as engines and heavy equipment for fire line construction, as well as aviation support needs.

High-priority areas for fuel reduction treatment are those areas in WUIs and in fire regime groups I, II, and III and condition classes 2 and 3, as directed in the HFRA. Most roadless areas are in condition class 2, which departs from historical conditions and poses a risk of losing key ecosystem components. Most roadless areas are in fire regime groups III and IV, primarily consisting of lodgepole pine, spruce-fir, and aspen, which historically experience infrequent, high-severity, stand-replacing fires. These fire regime groups are considered high priority to treat where they occur in WUIs, in order to reduce unwanted high-severity fire behavior. In those forest types the objective is not to shift toward a historical or characteristic fire regime, but to protect communities and values at risk from the threat of a high-severity fire.

To effectively reduce wildfire threats in a WUI, it is usually necessary to strategically place treatments at a range of distances from homes or other values at risk. Fuels treatments within 200 feet of a structure may not be sufficient to reduce the threat to neighborhoods and individual structures (Finney and Cohen 2003). Treatments up to several miles away from the value at risk can reduce the fire threat if located where the treatment can affect the way fire spreads and behaves.

Environmental Consequences – Direct and Indirect Effects

For this analysis, each alternative was evaluated to determine the impact it would have on the ability to conduct hazardous fuels reduction treatments in the WUI, and the resulting impact on wildfire management.

Alternative 1 – 2001 Rule (No Action)

Although fuel reduction treatments including thinning in IRAs would be allowed to occur under alternative 1, it would be less likely to occur without the ability to construct new roads in the IRAs to make the treatments economically feasible. Only 800 acres annually would be feasible or likely to occur for forest health and/or fuel reduction purposes in IRAs (see Analysis Framework section).

If the agency continues to conduct fuel reduction treatments on about 61,000 acres of NFS lands annually in Colorado as previously mentioned, the 800 acres of treatment in IRAs would be about 1 percent of the total annual treatments on NFS lands in Colorado.

Treating 800 acres per year in IRAs would result in treating 12,000 acres over a 15-year period. Treating 12,000 acres of the 4.25 million acres in IRAs would reduce fuels and wildfire hazard on less than 1 percent of the total IRA acres. Thus, treating 800 acres per year, spread across many different IRAs, would not result in a significant reduction in wildfire hazard to more than 600 at-risk communities (table 32, earlier) that lie within the vicinity (3 miles) of an IRA.

Treating hazardous fuels on approximately 800 acres annually would be a reduction from the current trend of treating about 5,800 acres per year in IRAs, as described in the Affected Environment section. This decline in fuel reduction treatments in IRAs is partly due to the fact that during most of the past 7 years, the 2001 Rule was not in effect because of court orders.

Also, the more easily accessible acres (near existing roads) have already been treated in the recent past, and treatments become increasingly more expensive and less feasible with increasing distances to existing roads. If the total NFS budget for hazardous fuel treatment remains flat, there would be a shift toward treating fewer acres in roadless areas and more acres outside roadless areas compared to the past 7-year trend.

Therefore, alternative 1 would pose a higher risk of having large-scale insect and disease outbreaks and high-severity wildfires, compared to the other two alternatives. In addition, fuel treatments would likely be more expensive and less efficient to implement in IRAs because of the lack of established roads and inability to reconstruct or construct roads. Treatments would generally occur near existing roads, which limits the ability to more strategically locate treatment areas on the landscape to improve effectiveness. Prohibiting road construction or reconstruction in the IRAs would reduce opportunities to cut trees to reduce hazardous fuels in IRAs.

Hazardous fuel reduction treatments would typically occur in small portions of IRAs where there are existing roads in useable condition, in the high-priority areas. Annual fuel reduction treatments in IRAs would gradually reduce a small percentage of the existing fuel hazard over a long period of time, reducing threats to a portion of the at-risk communities in the vicinity of the IRAs. Treatments would also improve protection of priority watersheds, water supplies, and other values at risk in the WUIs. While this may not be a significant proportion of the total roadless area or NFS lands, it would reduce fire hazard around priority areas and for a portion of the more than 600 at-risk communities located within 3 miles of an IRA.

Projections of future activity in IRAs include decommissioning approximately 12 miles of existing roads annually over the next 15 years (in addition to decommissioning any temporary roads that are built in IRAs in the future). This would further reduce road access for conducting fuel reduction treatment in the IRAs. It would also reduce the number of fuelbreaks created by roads.

The projected decommissioning of roads in IRAs, together with the continued general prohibition on road construction and reconstruction under this alternative, would continue to constrain wildfire suppression efforts. The lack of roads in IRAs under this alternative would decrease the effectiveness, efficiency, and timeliness of fire suppression responses should a wildfire occur in an IRA. As a result, wildfires in IRAs may become larger, more severe, and more hazardous for firefighters and the public. In addition, the limited amount of roads and fuel treatments in IRAs under this alternative would constrain the range of appropriate management responses to a wildfire in an IRA. There would probably be fewer opportunities to apply wildland fire use in an IRA (described in affected environment), because of the lack of roads and limited acreage where hazardous fuels have been reduced.

The differences in the boundaries of IRAs in alternative 1, compared to the CRA boundaries under alternative 2, would not result in a major impact on the opportunity to reduce fuel and wildfire hazards at the landscape scale. However, differences in roadless area boundaries among the alternatives do affect the total acres likely to be treated for reducing fuels and wildfire hazard. In the substantially altered acres within IRAs (excluded from CRAs), there would be very little opportunity for fuel reduction treatments under alternative 1, primarily because of the roading prohibition. Fuel reduction treatments would not be likely to occur within ski areas under any of the alternatives. Fuel reduction treatments would potentially occur within some of the unroaded areas that are outside the IRAs (included within CRAs

under alternative 2), to essentially the same degree they would be expected to occur under the other alternatives. All alternatives provide opportunities to build roads and cut trees as needed in a WUI or under a CWPP, in those unroaded areas.

Alternative 2 – Colorado Rule (Proposed Action)

For this alternative, hazardous fuel reduction treatments may occur in CRAs if they are within CWPPs or WUIs (refer to chapter 2 for details). Projections estimate conducting forest health and/or fuel reduction treatments on approximately 7,600 acres annually within CRAs over the next 15 years (see Analysis Framework section). When compared to the 61,000 acres per year treated on average on all NFS lands in Colorado, the projected 7,600 acres that could be treated in IRAs would be 12 percent of the total acres treated.

The 7,600 acres of treatment per year in CRAs would total 114,000 acres over a 15-year period. Treating 114,000 acres of the 4.031 million acres in CRAs would result in reducing fuels and fire hazard on approximately 3 percent of the CRA acreage. This amount of hazard reduction in IRAs is significantly more than the reduction estimated for alternative 1.

Treating 7,600 acres per year would yield an increasing trend of conducting hazardous fuel treatments within the CRAs, compared with the 4,300 acres of CRAs treated annually on average from 2001 to 2007. If the agency treats 7,600 acres rather than 4,300 acres annually in designated roadless areas, there would likely be fewer acres treated for fuels outside the roadless areas, if the allocation of funds for fuel reductions on NFS lands remains flat. If fuel reduction funds were to increase, this alternative provides the opportunity to yield a measurable improvement in reducing wildfire hazard at a landscape scale.

A total of 88 miles of new roads would be constructed and 14 miles reconstructed in the CRAs over the next 15 years to facilitate hazardous fuels reduction and forest health treatments, or an average of approximately 6 miles of construction and 1 mile of reconstruction per year. Therefore, alternative 2 would pose a lower risk of having high-severity wildfires compared to alternative 1.

Fuel treatments would likely be less expensive and more efficient to implement in CRAs in alternative 2, compared to IRAs in alternative 1, because of the ability to build new roads to facilitate treatments. Increased road miles would increase the agency's ability to strategically locate fuel treatment areas on the landscape to improve effectiveness and possibly reduce the total amount of the landscape that requires treatment. Allowing for roads in CRAs (where allowed under the forest plan) would help reduce accumulations of thinning-generated woody fuels and further mitigate the fire hazard. This alternative would result in increased protection for at-risk communities and other values located in proximity to the CRAs.

While in existence and for a short time after, temporary roads would serve as fuel breaks, suppression firelines, anchor points, and safety zones for firefighters. They would temporarily improve accessibility for firefighting crews and other suppression resources, thereby improving efficiency and timeliness of wildfire suppression responses in CRAs. Therefore, compared to alternative 1, wildfires in CRAs that had temporary roads would not be as likely to become large high-severity wildfires under alternative 2.

The projected decommissioning of existing roads in CRAs and temporary roads built in CRAs would negate some of the benefits of having roads in CRAs for managing fuels and wildfires.

Reducing road density in CRAs through decommissioning would slightly reduce wildfire suppression effectiveness, as previously described for alternative 1.

The differences in the boundaries of CRAs in alternative 2, compared to the IRA boundaries under alternative 1, would not result in a major impact on the opportunity to reduce fuel and wildfire hazards at the landscape scale. However, differences in roadless area boundaries between these alternatives do affect the total acres likely to be treated for reducing fuels and wildfire hazard. In the substantially altered acres not included in the CRAs (that are included in IRAs), there would be more opportunity to conduct treatments to reduce fuels and fire hazard, as those areas would not be under any rule-related limitations. No other differences in roadless area boundaries would have an effect on opportunities to reduce wildfire hazard under alternative 2. Fuel reduction treatments would be expected to occur within portions of the unroaded areas that are included in CRAs (not included in IRAs) under alternative 2, the same as under the other alternatives. Little to no fuel reduction treatments are likely to occur in the ski areas under any of the alternatives.

Alternative 3 – Forest Plans

For this alternative, projections estimate forest health and fuel treatments may occur on approximately 16,300 acres annually within IRAs over the next 15 years (see Analysis Framework section). When compared to the average of 61,000 acres annually treated on all NFS lands in Colorado, the 16,300 acres projected to occur in IRAs would be 27 percent of the total NFS acres treated annually.

Treating 16,300 acres per year would total 244,000 acres over a 15-year period. Treating 244,000 of the 4.25 million acres in IRAs would result in reducing the fuel hazard on about 6 percent of the total in IRA acreage each year.

Treating 16,300 acres per year under alternative 3 would be a large increase over the recent past trend of treating about 5,800 acres per year in IRAs. If the total NFS budget for hazardous fuel treatment remains flat, there would be a shift to treating more acres in roadless areas and fewer acres outside roadless areas compared to the past 7-year trend. If funding for fuel reduction projects increases, this alternative would provide the greatest opportunity to reduce wildfire threats to values at-risk.

A total of 118 miles of new roads would be constructed and 14 miles reconstructed in the IRAs over the next 15 years under alternative 3 to facilitate hazardous fuels reduction and forest health treatments, or an average of approximately 8 miles of construction and 1 mile of reconstruction per year. Therefore, alternative 3 would pose the lowest risk of having high-severity wildfires compared to the other two alternatives. Effects of building more roads for fuel treatments would generally be the same as described for alternative 2, including increased efficiency, effectiveness, and timeliness in wildfire suppression response as well as hazardous fuel reduction in WUIs. Alternative 3 would provide a higher level of protection for at-risk communities and other values in the vicinity of IRAs compared to the other two alternatives.

Under alternative 3, some permanent roads may be constructed in the IRAs for fuel reduction and forest health purposes. Maintaining more permanent roads in the IRAs would enhance the effectiveness and value of roads for fuels and wildfire management purposes over the long-term. The increased flexibility to build both permanent and temporary roads in IRAs would improve the agency's ability to conduct additional fuel reduction treatments and maintain lower wildfire hazards in WUIs in the long term, compared to the other two alternatives.

Alternative 3 would improve the range of appropriate management responses to wildfires that occur in IRAs, including possible wildfire use, because of the increased amount of roads and fuel-treated areas that would occur over time in the IRAs. Other effects would also be the same as described for alternative 2, although the benefits to wildfire management would be slightly greater and longer lasting under alternative 3.

The projected decommissioning of existing roads in IRAs and temporary roads built in IRAs would negate some of the benefits of having roads in IRAs for managing fuels and wildfires. Reducing road density in IRAs through decommissioning would slightly reduce wildfire suppression effectiveness, as previously described for alternative 1.

The effects of roadless area boundary differences on the opportunity to reduce wildfire hazard in IRAs would not differ in alternative 3 from what was described for alternative 2. Although the IRA boundaries under alternative 3 differ from the CRA boundaries under alternative 2, both alternatives would provide nearly the same management flexibility to build roads and cut trees where needed in WUIs and in CWPP areas to reduce fuels and wildfire hazard near at-risk communities.

Summary of Direct and Indirect Effects

Alternative 1 provides the least probability of conducting hazardous fuel and forest health treatments in roadless areas, and least likelihood of reducing wildfire threats to communities within and adjacent to roadless areas. Alternatives 2 and 3 both provide flexibility to prioritize where hazardous fuel and forest health treatments would occur in roadless areas, and the associated ability to reduce the high-severity wildfire threats to communities and municipal watersheds that lie near the roadless areas. Alternative 3 offers the greatest opportunity to reduce wildfire threats to values at risk.

As described in the previous environmental consequences narratives, the key differences among alternatives in terms of fire and fuels can be summarized as follows:

Alternative 1	Alternative 2	Alternative 3
1 percent of the annual fuel treatments on NFS lands in Colorado could occur in roadless areas.	12 percent of the annual fuel treatments on NFS lands in Colorado could occur in roadless areas (in CWPP areas or WUIs).	27 percent of the annual fuel treatments on NFS lands in Colorado could occur in roadless areas.
Fuel treatments could total less than 1 percent of total IRA acres after 15 years (12,000 of 4.25 million acres).	Fuel treatments could total 3 percent of CRA acres after 15 years (114,000 of 4.031 million acres).	Fuel treatments could total 6 percent of IRA acres after 15 years (244,000 of 4.25 million acres).
Least increase in roads in IRAs = least opportunity to improve fuels and fire management effectiveness.	A moderate increase in roads (temporary) in CRAs = moderate opportunity to improve fuels and fire management effectiveness.	Greatest increase in roads (temporary and permanent) in IRAs = greatest opportunity to improve fuels and fire management effectiveness.

Environmental Consequences – Cumulative Effects

Past fire exclusion and lack of treatment in roadless areas has contributed to the over-accumulation of hazardous fuels and the current amount of area in condition classes 2 and 3. Laws, regulations, and policies described in the Affected Environment section, have greatly increased the emphasis and interagency commitment to reducing hazardous fuels and unwanted and uncharacteristic wildfires.

Residential development in the WUI areas has raised concern among natural resource managers and is recognized as a primary factor influencing management activities. The increase in population growth and development adjacent to roadless areas is expected to continue. Colorado was among the top 9 western states with the greatest proportion of WUI expansion from 1970 to 2000, and is among the top six states from the intermountain West with the greatest anticipation of WUI expansion from 2000 to 2030 (Theobald and Romme 2007).

The current limitations under the 2001 Rule 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 WUIs and municipal watersheds within or adjacent to roadless areas.

Fire prevention programs, community fire safe councils, and continued development of CWPPs would continue to make valuable contributions to reducing wildfire threats to communities and resource values in the WUI. The increase in CWPPs coupled with existing fuel management policies will result in identifying and treating more of the highest priority acres to reduce the threat to communities, municipal water supplies, and other critical resources. Fuel treatments will not only continue to be implemented on other federal and state lands, but also on city, county, and private lands, to meet objectives in collaboratively developed CWPPs. These treatments on other land ownerships and on NFS lands outside roadless areas will combine with the beneficial effects expected under alternatives 2 and 3. Under alternatives 2 or 3, the increased opportunity to reduce wildfire hazard in priority areas as previously described, would cumulatively add to the treatments occurring on adjacent lands. Together these efforts would reduce the threat of catastrophic wildfires in WUIs and municipal watersheds in Colorado.

Global and regional climate change may increase the magnitude and extent of insect and disease epidemics, wildfires, and other natural disturbance events. A large body of evidence suggests that in the western United States there is a foreseeable trend toward warming, together with reduced precipitation and more frequent extremes in winds, tornados, and other weather events. The high-danger fire season is expected to become longer, and wildfires are expected to become more frequent and severe as a result of these climatic trends. Changing weather conditions coupled with the over-accumulation of fuels and increase in stands with condition class 2 or 3, create a situation that lends itself to extreme fire behavior having devastating effects to communities and the natural resources that people depend on. The differences in effects among the roadless rulemaking alternatives are not significant enough in magnitude, geographic extent, or duration to have any measurable cumulative effect relative to changes associated with global and regional climate change.

The beneficial fire and fuel-related effects associated with alternatives 2 and 3 are very small in comparison with changes in vegetation expected from all fuel treatments on surrounding lands, together with natural disturbance events such as wildfires. However, the effects expected from

alternatives 2 or 3 would provide a minor incremental cumulative effect in reducing wildfire threats to communities and natural resources in Colorado, and improving the agency's ability to meet other wildfire management objectives.

INVASIVE PLANTS

This analysis evaluates effects of the alternatives on the introduction or spread of invasive plants. Invasive plants for purposes of this discussion include non-indigenous plant species that adversely affect the habitats they invade economically, environmentally, or ecologically. Invasive plants become established after seed or other plant parts have been imported to an area, and where suitable environments exist. They often become detrimental to resource values, and the effects are often irreversible (Olson 1999).

This discussion focuses on the extent to which the alternatives would cause potential higher risk of increasing the abundance and distribution of invasive plants (also known as noxious weeds) from such vectors as increased roads, vehicular travel, and/or other ground-disturbing activities. Since no site-specific activities or effects are proposed as part of the analysis, the potential for invasive plants to spread is expressed in general terms, with no site-specific information provided. Future planned activities within any of the areas would undergo site-specific analysis to assess the localized impacts at that time.

Each alternative is evaluated with respect to the risk of establishment and spread of invasive plants, based upon the Analysis Framework section. That section includes estimates of the maximum foreseeable level of annual activities, including primarily road-building, vegetation management, and energy resource development.

This section addresses the subset of invasive plants that consists of non-native invasive plants. It is recognized that some native invasive plants are a threat in Colorado ecosystems. Invasive aquatic or terrestrial animal species or organisms are described in the Aquatic and/or Terrestrial Species and Habitat sections of this chapter.

Indirectly the spread of invasive plants in national forest ecosystems can adversely affect rare native plant populations, terrestrial wildlife and aquatic animal species habitats, soil stability, water quality, and other resource values. The estimated effects of invasive plants on those resources are discussed in other sections of this chapter.

Affected Environment

There are 71 invasive plant species (noxious weeds) currently known to occur in Colorado (Colorado Department of Agriculture 2001). Many of these invasive plant species are known or likely to occur in roadless areas in Colorado, especially in the substantially altered portions of IRAs where roads and timber harvest have occurred. Aside from their effects on agriculture, the effects of these invasive plants can also degrade national forests and other natural areas. This degradation can happen as a result of one or more of the following (Colorado Department of Agriculture 2001):

- Altering ecosystem functions of energy flow, nutrient cycling, and watershed stability
- Causing a decline in aquatic-riparian and terrestrial habitat for wildlife
- Potentially increasing water runoff, sediment delivery, and soil erosion
- Causing a potential decline in water quality (Lacey et al. 1989)

- Reducing biological diversity and degrading recreation values and scenic beauty, all of which can negatively affect resources values in roadless areas.

Invasive plants have become established in portions of roadless areas where suitable environments exist, after seeds or other plant parts initiated new populations. Opportunity for invasive plant infestations have been created by soil disturbance where native vegetation was temporarily removed and weeds invaded the site. Although roadless areas have substantially fewer acres of disturbed sites and invasive plants than roaded areas, there are localized sites in roadless areas that provide increased opportunity for invasive plant introduction and spread, such as where the following activities have occurred or continue to occur: wildfires and prescribed burning; mining ; timber harvest activities including creating skid trails and landings; concentrated livestock grazing; road-building; and recreation activities including hiking, horseback riding, camping, and off-road vehicle use. Areas of disturbed soil, especially where open to sunlight, can serve as long-term vectors that aid the spread of invasive plants (Baker 1986).

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 2003a). Seeds are transported from infested areas to new areas by becoming lodged in tire treads and on mud and dirt that can become dislodged from the fenders, undercarriage, and other parts of the vehicle. Because of the low road density and infrequent vehicular use in roadless areas and adjacent wilderness areas, there is substantially less occurrence of invasive plants in these areas compared to the more developed landscapes around them.

Vegetative manipulation (such as harvest or prescribed burning) that opens the forest canopy and allows more sunlight to reach the soil often creates site conditions that are more favorable to invasive plants. Transported seed in camping gear, clothing, and equipment unloaded from vehicles by national forest visitors is often inadvertently deposited on wildlands, allowing new populations to become established.

Numerous natural mechanisms also spread invasive plants, including wildlife, wind, and flowing water. Birds and rodents ingest seed from invasive plants and disperse them in their feces. Big game animals carry seed or other propagates on their fur or hooves. Seed ingested by larger mammals is carried in the gut, and deposited in the feces, enabling germination in a new location. After seed is imported into an area, invasive plants are often able to successfully establish in certain habitats even without ground disturbance, because of their aggressive nature and adaptability. Once new populations are established by wind, then wildlife or subsequent increases of human activity and ground disturbance have been proven to accelerate the spread.

To minimize spread of invasive plants in roadless areas and other NFS lands, the Forest Service follows direction in the Invasive Species Executive Order 13112**.** This executive order directs federal agencies to use relevant programs and authorities to: (1) prevent the introduction of invasive plants; (2) detect and respond rapidly to and control invasive populations efficiently and safely; (3) accurately monitor invasive populations; (4) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; and (5) promote public education on invasive plants. To further minimize the risk of invasive plant establishment and spread during road building, decommissioning, or other projects, the following best management practices for invasive plant prevention are typically followed:

1. Using certified weed free straw or mulch if re-seeding or other restoration practices are used post-project
2. Acquiring gravel for road surfacing from gravel pits that are inspected and known to be weed free
3. Inspecting seeds by the seed lab to ensure the absence of invasive plants
4. Washing vehicles used in off-road operations such as skid trail construction, skidding, or other equipment prior to entry into the NFS lands.

A complete listing of best management practices for invasive plant prevention can be found on the Web at www.fs.fed.us/r2/resources.

Although roads can be a contributing factor to invasive plant invasion, roads are often an asset to managing and controlling invasive plant populations. For example, the traditional cost of chemical or mechanical treatment in Colorado's forests on an acre of invasive plants is approximately $50 to $75 where there is a reasonable amount of road access. Comparatively, remote infestations cost five to eight times that amount when hiking, horses, or other means of transport need to be used.

As of 2001, approximately 3 percent of all lands in Colorado were estimated to be occupied by invasive plants at some density (Colorado Department of Agriculture 2001). Within Colorado, important invasive plants are categorized as either A-, B-, or C-listed species according to their potential threat to agricultural or wildland values within the state. Species on the A-list include the newer invaders, generally of low abundance in the state and with more potential for eradication and control. Species on the B- and C-lists include less important and generally more abundant invasive plant species, which tend to be more widely established. Of the 71 invasive plant species known to occur in Colorado, approximately 18 are on the A-list, 39 on the B-list, and 14 on the C-list.

In addition to using the state's system of priority species, each of the national forests in Colorado has identified "priority" invasive plants. Priority species, as defined in the Rocky Mountain Region's invasive species management strategy, are species that are low in abundance, have the ability to establish dominance in plant communities, and invade a variety of relatively healthy ecosystems. Priority invasive plants by national forest are identified in each forest's invasive species action plan, located on the Web at www.fs.fed.us/r2/resources.

While considerable effort has gone into the prioritizing treatments and building effective prevention programs on each national forest, the program has faced many challenges because of lack of adequate funding and competing priorities. It is estimated that on the average, national forests in Colorado are treating approximately 5 percent of known infestations per year.

Rates of spread for invasive plants are variable according to species, habitat, and a variety of other factors. Spread-rate estimates as high as 14 percent have been documented (Buhler 2002). In this analysis, estimates of invasive plant spread are derived using a more conservative 5 percent annual spread rate. Again, given the uncertainty, these are only rough estimates to be used in a relative sense for comparison purposes.

Current invasive plant management programs on Colorado national forests are at best staying even with, rather than reducing, total acres of invasive plant populations, because of inadequate funding and competing priorities. Substantial increases in invasive plants on a broad scale are likely to have a measurable effect on long term health of forest and rangelands on all national

forests. A critical factor in the site-specific planning and implementation of future projects is the degree to which prevention and early detection/rapid response measures are used.

Environmental Consequences – Direct and Indirect Effects

The exact acreage of inventoried invasive plant populations that are potentially affected by the various alternatives is not known. Under each alternative there are projected or foreseeable activities that would likely result in ground disturbance, increased vehicle activity, construction, and other activities. All these activities generally elevate the risk of invasive plant import, establishment, and spread.

Site-specific planning will occur in the future for any proposed project in a roadless area. Therefore, the estimates used in this analysis for acres disturbed and possible invasive plants outcomes cannot be interpreted literally, but used instead as a relative indicator of risk, for the comparison of alternatives.

Alternative 1 – 2001 Rule (No Action)

Under the 2001 Roadless Rule, road construction/reconstruction is generally prohibited; therefore, ground disturbance resulting from new roads and vehicular access would remain quite low. Consequently, the potential spread of invasive plants in roadless areas under this alternative would remain low.

Based on data provided in the Analysis Framework section, the extent of annual average activity is summarized for alternative 1 below. These estimates represent the estimated maximum foreseeable acreage of ground disturbance and, therefore, elevated risk of invasive plants by activity. An average of 2.9 acres of disturbance per mile of road construction or reconstruction was used to calculate the amount of cleared ground to include in this analysis, using an average of 30 percent side slope and a 20-foot-wide swath of land to accommodate a road bed. The following calculation highlights the acres likely to be disturbed within IRAs and open for growth of invasive plants:

Tree-cutting:	800 acres annually
Road building:	17 acres (for 6 miles annually)
Energy development:	4 acres (annually, associated with site occupancy)
	821 annual acres

It is difficult to quantify the actual number of acres potentially affected by the establishment of invasive plants as a result of these ground-disturbing activities. For comparison purposes, if one half of 1 percent of the 821 acres of IRA disturbed ground were invaded by non-native plants, the result would be approximately 4 acres per year, spread out over the 4.25 million acres of IRAs.

Indirect effects would result from the gradual steady encroachment of newly established invasive plant populations over the long term, if adequate resources are not available to address the issue. The extent of this expansion is difficult to quantify. However, assuming the compound effect of a 5 percent annual growth rate for the additional 4 acres of invasive plants, per year, approximately 90 acres of invasive plants would be found within the affected area after 15 years under alternative 1.

Although roads built for vegetation management or energy exploration would eventually be decommissioned, there is nonetheless a moderate risk of import of invasive plant seeds during the activity. In the case of energy development, the roads would be expected to remain in use for a much longer period of time (decades) compared to other activities where roads are allowed under the proposed Rule.

Under alternative 1, tree-cutting activities, together with prescribed burning, would likely result in less ground disturbance and open forest canopies than under other alternatives. Many sites, particularly south-facing slopes, are likely to be at higher risk for invasive plant establishment and spread, because many invasive plants are better adapted to sunnier, drier sites. Cleaning of logging equipment prior to use and routine roadside monitoring for new populations would minimize the likelihood of roadside populations spreading from the roadway and/or harvest areas into native plant communities.

In addition to the 821 acres projected to be disturbed annually, it is projected that about 12 miles of existing roads (about 35 acres) would be decommissioned annually under alternative 1. For road decommissioning, there would be a gradual reduction in the likelihood of imported seed via vehicular traffic in the long term. However, during the decommissioning job and for a period of approximately 3 to 5 years, there is an elevated risk of invasive plant establishment and spread, if proper precautions are not followed. To minimize the risk of invasive plant establishment and spread during road decommissioning or other projects, best management practices for prevention would be followed, as previously discussed.

By maintaining current limitations on future road construction or reconstruction under alternative 1, tree-cutting activities, and leaseable minerals development within roadless areas, the introduction or spread of invasive plants would remain limited to the current rate of invasive plant spread, which results from the natural mechanisms mentioned in the Affected Environment section. As a result, invasive plant expansion due to vehicles and human activity, including planned management activities, would be minor under alternative 1. Population establishment and expansion as a result of existing activities would continue at current estimated rate of 5 percent annually.

In the substantially altered portions of the IRAs in particular, establishment and spread of invasive plants would continue at rates unchanged from current levels through continued use of existing roads.

Alternative 2 – Colorado Roadless Rule

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 alternative 1. 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.

Under alternative 2, portions of 190 roadless areas would experience a projected increase in road construction, tree-cutting activities, or leaseable mineral-related activities. Roadless areas most likely to see increased abundance of invasive plants are those in or near substantially altered areas, and on sites where invasive plants populations currently occur. These invasive plant infestations are likely to be spread primarily by roads and vehicular use in substantially altered areas. On the other hand, unroaded areas currently not included in IRAs but included in

CRAs, more than 300,000 acres, would experience a reduction in the potential for ground-disturbing activities and associated invasive plant infestations.

Based on data provided in the Analysis Framework section, the extent of annual average activity is summarized for alternative 2 below. As highlighted in alternative 1, these estimates represent the estimated maximum foreseeable acreage of ground disturbance, and therefore elevated risk of invasive plant growth by activity.

Tree-cutting:	7,600 acres annually
Road building:	61 acres (21 miles annually)
Energy development:	37 acres (annually, associated with site occupancy)
	7, 698 annual average acres

It is difficult to quantify the actual number of acres potentially affected by the establishment of invasive plants as a result of ground-disturbing activities. For comparison purposes, if one half of 1 percent of the 7,698 acres of CRA disturbed ground were invaded by invasive plants, the result would be approximately 38 additional acres per year of invasive plants, spread out over many of the 4.031 million acres of CRAs.

Indirect effects would result from the gradual steady encroachment of newly established invasive plant populations over the long term, if adequate resources are not available to address the issue. The extent of this expansion is difficult to quantify. However, assuming the compound effect of 5 percent annual spread of the 38 acres per year of invasive plants, approximately 820 acres would experience invasive plant increases within the affected area after 15 years.

As in alternative 1, a similar level of road decommissioning would occur under alternative 2, with similar impacts on invasive plant species. The impacts of long-term use of roads discussed in alternative 1 would be higher in alternative 2 because of the increased acres disturbed for road construction. Similarly, acres disturbed for vegetation management are also higher in alternative 2, so impacts would be greater than alternative 1.

Potential increases in the introduction or spread of invasive plants would be minimized by standard or required mitigation measures as previously described for alternative 1. Overall, the potential magnitude and geographic extent of ground disturbance and spread of invasive plants in roadless areas would remain low under alternative 2.

Alternative 3 – Forest Plans

Alternative 3 would potentially have the highest amounts of foreseeable road construction/reconstruction, tree-cutting, fuels management, and leaseable mineral activities in roadless areas. This would result in a somewhat higher risk scenario for invasive plant establishment, as compared to either of the other two alternatives. Although they would affect roughly the same number of roadless areas as alternative 2, the projected activities possible under alternative 3 have a higher likelihood of occurrence and may involve more extensive areas of soil disturbance.

Based on data provided in the Analysis Framework section, the extent of annual average activity is summarized for alternative 3 below. As described in alternative 1, these estimates

represent the estimated maximum foreseeable acreage of ground disturbance, and therefore elevated risk of invasive plants by activity.

Tree-cutting:	16,300 annual acres
Road building:	87 acres (30 miles annually)
Energy development:	43 annual acres associated with site occupancy
	16,430 annual average acres

It is difficult to quantify the actual number of acres potentially affected by the establishment of invasive plants as a result of ground-disturbing activities. For comparison purposes, if one half of 1 percent of the 16,430 acres of IRA disturbed ground were affected by invasive plants, the result would be approximately 82 acres per year of new invasive plants, spread out over many of the 4.25 million acres of IRAs.

Indirect effects would result from the gradual steady encroachment of newly established invasive plant populations over the long term, if adequate resources are not available to address the issue. The extent of this expansion is difficult to quantify; however, assuming the compound effect of 5 percent annual spread of the 82 acres per year of new invasive plants, approximately 1,770 acres would experience invasive plant increases within the affected area after 15 years.

As in alternative 1, a similar level of road decommissioning would occur under alternative 3, with similar impacts on invasive plant species. The impacts of long-term use of roads as discussed in alternative 1 would be the highest in alternative 3 because of the increased acres disturbed for road construction. Similarly, acres disturbed for vegetation management are also be the highest in alternative 3, so impacts would be greater than alternative 1.

Potential increases in the introduction or spread of invasive plants would be minimized by standard or required mitigation measures as previously described for alternative 1. Overall, the potential magnitude and geographic extent of ground disturbance and spread of invasive plants in roadless areas would relatively low under alternative 3.

Summary of Direct and Indirect Effects

Potential effects differ by alternative primarily in terms of the acres included in or eliminated from roadless designation. They also differ in terms of the potential for foreseeable management activities such as road construction or maintenance; forest vegetation management; fuels management; and oil, gas, or coal mining.

Based on the amount of projected ground-disturbing activities associated with each alternative, the relative magnitude of difference in the potential for increases in invasive plant populations in roadless areas is as follows:

- Alternative 1 would have 4 acres per year with an increase in invasive plants in IRAs.
- Alternative 2 would have 38 acres per year with an increase in invasive plants in CRAs.
- Alternative 3 would have 82 acres per year with an increase in invasive plants in IRAs.

Those figures should not be considered accurate acreage predictions but provide a reasonable way to compare alternatives in terms of the relative difference in the potential for future increases in invasive plant infestations in roadless areas.

Equally under all three alternatives, invasive plant populations would continue to become established and spread in roadless areas as a result of natural dispersal mechanisms described in the affected environment section.

Environmental Consequences – Cumulative Effects

In general, the greater the extent of acres where ground-disturbing activities are allowed to occur, the greater the potential for cumulative risks of invasive plant establishment and spread (Baker 1986; Sheley and Petroff 1999).

Activities such as road construction; tree-cutting and removal; and oil, gas, and coal mining operations would likely enhance opportunities for invasive plant infestations. Where these plants become established, and particularly where they becomes dominant on the site, the long-term health of the native plant community becomes degraded because of disruption in ecosystem functions such as energy flow, nutrient cycling, and watershed stability. Soil moisture regimes and watershed stability are often disrupted because of decreased litter quantity and quality and increased soil temperatures.

All the human developments and project activities that are ongoing or expected in the foreseeable future, as listed in the cumulative effects framework in appendix D, would contribute to the cumulative increases in opportunities for invasive plant infestations. Particularly as human populations continue to increase adjacent to roadless areas, these developments and human activities will likely increase invasive plants. The invasive plants that become established in the WUI areas would likely spread into adjacent roadless areas.

Effects from alternatives 2 and 3 would be combined with effects from ongoing oil and gas exploration on state and private lands adjacent to roadless areas, especially on the White River; Grand Mesa, Uncompahgre, and Gunnison; Routt; and San Juan National Forests. These increases in invasive plants from energy development activities would combine with the potential increases on national forests, to result in a likely cumulative effect. Additionally, in several areas of the state where substantial activity is ongoing on BLM and private lands (such as Mamm Creek or Divide Creek), there is an elevated risk of seed transport from non- Forest Service oil and gas exploration areas onto NFS lands. Taken cumulatively, these combined increases are likely to represent a measurable, if not quantifiable, adverse effect on the extent and distribution of invasive plant populations in and around National Forests in Colorado in the coming decade.

THREATENED, ENDANGERED, AND SENSITIVE PLANTS

This analysis evaluates effects of the alternatives on threatened and endangered (T&E) and sensitive plants. It focuses on the most significant issues relevant to how this proposed rulemaking action may affect T&E and sensitive plants, in particular through road construction or reconstruction, tree-cutting, and energy resource development.

Separate sections of the EIS cover T&E and sensitive terrestrial and aquatic animals and their habitats.

Affected Environment

Taken as a whole, T&E and sensitive plants in Colorado occur in a wide variety of habitats, ranging from wetlands or piñon-juniper woodlands to rock cliffs or alpine tundra. Within these broad types, T&E and sensitive plants are typically restricted to small areas having specific combinations of soil type, moisture regime, elevation range, and plant communities or other factors. Some species (called endemic) grow nowhere else in the world except Colorado and may be restricted to a single mountain range, while for others Colorado may be at the edge of their geographic range.

In contrast to certain animal species that are more likely to be found in areas with less human activity, nothing specific about habitat conditions within roadless areas makes them more likely to harbor T&E and sensitive plants than places outside roadless areas. However, because roadless areas are generally less altered by human activities compared to more intensively managed lands, T&E and sensitive plants in roadless areas are less likely to have been adversely affected by activities. These areas also may have lower threats from invasive non-native plants (that is, noxious weeds).

Threatened and Endangered Species

The T&E plants discussed in this document are those federally listed under the Endangered Species Act (ESA). Two such plant species are known to occur within Colorado roadless areas: Penland's eutrema (*Eutrema penlandii*) and Uinta Basin hookless cactus (*Sclerocactus glaucus*); see table 34 (Colorado Natural Heritage Program 2008). Both are listed as threatened (USDI Fish and Wildlife Service 1993; USDI Fish and Wildlife Service 2008). No other T&E plants are known or likely to occur in roadless areas in Colorado. One endangered plant, Kremling milkvetch (*Astragalus osterhoutii*), occurs relatively near a roadless area; however, that roadless area does not have the soil types required to support Kremling milkvetch. Therefore, it is highly unlikely that this species occurs in any of the roadless areas.

Table 34. Occurrence of threatened and endangered plant species within roadless areas (IRAs or CRAs)

Species – common name, scientific name (ESA Status)	Habitat description	Roadless areas with T&E species occurrence or suitable habitat
Penland's eutrema *Eutrema penlandii* (threatened)	Rooted in mosses on stream banks and in wetlands that remain wet all season in the alpine at elevations of 12,300 to 13,100 feet	Hoosier Ridge and Silverheels
Uinta Basin hookless cactus *Sclerocactus glaucus* (threatened)	Rocky hills, mesa slopes, and alluvial benches in desert scrub communities at elevations of 4,500- to 6,000 feet	Kannah Creek

Source: Colorado Natural Heritage Program 2008.

Habitat for Penland's eutrema is narrowly restricted to the Mosquito Range, where the plant occurs in alpine seeps on soils that remain wet year-round. This habitat is treeless, and based on projections of foreseeable activities in roadless areas under any alternative, there is no likely potential for oil, gas, or coal development, new roads, or tree-cutting activities in the Penland's eutrema habitat that occurs within roadless areas (IRAs or CRAs).

Uinta Basin hookless cactus "was listed as a threatened species, in part because of the potential of energy development and mining actions adversely impacting this species" (USDI Fish and Wildlife Service 1990a). The recovery plan for Uinta Basin hookless cactus specifically mentions a need to manage "oil and gas exploration, drilling, and production", as well as "road building and maintenance" for the protection of this threatened cactus species. Where the cactus occurs in the Kannah Creek Roadless Area, it is in the dry shrub plant communities in the southwestern part of the roadless area. Its habitat is outside the 158 acres under lease for oil and gas development in the northwestern part of the Kannah Creek Roadless Area. Therefore, there is no anticipated threat to this cactus from oil and gas activities including associated road building in the roadless areas under any alternative.

Consultation with the U.S. Fish and Wildlife Service in accordance with section 7 of the ESA has been initiated and is ongoing for this proposed rulemaking action. As part of the section 7 process, the estimated effects on federally listed plants from the preferred alternative will subsequently be documented in a biological assessment and submitted for U.S. Fish and Wildlife Service concurrence, once a preferred alternative has been clearly identified (between the draft and final EIS).

Forest Service Sensitive Species

Forest Service sensitive species are those designated by a regional forester for which population viability is a concern (Forest Service Manual 2670). All roadless areas in Colorado are within the Forest Service's Rocky Mountain Region except the Roc Creek Roadless Area, which is in the Intermountain Region. No Intermountain Region sensitive plants are known or likely to occur within the Roc Creek Roadless Area, based on communications with appropriate specialists from the Natural Heritage Program and Manti-LaSal National Forest (specialist report in EIS Record). No Forest Service sensitive plants are known or likely to occur in that roadless area. This analysis will include only those sensitive plant species in exhibit 1 in the Rocky Mountain Region's 2007 supplement to the Forest Service manual 2672.11(4).

Forest Service sensitive species have special conservation status and protection requirements. Forest Service objectives for sensitive species include: (1) ensure that sensitive species do not

become endangered or threatened by Forest Service actions; (2) maintain viable populations distributed throughout the species' geographic range on NFS lands; (3) implement management objectives for populations and/or habitat; (4) develop and implement conservation strategies; and (5) coordinate management with state and federal agencies, tribes, and other cooperators (Forest Service Manual 2670 including the Region 2 supplement to FSM 2670). The list of sensitive plant species includes consideration of plants that are "candidate" species for listing under the ESA.

There are 44 sensitive plant species known or likely to occur in the roadless areas in Colorado (table 35). This estimation was based on analysis of spatial GIS map data and species occurrence information, conducted and documented by the Colorado Natural Heritage Program (Colorado Natural Heritage Program 2008). The Natural Heritage Program's list of sensitive species known or likely to occur in each roadless area was reviewed by specialists on each of the national forests in Colorado and refined based on their additional inventory information or knowledge of the area (EIS record). Sensitive plant species that are not known or likely to occur in any roadless areas were eliminated from further analysis in this EIS.

Inventories of sensitive plant species on NFS lands in Colorado are incomplete, especially in roadless areas. However, based on available information from the Colorado Natural Heritage Program and personnel on the national forests, about one-third of the existing roadless areas (IRAs) are known or likely to support sensitive plants.

Table 35 provides a list of sensitive plant species within the roadless areas by general habitat group. The grouping of species by general habitat group was primarily based on habitat descriptions for each plant contained in the *Colorado Rare Plant Field Guide* (Spackman et al. 1997). Because the general habitat description categories used in these groups are not exclusive, it is important to note that some plants could be placed in more than one category. For example, plants that occur in alpine wetlands could be placed under either the alpine group or wetlands group, and some species may occur in more than one type of habitat. Nevertheless, these general categories provide a broad overview of the range of habitats that support sensitive plants in roadless areas, and the relative distribution of species among these habitats. The wetlands and high-elevation alpine habitat in roadless areas contain the widest variety of sensitive species.

Table 35. List and distribution of sensitive species by habitat groups within roadless areas

Habitat group	Scientific name	Common name
Alpine or subalpine	*Aliciella sedifolia*	stonecrop gilia
	Armeria maritima ssp. *sibirica*	Siberian sea thrift
	Braya glabella ssp. *glabella*	smooth northern-rockcress
	Draba exunguiculata	clawless draba
	Draba grayana	Gray's draba
	Draba smithii	Smith's draba
	Festuca hallii	plains rough fescue
	Ipomopsis globularis	Hoosier Pass ipomopsis
	Oreoxis humilis	Rocky Mountain alpineparsley
	Parnassia kotzebuei	Kotzebue's grass of Parnassus
	Ranunculus karelinii	ice cold buttercup
Wetlands, seeps, or wet areas	*Carex diandra*	lesser panicled sedge
	Carex livida	livid sedge
	Drosera rotundifolia	roundleaf sundew
	Eriophorum altaicum var. *neogaeum*	whitebristle cottongrass
	Eriophorum chamissonis	Chamisso's cottongrass
	Eriophorum gracile	slender cottongrass
	Mimulus gemmiparus	Rocky Mountain monkeyflower
	Ptilagrostis porteri	Porter's false needlegrass
	Rubus arcticus ssp. *acaulis*	dwarf raspberry
	Salix candida	sageleaf willow
	Salix serissima	autumn willow
	Sphagnum angustifolium	sphagnum
	Utricularia minor	lesser bladderwort
Meadows or open areas	*Botrychium campestre*	Iowa moonwort
	Botrychium lineare	narrowleaf grapefern
	Botrychium tax. nov. "furcatum"	fork-leaved moonwort
	Ipomopsis aggregata ssp. *weberi*	scarlet gilia
Aspen or conifer forests	*Astragalus ripleyi*	Ripley's milkvetch
	Cypripedium parviflorum	lesser yellow lady's slipper
	Penstemon degeneri	Degener's beardtongue
	Potentilla rupincola	rock cinquefoil
	Viola selkirkii	Selkirk's violet
Shale/clay barrens or other sparsely vegetated areas	*Astragalus missouriensis* var. *humistratus*	Missouri milkvetch
	Cirsium perplexans	Rocky Mountain thistle
	Eriogonum brandegeei	Brandegee's buckwheat
	Lesquerella pruinosa	Pagosa Springs bladderpod
	Machaeranthera coloradoensis	Colorado tansyaster
	Neoparrya lithophila	Bill's neoparrya
	Phacelia scopulina var. *submutica*	Debeque phacelia
	Thalictrum heliophilum	Cathedral Bluff meadow-rue
Piñon-juniper or shrublands	*Astragalus proximus*	Aztec milkvetch
	Astragalus wetherillii	Wetherill's milkvetch
	Penstemon harringtonii	Harrington's beardtongue

Sixteen sensitive plant species that are known or likely to occur in roadless areas (IRAs or CRAs) are considered endemic, because they occur only in Colorado. Endemic species may be at higher risk of extinction because of small population number and very limited geographic range.

Populations of four sensitive plant species occur in portions of IRAs (in alternatives 1 and 3) that are not included in CRAs (in alternative 2). These four sensitive species are:

- Smooth northern-rockcress (*Braya glabella*)
- Whitebristle cottongrass (*Eriophorum altaicum* var. *neogaeum*)
- Colorado tansyaster (*Machaeranthera coloradoensis*)
- Ice cold buttercup (*Ranunculus karelinii*).

In particular, some populations of the Colorado tansyaster are likely to occur in portions of five IRAs that are not included in CRAs, in addition to the species' likely occurrence in seven CRAs. In other words, 5 of the 12 occurrences of tansyaster in roadless areas would not have roadless status under alternative 2. The other three species also have occurrences in a portion of an IRA that is outside CRA boundaries and are additionally known or likely to occur within some CRAs. Altogether, a relatively small number of individual plant occurrences of these four sensitive plant species would be removed from roadless area protections under alternative 2 because of the difference in the boundaries between IRAs and CRAs.

Forest Service manual direction requires that potential adverse impacts on sensitive species must be avoided or minimized to a point that they do not result in a loss of viability or create significant trends toward federal listing (Forest Service Manual 2070.32, item #4). Management actions such as road construction or tree-cutting and removal typically include mitigation measures that adjust locations of these activities to avoid populations of sensitive plants. However, the manual direction also provides discretion to the line officer making the project-level decision to allow adverse impacts to sensitive species, provided that the decision does not result in loss of species viability or create significant trends toward federal listing of the species under the ESA.

In addition to policies that require actions to avoid or minimize harm to sensitive plants, projects may also be designed to have beneficial effects on sensitive plant populations. For example, projects implemented for forest health, fuel reduction, or other purposes where management activities may occur in roadless areas could be designed to correct poor road alignments or existing soil erosion impacts on sensitive plants, or to reduce the risk of a high-severity wildfire that might eliminate a sensitive plant population and its seed bank. Thus, some management actions in roadless areas could benefit sensitive plants over the long term, even if there are short-term adverse impacts.

Of the 44 sensitive plant species known or likely to occur in roadless areas, 5 sensitive plant species (roughly 10 percent of the total sensitive plant species) grow in forest habitats that might benefit from tree-cutting to reduce the risk of severe stand-replacing wildfires (the aspen/conifer habitat group listed in table 35). It is possible that other sensitive plants may also benefit from reduced risk of severe wildfires, because wildfires could spread into or otherwise adversely affect other habitat groups as well. However, depending on where and how equipment is brought on-site for fuel reduction projects, there also could be increased risk of

adverse impacts on sensitive plant species (for example, temporary road construction or skidder operations across shrublands or open areas).

Environmental Consequences – Direct and Indirect Effects

Alternative 1 – 2001 Rule (No Action)

Threatened and Endangered Species

As mentioned in the Affected Environment section, there would be no projected likelihood of impacts on threatened or endangered plants in IRAs from road construction or reconstruction, tree-cutting and removal activities, or energy resource development activities in IRAs (activities that differ by alternative). This is because (1) no endangered plants occur in IRAs and (2) those management activities would not be expected to occur where threatened plants occur in the IRAs. Thus, the risk of impacts on federally listed species under any of the alternatives would remain low over the 15-year analysis period (see Analysis Framework for details and underlying assumptions).

Potential direct impacts on threatened and endangered plants from future projects not foreseen in current projections for this analysis would be minimized by avoiding those specific plant populations as a result of site-specific project analysis and design.

There is some risk of indirect impacts on federally listed plants from the spread of invasive non-native plants that would increase as a result of road construction or reconstruction, tree-cutting and removal activities, or energy resources development activities that differ by alternative. Some invasive plants can spread from more distant activity areas (within or outside IRAs) into habitat for threatened or endangered plants. However, this risk is the lowest for alternative 1 compared to other alternatives because of the higher level of restrictions on new roads and other activities in the IRAs.

Under alternative 1 as well as other alternatives, the risk of adverse effects would be considered insignificant. Implementation of these alternatives is not likely to adversely affect threatened and endangered plant species because the projected activities foreseeable to occur in roadless areas would not overlap the portions of roadless areas where the only two threatened plant species occur. Continuing management under alternative 1 could benefit threatened and endangered plants primarily because it restricts or limits new road construction and other management activities within IRAs.

Sensitive Species

The potential risk of adverse impacts on sensitive plant species under alternative 1 and other alternatives is not related to the total projected miles of new road or acres affected by management activities, but rather to whether those activities may occur in the specific roadless areas where sensitive species are known or likely to occur. Likewise it is assumed that such activities would not pose a risk in IRAs where sensitive plants are *not* known or likely to occur. For example, the Hoosier Ridge Roadless Area supports ten sensitive plant species (and one federally listed plant), but road construction, road reconstruction, tree-cutting and removal, and energy resource development are not projected to be likely to occur in that roadless area under any alternative (see appendix C regarding the likelihood of those activities by roadless area).

In addition, it is assumed that there would be some risk of adverse impacts on sensitive plants related to inadvertent mistakes made during project implementation, the potential for invasive species invasion, or other unintended consequences from the management activities projected to occur over a 15-year period.

Of the 116 IRAs where sensitive plants are known or likely to occur, approximately 20 percent are projected to be likely to experience road construction or reconstruction, tree-cutting and removal, or energy resource development in some portion of the IRA under provisions of the 2001 Rule (see appendix C regarding projections). Examples of those projections include road construction for oil and gas under lease or private inholding access, as well as tree-cutting and removal for ecosystem treatments. The potential risk of adverse effects on sensitive plants is tied to the differences among alternatives in the likelihood of projected roading, tree-cutting and removal, and energy resource development. These activities would pose some risk of losing sensitive plants, as well as indirectly rendering the habitat unsuitable or promoting invasion by non-native species.

The overall risk of adverse impacts on sensitive plants from management activities in roadless areas would be considerably lower under alternative 1 compared to alternatives 2 or 3, because of the fewer number of management activities projected to occur in the IRAs that support sensitive plants. However, an unusual exception exists in three roadless areas where there would be a higher risk to the lesser panicled sedge (*Carex diandra*) under alternative 1 than under alternative 2 because more roading is projected to occur in those particular roadless areas under alternative 1 (in the Black Mountain, Elkhorn, and Nipple Peak North Roadless Areas on the Routt National Forest).

Indirectly, sensitive plants in IRAs may be affected by the spread of invasive plant populations. The abundance and distribution of invasive, non-native plants would likely increase over time as a result of roading, tree-cutting and removal activities, or energy resource development, because increased ground disturbance is known to enable existing infestations to expand or because new populations would become established from seeds or root fragments carried by vehicles and heavy equipment. Sensitive plants would be more likely than T&E plants to be affected by the spread of invasive non-native plants into IRAs because there are more sensitive plant habitats than T&E plant habitats in IRAs. Some of this potential indirect impact from invasive plants would be mitigated by implementation of the Forest Service's active weed management and prevention programs (see Invasive Plants section). Over time, weeds could spread from activity areas into sensitive plant habitat, even if the activities are conducted at some distance from these habitats. In general, the limitations on roading and other activities in alternative 1 would result in less risk of adverse effects on sensitive plants from invasive plants compared to what would be expected under alternatives 2 and 3.

Based on recent past trends, authorized activities in IRAs are designed and conducted to avoid habitat containing sensitive plant species, or at least to avoid a loss of population viability over the species' geographic range (as described in the Affected Environment section). Nevertheless, under any alternative, there would be some level of risk of accidental damage to or loss of sensitive plants during project implementation, or indirect impacts from increases in invasive plant populations. Those risks would be lowest under alternative 1 compared to alternatives 2 or 3 because of the substantially lower number of roadless areas supporting sensitive plants that are expected to experience additional management activities over the next 15 years.

There would a small potential for beneficial effects on sensitive plants from projected management activities in IRAs associated with improving ecosystem conditions, which in turn may improve sensitive plant habitat conditions. However, treating approximately 700 acres per year in IRAs to maintain or restore characteristics of the ecosystem as described in the Analysis Framework would not likely be of sufficient magnitude to measurably reduce soil erosion or the risk of severe wildfires within sensitive plant habitat.

Overall, alternative 1 may adversely affect individual sensitive plant populations but is not likely to result in a loss of viability for sensitive plant populations on any national forest in Colorado or cause a trend toward federal listing for the sensitive plant species analyzed in this document. The programmatic biological evaluation in the EIS record contains additional details about the potential effects on sensitive species, in accordance with policy requirements in Forest Service Manual 2670.32.

Alternative 2 – Colorado Rule (Proposed Action)

Threatened and Endangered Species.

Under alternative 2, effects on the two threatened plants identified as occurring or likely to occur in roadless areas would be almost the same as described for alternative 1. Implementation of any of the alternatives is not likely to adversely affect threatened and endangered plant species because the projected activities likely to occur in roadless areas would not overlap roadless areas where threatened or endangered plants are known or likely to occur.

The only difference would be a higher risk of indirect effects from invasive plants that could spread from more distant activity areas in other portions of the CRAs or outside CRAs into the threatened plant habitat within the CRAs. This increase risk is due to additional circumstances under which roading and tree-cutting activities are allowed, compared to alternative 1.

Sensitive Species

The risk to sensitive plants would be considerably higher under alternative 2 than alternative 1. More than 90 percent of the roadless areas that contain sensitive plants and vary by alternatives are projected to have roading, tree-cutting, or energy resource development activities in them under this alternative (as per projections in Analysis Framework section and appendix C).

There would be relatively little difference in the risk to sensitive plants related to the roadless area boundary adjustments under alternative 2. As described in the Affected Environment section, a relatively small number of individual sensitive plant populations occur in portions of IRAs that are not included in CRAs under the Colorado Rule, and those plant species have additional occurrences within some CRAs. None of the endemic sensitive plant species occur within IRAs that are not included in the CRAs under the Colorado Rule.

Of the estimated 57 CRAs that are known or likely to support sensitive plants, approximately 54 CRAs (about 95 percent) would likely experience road construction or reconstruction, tree-cutting and removal, or energy resource development in some portion of a CRA under provisions of the Colorado Rule (see appendix C). Thus, the risk of adverse impacts on sensitive plants would be higher under alternative 2 than under alternative 1. This is because alternative 1 has only 12 IRAs compared to 54 CRAs under alternative 2 that support sensitive plants and have projections of likely roads and/or other activities. Under all alternatives, the Forest Service would try to avoid sensitive plants during project implementation, or would apply appropriate

mitigation measures. However, there would be a risk of unintended adverse impacts related to the level of projected activities in the CRAs known or likely to support sensitive plants.

Indirect adverse impacts on sensitive plants from the expected spread of invasive non-native plants would be similar to the impacts described for alternative 1. However, there would be a higher potential for these impacts under alternative 2 than alternative 1 because of the higher number of projected activities over the next 15 years in the CRAs where sensitive plants are known or likely to occur.

There would be a potential for beneficial effects on sensitive plants, similar to those effects described for alternative 1, related to the expectation that the Colorado Rule would provide substantially more opportunity to improve forest health and reduce wildfire hazards compared to alternative 1 (refer to Fire and Fuels section). Compared to alternative projected treatments in CRAs under alternative 2 would have a higher chance of reducing the potential of an extremely hot fire eliminating a sensitive plant population and its seed bank. As was mentioned for alternative 1, only about 10 percent of the sensitive plant habitats in roadless areas grow in forests and similar habitats that would benefit from reducing the risk of a severe wildfire event. This means that 90 percent of the sensitive plant species in roadless areas are not in forest habitats that may experience reduced wildfire hazard. More importantly, compared to alternative 1, this alternative is likely to result in projected activities in 95 percent of the CRAs where sensitive plants are known or likely to occur, which increases the risk of adverse impacts on sensitive plants.

Overall, alternative 2 may adversely affect individual sensitive plant populations but is not likely to result in a loss of viability for sensitive plant populations on any national forest in Colorado or cause a trend toward federal listing for the sensitive plant species analyzed in this document. The programmatic biological evaluation in the EIS record contains additional details about the potential effects to sensitive species, in accordance with policy requirements in Forest Service Manual 2670.32.

Alternative 3 – Forest Plans

Threatened and Endangered Species

Under alternative 3, effects on the two threatened plants identified as occurring or likely to occur in roadless areas would be the same as described for alternatives 1 and 2. Implementation of any of the alternatives is not likely to adversely affect threatened and endangered plant species because the projected activities likely to occur in roadless areas would not overlap roadless areas where threatened or endangered plants are known or likely to occur.

The only difference would be that alternative 3 would result in a greater increase in the risk of invasive plants affecting T&E plants, compared to alternative 1. This risk would be approximately the same as described for alternative 2.

Sensitive Species

All the effects on sensitive plants under alternative 3 would be essentially the same as those described for alternative 2. This is because under alternative 3, 93 percent of the IRAs likely to support sensitive plants are projected to include roading, tree-cutting, or energy resource development activities over the next 15 years. This is close to the 95 percent estimation of the number of CRAs that support sensitive plants and include those same types of projected

activities under alternative 2. The difference between alternatives 2 and 3 is probably not meaningful and may be due to the incomplete sensitive plant inventory.

The indirect effects from invasive plants would be expected to be similar to effects described for alternative 2, because the level of activity in roadless areas where sensitive plants occur would be roughly the same under both alternatives. There also would be no substantial difference in effects on sensitive plants related to the boundary differences between IRAs and CRAs.

The potential for beneficial effects on sensitive plants would be the same as described for alternative 2 and would affect only a small percentage of the habitats where sensitive plants are known or likely to occur. Most IRAs supporting sensitive plants would not be improved by reductions in wildfire hazard. More importantly, in alternative 3, 93 percent of roadless areas that support sensitive plants would have projected activities in them over the next 15 year, which would increase the risk of adverse impacts on sensitive plant populations.

Overall, alternative 3 may adversely affect individual sensitive plant populations but is not likely to result in a loss of viability for sensitive plant populations on any national forest in Colorado or cause a trend toward federal listing for the sensitive plant species analyzed in this document. The programmatic biological evaluation in the EIS record contains additional details about the potential effects on sensitive species, in accordance with policy requirements in Forest Service Manual 2670.32.

Summary of Direct and Indirect Effects

The estimated effect on T&E species would not substantially vary by alternative 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 alternatives 2 and 3, compared to alternative 1, that invasive plants would spread into T&E plant communities (see table 36).

For sensitive species, the biggest difference among alternatives is that under alternative 1, projected activities that differ by alternative would be likely to occur in fewer than 20 percent of the roadless areas likely to support sensitive plants. Under alternatives 2 and 3, projected activities that differ by alternative would be likely to occur in more than 90 percent of the roadless areas likely to support sensitive plants.

The risk to sensitive plants would not substantially differ between alternatives 2 and 3 because the number of projected activities in roadless areas that support sensitive plants is not measurably different between these two alternatives. For example, the amount of projected oil and gas activities in roadless areas supporting sensitive plants would be highest under alternative 3 or alternative 2, and lowest under alternative 1. Oil and gas development would affect only nine roadless areas known or likely to support sensitive plants, and only three of these are roadless areas for which these activities vary by alternative. Coal development is not anticipated in any of the roadless areas that support sensitive plant species (refer to Analysis Framework section and appendix C for details on projected activities).

The risk of impact on sensitive plants would be higher under alternatives 2 and 3 compared to alternative 1 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 (see appendices C and E). Table 36 displays the differences among alternatives in the percent of roadless areas in which sensitive plants are known or likely to occur and projected activities vary by alternative.

Table 36. Percent of roadless areas in which sensitive plants are known or likely to occur and projected activities vary by alternative

Road-building or tree-cutting activities	Alternative 1	Alternative 2	Alternative 3
Unlikely	79%	5%	7%
Likely	19%	95%	93%

Table 37 displays a relative ranking of risks to T&E and sensitive plants associated with each of the alternatives, which reflects the previous narrative discussions.

Table 37. Relative rank of alternatives for risks due to levels of projected activities and associated threats from weed invasion or fragmentation

Activity or threat	Relative risk to T&E plants	Relative risk to sensitive plants
Oil and gas	Alt 1 = Alt 2 = Alt 3	Alt 1 < Alt 2 < Alt 3
Coal development	None anticipated	None anticipated
Roading	Alt 1 = Alt 2 = Alt 3	Alt 1 < Alt 2 = Alt 3
Tree-cutting and removal	Alt 1 = Alt 2 = Alt 3	Alt 1 < Alt 2 = Alt 3
Invasive species	Alt 1 < Alt 2 = Alt 3	Alt 1 < Alt 2 = Alt 3
Fragmentation*	Alt 1 = Alt 2 = Alt 3	Alt 1 < Alt 2 = Alt 3

Abbreviations and symbols: Alt—alternative; <—less than.
See discussion of fragmentation under Cumulative Effects.

Environmental Consequences – Cumulative Effects

Past, present, and reasonably foreseeable programs and activities in roadless areas and on lands of all ownerships immediately surrounding them that are likely to affect T&E and sensitive plants primarily include: tree-cutting and wood removals, livestock grazing, road work, energy development, and land conversion (for example, home construction on private lands outside roadless area). These actions may adversely affect T&E and sensitive plants, their habitats, or their pollinators, and may contribute to habitat fragmentation for the plants or their pollinators. These activities and other activities considered for this cumulative effects analysis are described more fully in the cumulative analysis framework appendix D.

Fragmentation of T&E or sensitive plant species habitat can result from the combined effects of a wide array of ongoing, future, or past management actions in and around roadless areas. Habitat fragmentation has been cited frequently as a concern for wildlife, and its impact on plants can vary widely depending on the species' breeding system, capacity for migration, and other factors (Lienert 2004). Although some plant species are able to persist in very small populations over long periods of time, there is also evidence for the disruption of plant–pollinator relationships in fragmented landscapes (Harris and Johnson 2004). The causes may include a lack of nesting sites for insect pollinators or reduced pollinator visits to small plant populations, which can lead to lower seed production, with subsequent reduced seedling recruitment and eventually smaller plant populations or local extirpation of the population.

Habitat fragmentation can also affect plant populations through a loss of genetic diversity within populations (USDA Forest Service and University of California 2006).

Climate change can be expected to alter the distribution of plants and other species (Hansen et al. 2001; Intergovernmental Panel on Climate Change 2007). Some species will be more vulnerable to the effects of climate change than others (Millar et al. 2007). Alpine plants may be among those in the most precarious situation because they already exist at high elevations; some are already on the highest points available in Colorado and they are isolated from potentially suitable habitat elsewhere. Pollinators may be more capable of migrating and may leave some plant species behind, unable to produce viable seed. Some of these changes are unlikely to occur to a measurable extent over the next 15 years, but other changes have already been documented. For example, earlier snowmelt near Crested Butte, Colorado, has been found to result in earlier flowering of some subalpine plants (Inouye 2008). Earlier flowering subjects these plants to frost, which results in significantly lower seed production, in turn leading to changes in plant community composition, which may alter habitat suitability for some plants and their pollinators. Additionally, changes in land use also challenge the ability of plants to adapt to climate change (Intergovernmental Panel on Climate Change 2007).

The Rocky Mountain Region of the Forest Service generally updates its sensitive species list every 2 years to account for new information. During an update, species are considered for sensitive status based on factors ranging from geographic distribution and abundance, to population trend and life history characteristics. There are currently more than 100 plant species for which insufficient information has been available to determine whether or not designation as sensitive species by the regional forester is merited. Information is being collected and evaluated in order to resolve the status of these species over the next 15 years. It is reasonable to assume that some would warrant sensitive status, while others would not. Those designated sensitive during the next 15 years that are known or likely to occur within roadless areas would likely be addressed during project-level analysis (except in cases where sensitive species policy no longer applies).

The effects of all these past, present, and reasonably foreseeable activities and climatic changes that are not part of the roadless rulemaking alternatives would likely combine with effects previously described for each of the roadless rulemaking alternatives. These cumulative effects cannot be quantitatively described in this programmatic evaluation. However, many human activities occurring in and adjacent to roadless areas would be likely to further (cumulatively) increase the risk of invasive plant spread or inadvertent impacts on T&E or sensitive plants in the roadless areas. For example, with increases in population growth and development adjacent to roadless areas, and recreation activities within the roadless areas, together with increases in climatic extremes and warming trends, there would be an increased risk of additive impacts on T&E or sensitive plants in roadless areas. Thus, based on the discussion of direct and indirect effects, the risk of cumulative effects would be somewhat lower under alternative 1 because the total amount of ground-disturbing activity would be less under that alternative than under alternatives 2 or 3.

TERRESTRIAL SPECIES AND HABITAT

This section evaluates effects of the alternatives on terrestrial (land-based) animal habitats and species. The animals evaluated in this analysis include mammals; birds; reptiles (snakes and lizards); amphibians (frogs, toads, and salamanders); and terrestrial invertebrates (insects).

This section focuses on threatened and endangered (T&E) and sensitive species; management indicator species (MIS); migratory bird species; and associated habitats. This approach covers the full range of habitats potentially affected by differences among the alternatives analyzed in this EIS. The analysis focuses on the habitat elements most likely to be affected by the alternatives, including habitat availability and effectiveness, fragmentation and connectivity, spread of non-native invasive species, and human access and disturbance.

A separate section evaluates aquatic habitat and species (excluding amphibians, which are addressed here). Another separate section covers T&E and sensitive plants.

A more detailed specialist report located the EIS record supports the evaluation that is summarized in this section of the EIS.

Affected Environment

Terrestrial Wildlife Habitats

Roadless areas provide large, relatively undisturbed blocks of important habitats for terrestrial animal species and communities. Because roadless areas are usually more than 5,000 acres in size, often border wilderness areas, and are largely unroaded and undeveloped, they typically provide:

- Critical wildlife travel, migration, and dispersal corridors and connectivity between large blocks of unfragmented habitat
- A higher degree of habitat diversity and complexity with higher levels of snags and down woody material compared to areas with more roads
- A high level of security and seclusion for wildlife during incubation, hatching, birthing, and rearing of young
- Islands of refugia or biological strongholds for species dependent on large, relatively undisturbed areas of land
- An increasingly important role in supporting native species viability and biodiversity because of the cumulative degradation and loss of other habitats in adjacent landscapes that are experiencing increases in human population growth.

Roadless area characteristics and values relevant to terrestrial species and habitats include the following (from chapter 1 of this EIS):

- A diversity of native and desired non-native plant and animal communities, due to the absence of disturbances caused by roads and accompanying activities
- Conservation of native biodiversity by serving as a bulwark against the spread of non-native invasive species

- Habitats for threatened, endangered, proposed, candidate, Forest Service sensitive species, and Colorado priority species (Colorado DNR Division of Wildlife 2006a), and for species dependent on large, undisturbed areas of land
- Biological strongholds and refuges for many species, including terrestrial and aquatic plant and animal species.

Roadless areas in Colorado are composed of a wide range of habitat types and range in elevation from approximately 7,000 to 14,000 feet above sea level. Compositionally, the predominant vegetation cover types are spruce-fir, aspen, lodgepole pine, and Douglas-fir, with smaller amounts of ponderosa pine and pinyon-juniper woodlands at lower elevations. Habitat structural types range from early through late successional stages, dominated by coniferous forest. Most roadless areas provide high-quality late-successional habitat, supporting a rich array of species that depend on the abundance of snags and down logs, large trees, and dense canopy cover. Refer to the Vegetation and Forest Health section for details on vegetation types and their distribution in the roadless areas.

Roadless areas also provide important summer and winter range habitat for big game species. Big game winter range is known to occur on more than 50 percent of the roadless areas. Deer fawning and/or elk calving habitat has been documented on more than 40 percent of roadless areas in the state, and approximately one-third of the roadless areas are known to have migration or linkage corridors in them.

The wide range of vegetation types and habitats in Colorado's roadless areas support a diverse array of animal species. There are approximately 600 native and non-native species of terrestrial animals that occur within the state. Roadless areas are considered to be rich in biodiversity (variety of species). In part this is because natural ecological processes remain essentially intact where there are low levels of human activity and habitat alteration.

Roadless areas typically contain a larger number of threatened, endangered, or sensitive species compared to adjacent national forest lands experiencing higher levels of vegetation management and human activity. Virtually all the roadless areas (except two or three) have a threatened, endangered, or sensitive species or habitat in them, based on known species occurrences and habitat requirements. The next two sub-sections discuss the relevant federally listed T&E species and Forest Service sensitive species.

Federally Listed Species and Habitats

Threatened and endangered (T&E) and proposed species and their designated critical habitats are evaluated in accordance with requirements set forth under section 7 of the Endangered Species Act (ESA), ESA regulations at 50 CFR 402, and Forest Service Manual 2670.31-2672.42). The ESA is intended to protect imperiled species from extinction along with the habitats on which they depend.

Pursuant to ESA requirements, the Forest Service initiated informal consultation with the U.S. Fish and Wildlife Service on this proposed rulemaking action, and will continue consultation throughout the development of this EIS. As part of the ESA section 7 consultation process, a biological assessment will be prepared on the potential effects of the agency's preferred alternative, sometime after the draft EIS has been completed and a preferred alternative has been identified. Although this proposed rulemaking action is not a "major construction activity" or site-specific activity for which a biological assessment is mandated under ESA

regulations at 50 CFR 402.02, both agencies agree that the prohibitions and permissions proposed under the Colorado Roadless Rule would indirectly have implications for listed species management and conservation within roadless areas.

In evaluating effects of the roadless area management alternatives on federally listed species, consideration was also given to the results of past biological assessments and consultations with the U.S. Fish and Wildlife Service on the 2001 Roadless Rule and on the forest plans for Colorado national forests. In 1999 and 2000, the Forest Service consulted with U.S. Fish and Wildlife Service and submitted a biological evaluation on the final 2001 Roadless Rule (the BE was finalized November 13, 2000). For the 2001 Roadless Rule, the Fish and Wildlife Service concurred with the Forest Service determination that the action *may affect but is not likely to adversely affect federally listed species.* The Fish and Wildlife Service further determined that the anticipated impacts would be beneficial to listed species due to the additional restrictions imposed on activities in IRAs in comparison to the restrictions imposed by solely by the forest plans.

Prior to evaluating effects of the proposed Colorado Roadless Rule and other alternatives on federally listed species, the Forest Service submitted to Fish and Wildlife Service a list of T&E species that are known or likely to occur in the IRAs in Colorado. Interagency consultation will continue to proceed between the draft and final EIS for the proposed Colorado Rule, and will conclude before a final rule is promulgated.

Evaluations conducted for this EIS found that of the ten T&E animal species known to occur in Colorado, there are six that occur or are likely to occur on NFS land within one or more roadless areas in Colorado (refer to appendix E showing national forests where T&E species are likely to occur). There is also a historical record for the black-footed ferret in a roadless area on the Arapaho and Roosevelt National Forests. Additionally, the grizzly bear is currently listed for the state but is not believed to occur in Colorado at this time. There are no species identified as proposed under ESA that presently occur in Colorado. The T&E species on Colorado's national grasslands and other areas outside the inventoried roadless areas are not included in this analysis.

There are no ESA candidate species known or likely to occur in any of the national forests in Colorado. While records exist for a candidate species and its habitat, the yellow-billed cuckoo (*Coccyzus americanus*), the data do not indicate that it occurs or has habitat in any of the roadless areas. Under regional policy, federal candidate species are automatically added to the Forest Service sensitive species list, and sensitive species are addressed later in this report.

The Forest Service estimated the potential for T&E (and sensitive species) to occur in roadless areas based on known occurrences and habitat potential (in the absence of dedicated animal surveys), using information and data from several sources including species' occurrence matrices housed at the Region 2 and 4 regional offices, Colorado Division of Wildlife comments on the Colorado Governor's roadless areas petition (Colorado DNR Division of Wildlife 2006b), species' occurrence databases of the Colorado Natural Heritage Program, and input from wildlife program managers on each of Colorado's national forests.

Table 38 displays the T&E animal species that occur or are likely to occur within approximately 330 to 350 roadless areas under any of the alternatives. The table displays key habitat requirements for each T&E species and the number of roadless areas where they occur or have

suitable habitat. Appendix E shows the national forests where these T&E species are known or likely to occur.

Table 38. Occurrence of threatened and endangered species or suitable habitat within roadless areas, under any alternative

Species and status (T) or (E)	Key habitat requirements	Roadless areas with T&E species occurrence or suitable habitat (# of RAs)
BIRD		
Southwestern willow flycatcher (E) *Empidonax trailii extimus*	Dense riparian thickets of willow, cottonwood, and other deciduous shrubs and trees about 13–23 ft. or more in height. At high elevations, shrub willows are a major component.	9
Mexican spotted owl (T) *Strix occidentalis lucida*	Nest and roost in closed-canopy forests and rocky canyons containing dense, uneven-aged stands. These characteristics are mostly found in mixed-conifer forests, but may also be found in ponderosa pine, Gambel's oak and riparian woodlands. In Colorado, most nests are in caves or on cliff ledges in steep, narrow canyons. A wider variety of habitats are used for foraging.	34
INVERTEBRATE		
Pawnee montane skipper (T) *Hesperia leonardus montana*	Restricted to the South Platte River drainage in Colorado; dry open ponderosa pine woodlands at 6,000–7,500 ft., sparse understory with blue grama (larval food) and prairie gayfeather (nectar).	4
Uncompahgre fritillary (T) *Boloria acrocnema*	Above timberline in patches of its larval host plant, snow willow. Most often found on cool, moist, north- and east-facing slopes.	16
MAMMAL		
Canada lynx (T) *Lynx canadensis*	Boreal forest (spruce-fir potential vegetation type) with cold winters, deep snow, and an adequate prey base of snowshoe hare. Cover types may include spruce, fir, lodgepole pine, Douglas-fir, and aspen.	303
Preble's meadow jumping mouse (T) *Zapus hudsonius preblei*	Riparian vegetation and adjacent upland vegetation up to ~7600 ft. elevation Lush undergrowth of grasses or forbs in riparian areas and moist meadows, often with tree and shrub cover.	17

Critical habitat has been designated by the U.S. Fish and Wildlife Service for two of the potentially affected T&E species listed in the table: Preble's meadow jumping mouse and Mexican spotted owl. Four roadless areas on the Arapaho and Roosevelt National Forests and two roadless areas on the Pike and San Isabel National Forests contain critical habitat for the Preble's mouse. Nine roadless areas on the Pike and San Isabel National Forests contain critical habitat for Mexican spotted owl. Appendix E identifies the designated critical habitat by roadless area.

Forest Service Sensitive Species

Forest Service sensitive species are species identified by a regional forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in

population numbers or density, or in habitat capability that would reduce a species' existing distribution (Forest Service Manual 2670.5). The Forest Service policy is to conserve sensitive species so that they do not become endangered or threatened by authorized activities and so that their habitats remain well-distributed throughout their geographic range on NFS lands (Forest Service Manual 2670.22). Therefore, the Forest Service provides special conservation status and attention to sensitive species in the planning and implementation of management activities. The list of sensitive species includes federal candidate species and species of greatest conservation concern identified in Colorado's 2006 Comprehensive Wildlife Conservation Plan (Colorado DNR Division of Wildlife 2006a).

There are 34 sensitive animal species that occur or are likely to occur in roadless areas, based on their known occurrence or habitat requirements. These consist of 19 birds, 11 mammals, 3 amphibians, and 1 invertebrate (insect). The comprehensive list of sensitive species for the Rocky Mountain Region (Region 2) and the Intermountain Region (Region 4) and their potential for occurrence in roadless areas in Colorado is contained in the EIS record. The sensitive species list from Region 4 is included because of the portion of the Manti-La Sal National Forest that overlaps a portion of Colorado is in Region 4. Table 39 displays the sensitive species that occur or have habitat in the roadless areas in Colorado (including IRA or CRA boundaries). It also shows which national forests in Colorado are associated with those species' habitats and roadless areas. Appendix F shows the specific roadless areas that contain T&E or sensitive species or key habitat features for those species where projected roading or tree-cutting activities differ by alternative (also shown on a map in the map packet).

Table 39. Sensitive animal species associated with roadless areas in Colorado

Species scientific name	Common name	Habitat	National forest
AMPHIBIAN			
Bufo boreas boreas	Boreal toad	Wetlands near ponds, lakes, reservoirs, rivers, and streams between approximately 7,500 and 12,000 ft. elevation. May be observed in other habitats during dispersal	AR, GMUG, PSI, RG, Routt and WR
Rana pipiens	Northern leopard frog	Smaller, semi-permanent ponds with emergent vegetation; disperses along creeks and small riparian areas	AR, GMUG, RG, Routt, SJ, WR
Rana sylvatica	Wood frog	Semi-permanent and temporary pools of natural origin and adjacent wet meadows; early fall seek hibernacula in upland forest habitat	AR, Routt
BIRD			
Accipiter gentilis	Northern goshawk	Large tracts of mature, closed canopy, deciduous, coniferous and mixed forests with an open understory	AR, GMUG, MLS, PSI, RG, Routt ,SJ,WR
Aegolius funereus	Boreal owl	Mature, mixed stands of subalpine fir and Engelmann spruce with cavities	GMUG,PSI, RG, Routt, SJ, and WR
Buteo regalis	Ferruginous hawk	Variety of habitat types but generally open grasslands east of the Continental Divide and shrub-steppe west of the CD; requires adequate supply of small rodents	WR

Species scientific name	Common name	Habitat	National forest
Centrocercus minimus	Gunnison sage-grouse	Relies almost entirely on sagebrush communities; wet meadow habitats interspersed within the sagebrush type also important	GMUG, PSI, RG
Centrocercus urophasianus	Greater sage-grouse	Sagebrush grasslands; sagebrush overstory, and grass understories important to breeding habitat	Routt, WR
Charadrius montanus	Mountain plover	Short-grass prairie; bare ground or prairie dog towns	PSI
Circus cyaneus	Northern harrier	Wide range of open wetland and upland habitats; during breeding season especially needs large tracts of undisturbed habitat	WR
Contopus cooperi	Olive-sided flycatcher	Forest openings and edges in mature forests and following natural and anthropogenic disturbances, such as tree fall gaps, fire, and logging; presence of snags essential	AR, GMUG, WR
Cypseloides niger	Black swift	Rock ledges associated with waterfalls	AR, GMUG, PSI, SJ, RG and WR
Falco peregrinus anatum	American peregrine falcon	Cliff habitat more than 200 ft. high with ledges suitable for nesting, usually associated with river corridors, reservoirs, or lake basins	AR, GMUG, MLS, PSI, RG, Routt ,SJ,WR
Haliaeetus leucocephalus	Bald eagle	Large trees for nesting near fish bearing aquatic ecosystems	AR, GMUG, MLS, PSI, RG, Routt ,SJ, WR
Lagopus leucurus	White-tailed ptarmigan	Alpine ecosystems at or above treeline or stream courses and meadows within the subalpine zone; primary winter food need is willow	AR, GMUG, PSI, WR
Lanius ludovicianus	Loggerhead shrike	Open habitats such as deserts, sagebrush, grasslands, and pastures	WR
Melanerpes lewis	Lewis's woodpecker	Open forest of less than 30 percent canopy cover and abundant snags; preference for pine forest may be stronger at low to medium elevations and for riparian cottonwoods at low elevation	AR, GMUG, PSI, RG, Routt, SJ, WR
Otus flammeolus	Flammulated owl	Open ponderosa pine or mixed conifer forests with cavities for nesting intermixed with grassy openings and dense thickets	AR, GMUG, SJ
Picoides dorsalis	American three-toed woodpecker	Mature and over-mature coniferous forests with dead and dying trees teeming with insects	AR, GMUG, MLS,RG, Routt, WR
Progne subis	Purple martin	Mature aspen forest with nearby meadows and open water; nest in cavities in live aspen trees	GMUG, WR
Spizella breweri	Brewer's sparrow	Obligate of sagebrush communities dominated by big sagebrush of canopy height less than 1.5 m; also occurs in shrubby openings in pinyon-juniper and mountain mahogany woodlands and large shrubby parklands within coniferous forests	WR
Tympanuchus phasianellus columbianus	Columbian sharp-tailed grouse	Mid-tall prairie grasslands, upland sagebrush, and montane scrub during breeding; riparian scrub and open coniferous forests in winter	GMUG, Routt, WR

Species scientific name	Common name	Habitat	National forest
INVERTEBRATE			
Speyeria nokomis nokomis	Nokomis fritillary (or Great Basin silverspot)	Wetlands associated with flowing water (i.e., springs, seeps, wet meadows); an abundance of their larval food plant (e.g., bog violet); and availability of adult nectar sources (mostly composites) during the adult flight	WR
MAMMAL			
Conepatus leuconotus	Common hog-nosed skunk	Riparian areas, rocky canyonlands, piñyon-juniper woodlands, shrublands, and grasslands that contain brushy and rocky habitat	PSI
Euderma maculatum	Spotted bat	Xeric and riparian habitats in deep, narrow canyons with cliffs and rocky outcrops	NLS, WR
Gulo gulo	North American wolverine	Wide-ranging species that prefers extensive tracts of remote wilderness coniferous forests and riparian areas in winter; often associated with talus and downed woody debris for denning	AR, GMUG, PSI, RG, Routt ,SJ,WR
Lontra canadensis (syn. Lutra canadensis)	North American river otter	Streams, lakes, and reservoirs, wetlands	AR, Routt, SJ, WR
Martes americana	American marten	Mesic (moist), dense coniferous forests with complex physical structure; in winter prefer mature and old-growth conifers; summer habitat use is somewhat broader; large snags, large logs, large live spruce-fir trees, and squirrel middens are important characteristics of maternal dens	AR, GMUG, RG, Routt, SJ, WR
Myotis thysanodes	Fringed myotis	Low- and mid-elevation mines in steep river valleys, large canyons, or other sites having steep and rock terrain	AR, GMUG, PSI, RG
Ovis canadensis canadensis	Rocky Mountain bighorn sheep	Open habitats, such as alpine meadows, open grasslands, shrub-steppe, talus slopes, rock outcrops, and cliffs	AR, GMUG, PSI, Routt, SJ, WR
Plecotus townsendii (syn. Corynorhinus townsendii)	Townsend's big-eared bat	A wide variety of habitats from arid sagebrush and juniper breaks to high-elevation forests including caves, mines, and rock crevices	AR, GMUG,MLS, PSI, RG, WR
Sorex hoyi (syn. Microsorex hoyi)	Pygmy shrew	Ssp. montanus in Colorado occurs in moist coniferous forest, possibly preferring late-seral stands and the edges between wet and dry forest types	AR, GMUG, Routt, WR
Vulpes macrotis	Kit fox	Desert and semiarid habitats, inhabiting mixed-grass shrublands, shrublands, and margins of pinyon-juniper woodlands	GMUG
Vulpes velox	Swift fox	Variety of habitats including shortgrass and mid-grass prairies, plowed fields and fencerows, and sagebrush; select low-growing vegetation and relatively flat terrain, friable soils, and high den potential (prairie dog towns/burrows, badger burrows), and areas near roads	Routt

Key to national forest abbreviations: AR = Arapaho/Roosevelt; GMUG = Grand Mesa, Uncompahgre and Gunnison; MLS = Manti La Sal; PSI = Pike and San Isabel; RG = Rio Grande; SJ = San Juan; WR = White River.

Source: US Fish and Wildlife Service and Forest Service list of federally listed species, for national forests in Colorado, April 2008 (in EIS record).

Inventories of sensitive species on NFS lands are incomplete, especially in roadless areas. However, based on available information, it appears that the following sensitive species or habitats (five birds and one mammal) are the most prevalent in terms of number of roadless areas for which data occur: white-tailed ptarmigan, flammulated owl, boreal owl, northern goshawk, olive-sided flycatcher, and American marten.

Management Indicator Species (MIS)

Management indicator species (MIS) are species identified in forest plans for each national forest, as indicators of the effects of management activities on specific habitat types or features, as a means of compliance with the National Forest Management Act. There are 36 MIS animal species represented for the national forests in Colorado excluding those selected for national grassland ecosystems: 23 birds, 11 mammals, 1 amphibian (toad), and 1 invertebrate (insect). All 36 MIS are likely to occur in at least one roadless area and therefore are relevant to this analysis.

Of the 36 MIS that have habitat in portions of roadless areas, 5 were previously discussed as T&E species, and 7 were discussed as sensitive species. Thus, there are 24 MIS that have not been previously discussed, including elk and mule deer because they are important game species in Colorado. The MIS that are also threatened (T), endangered (E), or sensitive (S) are indicated in the table, as those have already been discussed.

Table 40 displays the population and habitat trend for each terrestrial MIS, based on the latest MIS monitoring report for each national forest in Colorado, as well as the reason the species was selected as a MIS, based on each national forest plan in Colorado.

Table 40. Terrestrial management indicator species, their population and habitat trend in Colorado, and reason for selection

MIS species	A/R	GMUG	MLS	PSI	RG	ROUTT	SJ	WR	Reason for sselection
MAMMALS									
Abert's squirrel		D/U	U/S	I/U			S/S		Management of ponderosa pine forest (GMUG, PSI)
American marten (S)		D/U					I/S		Management of spruce-fir forest (GMUG, Rio Grande)
Beaver							I/I		Riparian habitat
Bighorn sheep (S)	D/U								Management of forest openings (AR)
Black bear							D/S		Economically important, forest generalist
Canada lynx (T)							S/S		T&E species (San Juan)
Cave bats (S)								S/D	Management of cave recreation (WR)
Deer mouse							I/I		Early successional stages
Elk	S/U	S/U	S/S	I/I	D/S		S/D	D/U	Management of roads (GMUG, Rio Grande, WR), Public interest (PSI); juxtaposition of openings and forest cover (AR)
Mule deer	D/U		I/S		I/S		S/D		Habitat interspersion (AR); road density (Rio Grande)
River otter (S)							I/I		Sensitive species
BIRDS									
American pipit								U/U	Alpine grasslands (WR)
Brewer's sparrow (S)		D/U						U/U	Sagebrush shrubland management (GMUG, WR)
Bald eagle (S)							S/S		Sensitive species (San Juan)
Brown creeper					I/I				Management late succession spruce-fir (Rio Grande)
Columbia sharp-tailed grouse (S)							U/S		Sensitive species (San Juan)
Golden-crowned kinglet	D/U					S/D			Interior forest (AR), Spruce-fir forest timber management (Routt)
Green-tailed towhee							S/S		Mountain shrub communities
Hairy woodpecker	I/U						S/S		Snag management (AR)
Hermit thrush					S/S				Forest management (Rio Grande)
Lincoln's sparrow					S/S				Riparian willow management (Rio Grande)
Mallard							I/I		Economically important, wetlands
Merriam's wild		I/U					I/S		Management of oak, pinion/juniper, and ponderosa

MIS species	A/R	GMUG	MLS	PSI	RG	ROUTT	SJ	WR	Reason for sselection
turkey									pine (GMUG)
Mexican spotted owl (T)							U/S		T&E species (San Juan)
Mountain bluebird	S/U						S/S		Openings adjacent to forest (AR)
Northern goshawk (S)		D/U	U/U			S/U	S/S		Mature and older aspen, mixed conifer, and spruce-fir forest (GMUG); lodgepole pine timber management (Routt)
Pygmy nuthatch	S/U				S/S				Late succession ponderosa pine (AR, Rio Grande)
Red-naped sapsucker		S/U							Mature aspen in riparian areas (GMUG)
Southwestern willow flycatcher (E)							U/S		T&E species (San Juan)
Vesper sparrow					S/S	S/U			Rangeland residual forage and mountain grasslands (Routt, Rio Grande)
Virginia's warbler								U/U	Shrub management and shrub related species (WR)
Warbling vireo	S/U								Aspen community status (AR)
Wilson's warbler	S/U				S/S	D/U			Mountain riparian and wetland communities (AR); herbivore in riparian areas (Routt); riparian willow (RG)
AMPHIBIANS AND INSECTS									
Boreal toad (S)	D/U								Mountain riparian and wetland communities (AR)
Uncompahgre fritillary butterfly (T)							S/S		Wetland communities (SJ)

(T)(E)(S) indicate MIS that are listed as threatened (T), endangered (E), or sensitive (S) species.

Population trend and habitat trend are indicated with "I" for increasing, "D" for decreasing, "S" for stable, and "U" for unknown.

Source: MIS monitoring and evaluation reports completed for each national forest in Colorado (in EIS record).

A/R=Arapaho and Roosevelt National Forests; GMUG=Grand Mesa, Uncompahgre, and Gunnison National Forests; MLS=Manti-La Sal National Forest; PSI=Pike and San Isabel National Forests; RG=Rio Grande National Forest; SJ=San Juan National Forest; WR=White River National Forest.

Migratory Birds

The Forest Service also provides special conservation status and management attention for migratory bird species, in accordance with Executive Order 13186 and federal and state regulations associated with the conservation of those species. In evaluating potential effects on migratory birds, the Forest Service focuses on effects on the highest priority migratory bird species as listed by Partners in Flight (Partners in Flight 2007), together with the important bird areas and important over-wintering areas identified by the National Audubon Society (2000).

The Colorado Bird Conservation Plan (Colorado Partners in Flight 2000) identifies priority species and habitats and establishes objectives for bird populations and habitats in Colorado.

The roadless areas of Colorado are located within the Southern Rocky Mountains and the Colorado Plateau physiographic areas PA62 and PA87 (Colorado Partners in Flight 2000).

Because of the diversity of vegetation and habitat conditions in the roadless areas, a vast diversity of migratory bird species use roadless areas in Colorado. Migratory bird monitoring has been conducted annually from 1998 to 2007 through the implementation of the Forest Service partnership program, Monitoring Colorado Birds, which is being implemented in partnership with the Colorado Division of Wildlife, the Rocky Mountain Bird Observatory, the Bureau of Land Management, and the National Park Service. Monitoring is conducted annually during the breeding season across Colorado. Monitoring transects were randomly located in order to sample habitats that are representative of the state (Leukering et al. 2000). Of approximately 499 (current and retired) monitoring transects in Colorado, 10 transects (2 percent) exist within portions of the IRAs and 5 transects (1 percent) exist in portions of CRAs. Monitoring has focused on transects along roads, although the newly redesigned program is no longer road-based. Starting in 2008, of the 184 sampling units in Colorado, 44 (24 percent) occur in IRAs and 42 (23 percent) occur in CRAs.

The National Audubon Society defines important bird areas (IBAs) that are vital to bird migration, breeding, and wintering. Of the 53 IBAs designated in Colorado, two are within roadless areas or their adjacent wilderness areas on the White River National Forest: Hanging Lake IBA (in Grizzly Creek IRA) and Alfred M. Bailey Bird Nesting Area IBA (in Eagles Nest Wilderness adjacent to the Maryland Creek Roadless Area). Audubon has identified potential threats to the Hanging Lake IBA as habitat disturbance from recreational rock and ice climbers. The management activities projected to occur within this roadless area do not differ among alternatives. The Alfred M. Bailey Bird Nesting Area IBA was so-designated because it is one of the most diverse mountain bird breeding sites in Colorado, with approximately 44 species of breeding birds identified. Audubon has identified potential threats to this IBA as habitat conversion of the surrounding forest by logging.

Environmental Consequences – General

This subsection provides the background for understanding the environmental consequences described in more detail in the next part of this evaluation, while minimizing the need to reiterate effects of activities common to all alternatives. It provides a general discussion of potential impacts on animal species and their habitats from road construction and reconstruction (that is, roading), tree-cutting and removal activities, and energy resource operations. Those are the activities that differ by alternative and would likely have an effect on animal species and their habitats in roadless areas.

Forest plans for the national forests in Colorado contain numerous standards and guidelines designed specifically to maintain or improve habitat for terrestrial animal species, especially T&E and sensitive species, as well as MIS. Additional requirements in laws, regulations, and agency policies are aimed at conservation of these species or their habitats. Site-specific mitigation measures to address those standards and guidelines are identified during project-level planning. Thus, while the discussions in this section focus on the potential for adverse effects from roads and other management activities that differ by alternative, those potential adverse effects are expected to be either avoided or minimized during project planning and implementation.

The effects of livestock grazing, recreational activities, prescribed burning, road maintenance, and other activities likely to continue to occur in roadless areas that do not differ by alternative are not evaluated, except in the cumulative effects portion of this section.

Road Construction and Reconstruction

Almost all roads present some level of benefit and risk to animal species but vary greatly in degree and can shift over time (USDA Forest Service 2000c). The potential impacts of roads on terrestrial species and their habitats are well-documented in the scientific literature. Based on several comprehensive syntheses on this topic (Wisdom et al. 2000; Trombulak and Frissell 2000; Forman et al. 2003), effects of roads on animal habitats can be organized into the following categories: habitat availability and effectiveness; habitat fragmentation; invasive species; and human access and disturbance. These categories are not mutually exclusive as they represent many interrelated effects.

Habitat Availability and Effectiveness

Roading and road use can affect habitat availability. First, construction and reconstruction of roads can contribute to an immediate loss of habitat by removing existing vegetation and altering the substrate (Forman et al. 2003). Because roads, especially in the roadless areas, tend to be narrow (approximately 12 to 14 feet wide), their contribution to habitat loss on a landscape scale may appear minimal. However, the total extent of the landscape that is roaded has consequences for habitat availability (Forman et al. 2003). The higher road densities that exist outside roadless and wilderness areas increase the important role of roadless areas as refugia for terrestrial animal species. In addition, the impact of the direct loss of habitat from road construction may be more significant for species that are restricted to a narrow geographic range (endemic species), such as several amphibians, reptiles, small mammals, and various invertebrates.

The indirect effects of roading, tree-cutting, and other activities are known to cause noise and visual disturbance to various species. Disturbances from these activities (that vary by alternative) can displace wildlife species or cause them to avoid habitats that would otherwise be suitable. Where avoidance of a particular area due to disturbances is 100 percent, this effect equates to habitat loss as opposed to a decrease in habitat quality (Forman et al. 2003).

Larger animals with larger home ranges appear particularly vulnerable to habitat effects associated with roads and road use (Forman et al. 2003). Roads have been found to reduce habitat effectiveness across all seasons for female black bears (Gaines et al. 2005). Some evidence suggests that martens may use areas adjacent to forest roads less than they use interior habitats (Robitaille and Aubry 2000), although at a large scale martens were not found to select against roads or logging in winter habitat (Mowat 2006). Although some studies are inconclusive regarding the effect of increasing road density on habitat use by lynx, the U.S. Fish and Wildlife Service found that the lynx is threatened by human alteration of forests and by increased levels of road access into lynx habitats (Ruediger et al. 2000, USDI Fish and Wildlife Service 1998a). Factors identified as threats to lynx included timber management, forest and backcountry roads and trails, fragmentation and degradation of lynx refugia, and habitat degradation by non-native invasive plant species.

Roads can reduce habitat effectiveness and use by ungulate species (hoofed grazing animals) such as deer and elk. Habitat effectiveness for deer and elk has been shown to decrease with

increases in road density and use in some areas (Thomas et al. 1979, Cole et al. 2004, Marshal et al. 2006, Rowland et al. 2004). Areas of higher road density and use can increase hunting (and poaching) pressures, which can exacerbate avoidance behavior and displacement of deer and elk. Such displacement can have implications for survival and recruitment where these areas are important for foraging and reproduction (Donadio and Buskirk 2006, Laurance et al. 2006). Forest edge habitat created by road construction and/or tree removals also provides access to interior forest patches for opportunistic or predator species (Norse et al. 1986).

Numerous reviews of scientific literature on species–road relationships have been conducted, some of which are summarized below. In one such evaluation, for 91 vertebrate species in the Interior Columbia River Basin (Wisdom et al. 2000) found that more than 70 percent of those species could be negatively affected by one or more factors associated with roads. Effects included detrimental changes in species distribution, composition, and population size. Some of the findings include:

- Road construction converts large areas of habitat to non-habitat; that is, habitat loss (Hann et al. 1997, Reed et al. 1996).
- Loss of large trees, snags, logs, or other key habitat features by tree-cutting in areas adjacent to roads has adverse effects on cavity-dependent birds and mammals (Hann et al. 1997).
- Roads facilitate poaching (illegal unregulated hunting) of animals (Cole et al. 1997, Dood et al. 1985, Knight et al. 1988, McLellan and Shackleton 1988, Mech 1970, Stelfox 1971, Yoakum 1978).
- Reptiles seek roads for thermal cooling and heating and experience substantial mortality from motorized vehicles (Vestjens 1973).
- Roads facilitate more human activity, and many species are sensitive to harassment or human presence during particular seasons, with potential reductions in productivity, increases in energy expenditures potentially influencing survivorship, or displacements in population distribution or habitat use (Bennett 1991, Mader 1984).
- Roads restrict the movements of small mammals (Mader 1984, Merriam et al. 1988, Swihart and Slade 1984) and function as barriers to population dispersal (Oxley et al. 1974).
- Individual species are often killed during road construction or from being hit by vehicles (Trombulak and Frissell 2000).
- Species and their habitats are indirectly affected from invasive nonnative species (Trombulak and Frissell 2000).
- Some bird species have demonstrated sensitivity to roads. In selecting nest sites, species including bald eagles, golden eagles, and sandhill cranes may avoid areas close to roads (Anthony and Isaacs 1989, Fernandez 1993, Norling et al. 1992), and nesting behavior of female sage grouse appeared to be altered by road traffic (Lyon and Anderson 2003).

Temporary roads that would be built for forest health and fuel reduction activities present most of the same risks posed by permanent roads, although the impacts would likely be of shorter duration because temporary roads would be decommissioned after use. Roads built in support

of energy resource operations are expected to be in use for several decades or longer before they are decommissioned.

Road reconstruction can pose many of the same risks as road construction. For example, road realignments, and road re-grading and re-surfacing projects, may promote increases in human disturbances and disruptions to species and habitats, exceeding those previously experienced before reconstruction.

Fragmentation and Connectivity

Roads also contribute to changes in habitat quality and availability by fragmenting habitats in previously intact landscapes. As road densities increase, edge habitats increase and interior patches decrease, reducing habitat available to species requiring interior habitats. For example, Ortega and Capen (2002) noted that densities of forest-interior dwelling birds were significantly lower in forested areas adjacent to unpaved roads. Ingelfinger and Anderson (2004) found that breeding birds associated with sagebrush habitat were less abundant within 100 meters of roads than beyond this distance, and suggested that these species could have been responding to edge and fragmentation effects.

Edges created by roads not only alter the configuration and availability of interior habitat, they can alter conditions within interior habitats along roads, such as microclimate and humidity (Chen et al. 1996, Chen et al. 1993). Such changes may make these areas less hospitable to particular species (Marsh and Beckman 2004).

Habitat can become inaccessible to species where roads function as a barrier to their movement, particularly for species such as rodents, reptiles, turtles, snails, and salamanders (Trombulak and Frissell 2000, Baur and Baur 1990, Merriam et al. 1988, Swihart and Slade 1984, Oxley et al. 1974, Weatherhead and Prior 1992, Marsh et al. 2005). Roads acting as barriers to species movement can result in substantial amounts of suitable habitat being unavailable to these species and can fragment populations into smaller subpopulations through loss of habitat connectivity (Shine et al. 2004). Loss of habitat connectivity can lead to demography fluctuations, inbreeding, loss of genetic variability, and local population extinctions (USDA Forest Service 2000c). Where roads function as barriers to movement, travel, and dispersal, they can significantly alter population demographics and genetics of a species (Reh and Seitz 1990; Rico et al. 2007). These forest fragmentation impacts on populations can increase the risk of local extirpations or extinctions (Noss and Cooperrider 1994; Findlay and Bourdages 2000).

Refugia (back-country landscapes that are not readily subjected to hunting and frequent human disturbance) are recognized as necessary for persistence of forest carnivore populations by supporting source populations that can repopulate adjacent landscapes via dispersal and emigration. Mid- to large-sized carnivores require large home ranges and exhibit specialized biological and habitat requirements; they are therefore particularly vulnerable to habitat fragmentation. A large majority of the roadless areas in Colorado provide key seasonal habitats for the Canada lynx and connecting landscape linkages vital to healthy populations and persistence of the species in the southern Rockies.

Roadless areas contain an abundance of alpine and subalpine forest habitats, including wetland and bogs, which are ecologically sensitive habitats that show significant impacts after minor use (HaySmith and Hunt 1995). The dry, cold climate; short growing season; and slow formation of new soil affect the time required for plant regeneration, making these habitats particularly fragile and susceptible to disturbance (Fitzgerald et al. 1994).

Spread of Non-native Invasive Plants

Many non-native plants establish themselves preferentially along roadsides and in other disturbed habitats (Trombulak and Frissell 2000, Parendes and Jones 2000), as described in the Invasive Plants section. Other non-native animal species and other organisms can affect native animal species and their habitats. For example, building roads into grassland habitats can lead to invasions by parasitic cowbird species, thus reducing reproductive success in passerine species such as sparrows, blackbirds, and meadowlarks (Patten et al. 2006). 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. Local die-offs of boreal toads (an MIS) have occurred in Colorado from infection by the chytrid fungus (*Batrachochytrium dendrobatidis*) (Loeffler 2001).

Human Access and Disturbance

Roads facilitate human access and activities that can contribute to habitat alteration and direct and indirect mortality of some animal species, including collisions and crushing. Large numbers of animals are killed annually on roads, including NFS roads. Amphibians and reptiles appear to be especially vulnerable to roadkill for a variety of reasons (Andrews and Gibbons 2005, Mazerolle et al. 2005, Vestjens 1973; USDA Forest Service 2000c). In addition, decreased nest success of pied flycatchers along busy roads might be due to mortality of parent birds resulting from vehicle collisions (Kuitunen et al. 2003).

Semi-aquatic mammals such as beaver (an MIS) and river otter (a sensitive species) can be severely affected by loss or fragmentation of wetland or riparian habitat, and from roads and human disturbance near their aquatic habitat.

Wild ungulate populations (deer, elk, pronghorn antelope, wild sheep, and goat), can be affected by roads and tree cover removals that affect their security and habitat conditions. Winter range is considered the primary limiting factor within the environment. Human disturbance during winter months can result in displacement and physiological stress that can lead to impacts on reproduction and survival rates (Freddy 1986; Freddy et al.1986; Morrison et al. 1991).

As mentioned previously, roads allow people to access landscapes that would otherwise be difficult to reach. Even with closing roads to public vehicle travel, as would be likely to occur for most of the roads built in roadless areas, there would be more potential for human access into and through roadless areas if the number of roads in roadless areas increases. Associated impacts on animal species or their habitats from increases in human access and activities include:

- Avoidance of areas frequented by humans.
- Increased physiological stress, manifested in decreased recruitment and survival.
- Adverse effects on cavity-dependent birds and mammals from the loss by tree-cutting of large trees, snags, and logs in areas adjacent to roads (Hann et al. 1997).
- Increased wildfire ignitions that can result in both habitat loss and degradation.
- Increased vulnerability to hunting and poaching (Cole et al. 1997, Dood et al. 1985, Hayes et al. 2002, Knight et al. 1988, McLellan and Shackleton 1988, Mech 1970, Stelfox 1971, Yoakum 1978).

- Increased access for recreational shooting of animals such as ground squirrels (Ingles 1965, USDI Fish and Wildlife Service 2003).
- Bats are particularly sensitive to human disturbance, especially during hibernation periods if bats are disturbed in their maternal or hibernacula roosts. Roads can also affect bat populations by any reduction in insect populations. The Townsend's big-eared bat, fringed myotis, and spotted bat are examples of sensitive species associated with roadless areas in Colorado.

Potential beneficial effects of increasing human access into roadless areas include:

- More ready or convenient access for some plant and wildlife management activities (such as census survey and collection, and structure maintenance)
- Easier access for habitat restoration and enhancement using stand manipulation and vegetation management for some species
- Easier access for hunting, wildlife viewing, and photographing activities.

Although access is facilitated by roads for activities potentially beneficial to wildlife in the long term, in reality roads are not required to conduct wildlife habitat improvement activities.

Tree-cutting and removal activities

The primary purposes of the projected tree-cutting activities in roadless areas under one or more alternatives are to reduce hazardous fuels that could lead to uncharacteristic or unwanted wildfires or to reduce large insect-disease outbreaks (see Analysis Framework). Tree-cutting is also projected to occur in localized areas for incidental purposes such as for existing land use authorizations, hazard tree removal, and other allowable uses.

Tree-cutting is expected to be primarily in lodgepole pine, ponderosa pine, and pinyon-juniper cover types (Analysis Framework). Activities related to the tree-cutting and wood-removal activities may include: road construction or reconstruction, felling trees and scattering or piling the slash (unmerchantable wood generated by the cutting), and use of large machines to facilitate the cutting or disposal of cut material. In addition, tree-cutting in the roadless areas would most often be conducted in conjunction with prescribed burning, often to reduce slash accumulations after thinning operations. The effects of activities associated with tree-cutting are often difficult to separate from the effects of road construction and use. However, the following discussions focus on effects of the tree-cutting and wood-removal activities.

Habitat Availability and Effectiveness

Tree-cutting and wood removal can alter habitat availability, configuration, and effectiveness for terrestrial animal species. Uneven-aged management and thinning would be the most common regimes used in roadless areas and would have variable effects on animal communities, depending on the species. Thinning densely stocked conifer stands has been found to decrease detected abundance of some bird species while increasing abundance of other bird species (Hayes et al. 2003). Patriquin and Barclay (2003) also documented differential responses of bats depending on species.

Several studies have found that post-fire salvage logging reduces diversity and densities of cavity-nesting birds (Hutto and Gallo 2006, Wesolowski et al. 2005). Decreases in primary cavity

nesters may be due to a reduction in food availability compared to nest sites where sufficient snags are retained to support maximum densities of birds (Hutto and Gallo 2006).

Fragmentation and Connectivity

Research over the past two decades has shown that habitat edge is not benign to many species (Noss and Cooperrider 1994). The edge effect associated with tree removals can extend substantial distances from the harvest area. Some harvest activities create new edge habitat that influences air and soil temperature, wind velocity, radiation, and soil and air moisture in the adjacent forest stands (Chen et al. 1995). Further, creation of edge due to harvest can result in the introduction of edge-dwelling species, such as parasitic cowbirds or non-native invasive plants, which can have detrimental effects on native, interior forest-dwelling species (Baker and Lacki 1997, Robinson et al. 1995, Rosenberg et al. 1999). The establishment of these non-natives can lead to habitat loss, inter-specific competition, loss of quality forage, and lowered reproductive success for some plant and wildlife species (Trombulak and Frissell 2000).

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. Many amphibian species are found in lower densities in some timber harvest areas when compared to unmanaged forests (Ash 1997; Gibbs 1998; deMaynadier and Hunter, Jr. 1998, 1999; Petranka et al. 1993). Factors identified as potential threats to the lynx included some types of timber harvest, fragmentation, and degradation that potentially reduced essential prey habitat (Ruggiero et al. 1994; USDI Fish and Wildlife Service 1998a).

Human Access and Disturbance

Habitat and species disturbance from tree-cutting activities displaces animals previously occurring on or in proximity to the treatment locations. However, more significant effects on terrestrial species are due to the increased activity associated with the roads built for treatments.

Invasive Species

As described for roading activities, tree-cutting 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.

Beneficial Effects of Tree-Cutting

Beneficial effects on terrestrial species from tree-cutting and associated activities are often due to projects where the primary objective considers creating or maintaining some specific habitat condition. Tree-cutting creates forest age-class diversity and mosaic habitats used by some species (Wisdom et al. 2000; USDA Forest Service 2000c; Southern Appalachian Man and the Biosphere 1996, USDA Forest Service 1995a, USDI Fish and Wildlife Service 1990b, USDI Fish and Wildlife Service 1976). 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.

Some species require early seral or open-forest habitats that can be created and maintained by properly planned, restorative tree cutting. Tree-cutting may also reduce the risk of large stand-replacing insect and disease outbreaks and severe wildfires. These disturbance events can

present both benefits and risks to some species (Wisdom et al. 2000, USDI Fish and Wildlife Service 1995, USDA et al. 1993), at least at a local level. Some examples of the potential beneficial effects of tree-cutting include the following:

- The snowshoe hare, a primary lynx prey species, can benefit from properly planned regeneration harvests (USDA Forest Service 2000c).
- Juvenile goshawks could benefit from forest management regimes that are designed to support abundant prey items while maintaining forest structural conditions to allow juveniles to access prey within breeding areas (Wiens et al. 2006).
- Some species of bats appear to respond favorably to thinning in forested ecosystems (Loeb et al. 2002).
- Management activities such as tree thinning may be beneficial in producing and maintaining the desired conditions for sustaining goshawks and their prey species (Reynolds et al. 1991).
- Forest harvest can increase food resources for black bears, because of an increase in soft mast that is typically more limited in stands with significant overstory canopy. Where food resources are not limiting, forest management will have limited impacts on populations (Mitchell and Powell 2003).

Mineral and Energy Resource Operations

The alternatives do not vary in terms of projected mining for saleable (common variety) or locatable (hard-rock) minerals. The differences in effects among alternatives are associated with leaseable mineral exploration and development activity (oil, gas, and coal) across the three alternatives.

Oil and gas development activity (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 activities, and road construction (most roads are associated with the methane vents). Since the 1960s, about 70 miles of coal-related road construction has occurred in roadless areas. These activities and projected energy resource operations are described in the Analysis Framework and Leasable Minerals (Energy Resources) sections.

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

- Increased disturbance and associated physiological and reproductive effects on certain wildlife.

Environmental Consequences – Direct and Indirect Effects

This part summarizes the estimates of effects on terrestrial animals associated with each alternative, considering the general effects just described. These estimated effects further consider other potential risks to terrestrial animals in Colorado that were identified in a review of relevant scientific literature and Colorado Division of Wildlife reports, the details of which are contained in the specialist report in the EIS record.

Additionally, the estimated effects of each alternative are based on the information in appendix F, which lists the roadless areas with potentially high-risk terrestrial animal habitats and projected road building or tree-cutting activities that differ by alternative. Those are the roadless areas of highest concern with respect to this analysis. Refer to the map of roadless areas with potentially high-risk habitat for wildlife with projected road building and tree-cutting activities, located in the map packet.

Alternative 1 – 2001 Rule (No Action)

The prohibitions and permissions on road building and tree-cutting activities in IRAs under this alternative are described in detail in chapter 2. The projected amount of new roads and tree-cutting expected in IRAs over the next 15 years is described in the Analysis Framework section of this chapter.

Based on the general prohibitions and limitations on roading, tree cutting and removal, and energy resource operations in IRAs, this alternative would provide the highest level of protection to T&E species, sensitive species, MIS, and migratory bird species, compared to the other two alternatives. A lower level of permitted and projected activity within roadless areas means less human-caused disturbance and fewer of the potential adverse effects described in the preceding subsection. This is based on the scientific literature previously described, which supports the assumption that areas with low road densities, less altered or modified forest vegetation, and lower levels of human activity and ground disturbance are generally better for wildlife species and habitat conditions.

Thus, the potential detrimental effects described in the preceding subsection may occur in some small portions of roadless areas but at a scale that would be less likely to incur measurable adverse impacts on any of the potentially affected species listed in the Affected Environment section. In addition, the extent that the effects would actually occur would be based on site-specific factors such as location, timing, duration, frequency, and magnitude of the ground-disturbing activities.

As previously described, 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 T&E and sensitive species, MIS, and migratory bird species; appropriate conservation measures must be considered in the decision-making process.

The projections made for alternative 1—800 acres per year of tree cutting and 6 miles per year of roading spread over 4.25 million acres of IRA—would have little potential to increase the risk of adverse impacts on terrestrial wildlife species. Maintaining restrictions on roading and tree-

cutting in IRAs would especially benefit T&E species, sensitive species, MIS, and migratory bird species that require undisturbed blocks of land, have large home ranges, are sensitive to human disturbance, or are more vulnerable to mortality from roads and road uses. Habitats in IRAs would continue to provide good connectivity and facilitate movement within and between the roadless and wilderness areas.

The main potential for adverse effects would primarily be attributed to existing roads and past habitat alterations within substantially altered areas and ski area acres under special use permits. Those portions of IRAs would continue to receive higher levels of roads, tree-cutting, and human activity. Impacts in those areas would not likely be significant because of the mitigation measures that would be identified as required during project-level planning. In addition, there would be a relatively low potential for adverse effects from projected energy resource operations, because of the low magnitude of those activities that would occur under this particular alternative.

Open road density in IRAs would gradually be reduced over time. Under alternative 1, more roads would be decommissioned each year (12.8 miles) than would be constructed or reconstructed each year (6 miles) in the IRAs. In addition, unauthorized (non-system) roads would continue to be rehabilitated to reduce resource damage. Over time, this would benefit wildlife by providing more effective habitat and reducing the risk of adverse road-related impacts previously described.

Alternative 1 does not allow road construction in conjunction with tree-cutting to improve T&E or sensitive species habitats. Biologists on the national forests did not project any roading needs in roadless areas specifically to improve habitat for wildlife. By not allowing new road construction in conjunction with treatment actions to reduce wildfire hazard or large insect-disease outbreaks, this alternative would pose a higher risk of a more severe wildfire that could cause adverse impacts on habitats for some species. The 800 acres of treatment proposed each year in IRAs would provide the lowest level of beneficial effects that have been associated with tree-cutting activities (previously listed under beneficial effects of tree cutting).

Limitation of tree-cutting that could occur under alternative 1 to "generally small-diameter trees" would help maintain the larger trees and canopy cover and would provide for more variability in forest structure and canopy cover overall. The limitations on the type and extent of tree-cutting under this alternative would make it unlikely that tree-cutting would measurably increase habitat fragmentation, reduce habitat connectivity, or otherwise adversely affect habitat effectiveness for any of the animal species discussed in the Affected Environment section.

T&E Species

Some federally listed T&E species could be at a slightly increased risk of adverse habitat modifications or species impacts due to the projected increase in roads and tree-cutting activities (see Affected Environment section for potentially affected T&E species). The T&E animal species at highest risk would be those in any place a project might overlap with the listed species or critical habitats. The likelihood that a project would overlap such a species or affect a local population, while it cannot be ruled out entirely, is extremely unlikely given the small total area involved and the additional project-level analysis and consultation that would be done at the time of the project. Alternative 1 would provide much greater benefits overall to

listed species in these areas than alternatives 2 and 3, given the additional restrictions on roading in roadless areas under alternative 1 compared to the other two alternatives.

Based on evaluating potential effects on T&E species from what would be allowed and projected to occur in roadless areas under alternative 1, it is estimated that overall this alternative may affect individuals but is not likely to adversely affect populations of any of the T&E species identified as known or likely to occur in the roadless areas. It also would not be expected to adversely modify any designated critical habitat in the roadless areas (for the Mexican spotted owl or Preble's meadow jumping mouse). Furthermore, this alternative may beneficially affect T&E species and critical habitat by protecting large areas of lands and habitats in the state from extensive development that might otherwise occur without some level of protection of roadless areas.

Sensitive Species

Under alternative 1, individual sensitive species would be at higher risk where those species occur in those roadless areas identified in appendix F regarding roadless areas with potentially high-risk habitat and projected road building and tree-cutting activities. However, the risk is low that population viability of a sensitive species on a national forest would be compromised, based on the minimal increase in disturbance activities projected under this alternative. The boreal toad is one exception where a single project could have disproportionate impacts on boreal toad population for the entire national forest if it overlapped populations or affected them. This potential risk would likely be considered during the project-level analysis.

Based on all the potential effects described, alternative 1 may adversely affect individual sensitive species but is not likely to result in a loss of viability or cause a trend toward federal listing for the sensitive species populations on any of the national forests.

Management Indicator Species

The status and trend of MIS populations and habitats would be at a low risk of adverse habitat modification or species impact from the small projected increase in roads and tree-cutting activities (see Affected Environment section for potentially affected MIS species). There will essentially be no change or a very slight change from existing conditions because the magnitude of the activity is very small. The MIS at highest risk would be elk and mule deer if projects are not properly planned to avoid migration corridors, winter range, or important production areas. There is some limited potential for habitat degradation as a result of introduction and subsequent expansion of invasive species.

Based on the effects just described, there are not likely to be any significant changes in population trends for MIS because of the highly protective nature of alternative 1. The minimal effects of activity could be addressed through design criteria and mitigation measures developed as a part of site-specific project analysis allowing forests to meet objectives for MIS species.

Migratory Birds

The status and protection of important bird areas (IBAs) within roadless areas would remain the same as the existing condition. Project-level environmental analysis has not identified any major threats to those IBAs from roads, road uses, or land use actions that have been authorized in those areas.

Overall, alternative 1 would not likely affect the Forest Service's ability to adhere to requirements under the Migratory Bird Treaty Act or the executive order for protection of migratory birds.

Alternative 2 – Colorado Rule (Proposed Action)

The prohibitions and permissions on road building and tree-cutting activities in CRAs under this alternative are described in detail in chapter 2. The projected amount of new roads and tree-cutting expected in CRAs over the next 15 years is described in the Analysis Framework section of this chapter.

By continuing to limit human activities in CRAs through general prohibitions and limitations (described in chapter 2), this alternative would help maintain important protections for T&E species, sensitive species, MIS, and migratory birds and their habitats.

The same amount of road decommissioning of existing roads in roadless areas would occur under alternative 2 as in the other alternatives, which would have the same effect of improving terrestrial animal habitat conditions. While roads are being decommissioned, there may be disturbance impacts on terrestrial animal species and habitats in the area. Those effects would be of relatively short duration and of limited geographic extent at any one time.

One main difference in potential effects under this alternative compared to alternative 1 is that under alternative 2, approximately 21 miles of road are projected to be constructed or reconstructed each year in the CRAs. This is about three times the number of roading miles compared to alternative 1 (6 miles of roading per year). In addition to the 21 miles per year of roading in CRAs under alternative 2, approximately 3 miles of additional roading are projected to occur within some of the IRA acres that are not included in the CRAs under this alternative (no roading may occur on those IRA acres under alternative 1, with limited exceptions).

The increase in the projected number of road miles in alternative 2 compared to alternative 1 has the potential to cause a greater degree of habitat disturbance and fragmentation that could negatively affect wildlife in the manner described in the general effects discussion. It is recognized that road location would influence effects significantly, and that potential adverse impacts would be addressed and mitigated to the extent feasible during project-level planning.

Another key difference in effects of alternative 2 compared to alternative 1 relates to the fact that alternative 2 does not include more than 500,000 acres (substantially altered and other IRA acres) within CRAs that are included in IRAs under alternative 1. This reduction in roadless area acreage where road building is prohibited or restricted would diminish the habitat quality for a number of terrestrial species, compared to alternative 1. Many of the IRA acres not included in CRAs provide high wildlife value, as shown on the map in the map packet and in appendix F. The increases in roading projected to occur in IRA acreages that are not included in CRAs may further fragment terrestrial animal habitat for some species. Some of these effects from not including some IRA acres in CRAs would be offset by adding some unroaded acres into the CRAs that are currently not included in IRAs. More specific potential road-related effects on wildlife in terms of habitat availability and effectiveness, fragmentation, disturbance, and invasive species and pathogens are described in the general effects section.

The projections for tree-cutting activities described in the Analysis Framework indicate that most of the tree-cutting activities in CRAs would be designed for forest health or fuel reduction purposes. Tree-cutting activities are projected to cover approximately 7,600 acres of CRAs

under alternative 2 compared to 800 acres under alternative 1. Thus, alternative 2 would have a greater magnitude of both adverse and beneficial effects on terrestrial animals and their habitats compared to alternative 1. Removal of standing diseased and dead trees along with some down logs could have negative impacts on species that require those habitat features, although forest plan requirements for retention of snags and down logs would help mitigate some of these effects. On the other hand, treatments to improve forest health and fuels management under alternative 2 could improve habitats for early seral species in some areas. Reducing the amount of forest stands susceptible to a large and severe wildfire would also have beneficial effects on terrestrial animals in those treated portions of CRAs. The removal of standing dead trees and the reduction of fuel loading associated with beetle-killed stands that are identified as particularly important to T&E or sensitive species populations could be beneficial to those species. A more compete review of the effects of tree-cutting can be found in the general effects discussion.

An increase in opportunities for invasive species introduction, establishment, and spread would result from the additional miles of road and associated vehicular travel. The effects from invasive plants and pathogens on terrestrial wildlife would be as described in the general effects discussion. Removal of trees increases both sunlight and ground disturbance, which increases the potential for invasive plants, animals, and pathogens. The expected increase in mechanized equipment, people, and vehicles would further increase potential transport of invasive species into roadless areas. Thus, there would be more habitat degradation from invasive species expected, compared to what would occur under alternative 1.

Alternative 2 provides for additional road development associated with oil, gas, and coal exploration and development. Roadless areas that have projected oil, gas, and coal development activities that differ by alternative and overlap the roadless areas of particularly high importance to wildlife are displayed in appendix F. In many of those areas, the surrounding lands are also experiencing accelerated development, which likely elevates the biological importance and heightens the sensitivity of these roadless areas to fragmentation and disturbance effects.

Most roads under alternative 2 would be temporary and closed to public vehicular traffic, and they would be decommissioned after the intended road use is completed. However, those roads would likely be used by the public for hiking, biking, and horseback riding uses, which can have a greater effect on wildlife than occasional vehicle traffic. Unauthorized motorized use of the new temporary roads would likely occur and has historically been difficult to control. Budgets to support enforcement continue to be limiting. Thus there may be additional adverse impacts from unauthorized motorized travel in the CRAs.

CRA boundary adjustments that exclude land allocated in forest plans for ski area resort management result in removing three roadless areas from CRAs that are of high importance for terrestrial wildlife (see appendix F for roadless areas with potentially high-risk habitat and projected roading and tree-cutting). The amount of probable ski area developments within ski area acres that were under permit before 2001 would not be different under any of the alternatives. However, allocated ski area acres that were not under permits prior to 2001 would have the potential for a higher level of development under alternative 2 and 3. The three CRAs of particular concern for terrestrial animal species are: Bard Creek and Mount Sniktau (Loveland Ski Area on the Arapaho and Roosevelt National Forests); Game Creek (Vail Ski Area on the White River National Forest); and Porcupine Creek (Arapaho Basin ski area on the White

River national Forest). Bard Creek is a critical connecting land bridge for large carnivores and other wide-ranging species between the north and south ends of the state. Game Creek on the west side of Vail is a lynx linkage area, deer migration corridor, and elk winter range that is experiencing growing use for out-of-bounds skiing. The proposed piece of Game Creek that would be eliminated from the CRAs is located in a vital central position in the Dowd Junction lynx linkage. Continued protection of the integrity of that linkage over the long term as a viable lynx movement corridor would depend on close consideration of lynx needs in further ski resort planning in that area. There is a critical movement area for wildlife and landscape linkage for lynx (Loveland Pass linkage) through the Porcupine Peak CRA that is narrowly constricted between Arapaho Basin and Keystone Ski Areas. The integrity of this movement corridor could potentially be compromised by disturbance in these areas that essentially further fragments the landscape to the point of removing their functionality. However, mitigation measures would likely be applied during project planning to minimize this risk, based on the lynx amendment EIS (predecisional document, still in progress) along with forest plan direction, laws, regulations, and policies for protection of T&E species and habitat.

Appendix F and the associated map in the map packet identify the roadless areas and portions of IRAs outside CRAs that have exceptionally high wildlife habitat values and differences in potential levels of management activity under each alternative. The analysis for this EIS found that many wildlife species including T&E and sensitive species are selecting these areas. Modifying them may have varying levels of risk to the values they represent for these species such as migratory corridors or linkages; big game production or winter areas; or breeding, birthing, or rearing sites for T&E and sensitive species. For endemic and other species with a small geographic range, the magnitude of effect can be amplified with even small changes in their environment. It is anticipated that appropriate mitigation measures would be applied during project-level planning to avoid significant adverse effects on potentially affected T&E or sensitive species.

As the CRAs and wilderness areas form a network across the landscape, the increase in roading and other activities in them could sever linkages and disrupt the network of interconnected habitats and populations. Although many portions of the CRAs would continue to be protected from further development and fragmentation, alternative 2 has a greater potential than alternative 1 to negatively affect terrestrial animal species because alternative 2 allows more potentially harmful activities. Although this analysis has revealed potential risks, the location, timing, duration, and magnitude of activities that directly relate to magnitude of effects to species are unknown. Those specifics would be addressed in project-level analysis that would reveal the actual potential for effects and their magnitude.

Threatened or Endangered Species

Based on the activities allowed and projected to occur in roadless areas under alternative 2, individual T&E species may be affected but the alternative is not likely to adversely affect populations of T&E species. In addition, it also would not be expected to adversely modify the designated critical habitat in the roadless areas (for the Mexican spotted owl or Preble's meadow jumping mouse). Furthermore, this alternative may beneficially affect T&E species and critical habitat by protecting large areas of lands and habitats in the state from extensive development that might otherwise occur without the level of protection in this alternative for roadless areas.

Of particular cautionary note is the potential effect of removing from the roadless prohibitions some of the lands adjacent to ski areas that are within landscape linkages for the Canada lynx. These situations particularly elevate the risk to this species from this alternative. The more site-specific evaluations need to pay close attention to avoid permanently compromising vital travel corridors and realizing unacceptable effects to the species in the state. Refer to appendix E for lists of T&E species and critical habitats.

Sensitive Species

Overall, effects on sensitive species under alternative 2 may adversely affect individual sensitive species but would not likely result in a loss of viability or cause a trend toward federal listing for sensitive species populations on any of the national forests in Colorado.

Management Indicator Species

Some MIS could be at an increased risk of adverse habitat modification or species impact from the projected increase in roads, tree-cutting activities, and energy resource exploration and development (see Affected Environment for potentially affected MIS species). The risks are associated with direct habitat loss, reduction in habitat effectiveness, fragmentation, disturbance, and increased risk of establishment and spread of invasive species and pathogens. Roadless areas of particularly high importance to wildlife and have projected activities that differ by alternative are displayed in appendix F and on the map in the map packet. These are the areas of highest risk to landscape linkages, migration corridors, breeding, nesting, birthing, rearing, and wintering areas for terrestrial animal species.

Based on the effects described, there is a potential for change in population trends for MIS associated with this alternative depending upon the location, timing, intensity, and magnitude of activity. The loss of the substantially altered acres from roadless area protection may not be mitigated by the addition of unroaded acreage under this alternative. At this level of analysis there is no way to know if the function of acres lost is replaced in acres gained. These effects could potentially be avoided through design criteria and mitigation measures developed as a part of site specific project analysis. Using that assumption, forests should be able to meet conservation objectives for MIS.

Migratory Birds

The status and protection of important bird areas within roadless areas would remain the same as the existing condition. There would be no increased risk to IBAs existing in roadless areas

Overall, alternative 2 would not likely affect the Forest Service's ability to adhere to requirements under the Migratory Bird Treaty Act or the executive order for protection of migratory birds.

Alternative 3 – Forest Plans

The prohibitions and permissions on road building and tree-cutting activities in IRAs under this alternative are described in detail in chapter 2. The projected amount of new roads and tree-cutting expected in IRAs over the next 15 years is described in the Analysis Framework section of this chapter.

The same amount of road decommissioning would occur and have the same effect on terrestrial wildlife as described for alternatives 1 and 2.

The biggest difference in effects on terrestrial animals under this alternative is related to the substantial increase in the amount of new roads projected to be likely to occur in IRAs, particularly in comparison to alternative 1. This increased amount of roads in IRAs under alternative 3 would create disturbance and fragmentation that would negatively affect terrestrial species, in the manner described in the general effects discussion. It is recognized that road location would influence effects significantly and would be addressed at the project level.

The amount of road building in substantially altered acres would be approximately the same for alternatives 2 and 3. The forest plan direction is generally less restrictive of road building in these areas compared to the 2001 Rule. Thus, there would be a higher risk to terrestrial animal species on those substantially altered acres under this alternative compared to alternative 1. Similar to alternative 2, those substantially altered acres may not be prioritized for T&E and sensitive species habitat improvement efforts as more roads could be constructed and reconstructed in those areas.

Where the forest plan allows for increases in road construction or reconstruction in the IRAs, there would be increased opportunities for motorized access into the IRAs.

The unroaded areas outside the IRAs would not be managed under a roadless area rule that generally prohibits roading, so would be more subject to roading in the future, depending on the forest plan direction for those areas.

Most of the 16,300 acres of projected tree-cutting under alternative 3 would be designed primarily for forest health or fuel reduction purposes. However in this alternative, additional tree-cutting and product removal could be conducted for commercial timber removal purposes, depending on the forest plan direction for the given area. Removal of standing diseased and dead trees along with down logs would have negative impacts on primary cavity nesters and other species that depend on those habitat features. However, forest plan requirements for retention of snags and down logs would help mitigate some of these effects. Increases in harvesting activity of this magnitude in IRAs would result in direct losses of some individuals and may result in disturbance and displacement of some species.

The increased ability to treat acres for forest health and fuels management in this alternative would improve habitats for early seral species in some areas and in the short term. The treatments projected would reduce the potential for a severe stand-replacing wildfire that could otherwise have adverse impacts on terrestrial animal habitat. Reducing fuel loading and wildfire hazard in beetle-killed stands in the roadless areas of high importance to T&E and sensitive species could have beneficial indirect effects on those species because of the reduced wildfire severity expected.

There are differences in forest plan direction related to whether they are more or less restrictive than the 2001 Rule or Colorado Rule (see appendix B for details about forest plan management area direction). As shown in appendix B, there is a high degree of variability between forests in terms of whether roading and tree-cutting activities are more or less restrictive under this alternative compared to the other two alternatives. However, more roadless area acres under alternative 3 would be less restrictive on roading and tree-cutting activities compared to each of the other two alternatives.

The detrimental effects on terrestrial animal habitat from an expected increase in invasive plants, animals, and pathogens would be essentially the same as was described for alternative 2, but this risk would occur on more roadless area acres under alternative 3.

Roading associated with energy resource exploration and development is predicted to be higher under alternative 3. The effects on terrestrial species in roadless areas that have projections of oil, gas, and coal-related activities and overlap roadless areas of high importance to wildlife would be similar to the effects described for alternative 2 (see appendix F). In many of those IRAs, the surrounding lands are also experiencing accelerated development, which likely elevates the biological importance and heightens the sensitivity of these roadless areas to fragmentation and disturbance effects.

Based on recent past trends for road building on NFS lands in Colorado, it is expected that most roads built in roadless areas under alternative 3 would be temporary and closed to general public use, and they would be decommissioned after completion of the activity. Thus, the impact of these roads on terrestrial species and habitat would be relatively short-term. However, like alternative 2, the increase in roads would encourage more hiking, biking, and horseback riding into the IRAs, as well as more unauthorized motorized use in the IRAs. This would increase impacts related to human disturbance to terrestrial species and habitat as described in the general effects discussion.

IRA boundaries would retain the areas allocated to ski area resort development. For most of those acres, there would be no difference in the amount of ski area development allowed or likely to occur in those ski area permit boundaries. The relatively small percentage of IRA acres (Loveland Ski Area) that remain in the IRAs in this alternative and are excluded from CRAs in alternative 2, would be governed by the Arapaho and Roosevelt forest plan direction rather than any roadless rule prohibitions or permissions. The Durango Mountain ski area acreage will be governed by the San Juan Forest Plan. The areas of high concern would be the same as described for alternative 2. Alternative 3 would likely have similar effects to alternative 2 on lynx habitat connections, deer migration corridors, elk winter range, and other habitats of concern in those areas. The integrity of those movement corridors would be compromised by disturbance and fragmentation effects in these areas, although such concerns would be addressed and mitigated to some extent during project planning.

Appendix F identifies roadless areas and substantially altered areas (or other areas) in IRAs outside CRAs that have potentially high-risk wildlife habitats and differences in projected roading, tree-cutting, or energy resource related activities. The effects on species and habitats in those roadless areas would be the same as described for alternative 2. However, the higher level of roading and other activities under this alternative poses the greatest potential magnitude and extent of the detrimental impacts in those potentially high-risk habitats in roadless areas where activities are projected to occur.

The impacts described for alternative 2 that would be expected to occur on landscape connectivity among roadless and wilderness areas would be essentially the same under alternative 3. However, because of the much higher level of anticipated roading in the IRAs under alternative 3, this alternative would have the greater potential to sever linkages and disrupt the network of interconnected habitats and populations. The location, timing, duration, and magnitude of activities addressed during site-specific analysis would influence the actual magnitude of effects on species and critical habitats, and those factors are unknown at this time.

Threatened or Endangered Species

Overall, based on the activities allowed and projected to occur in IRAs, alternative 3 may affect individual T&E species but is not likely to adversely affect populations of the T&E species

associated with the IRAs (identified in Affected Environment). Additionally, alternative 3 would not likely result in adverse modification of designated critical habitat for the Mexican spotted owl or Preble's meadow jumping mouse. This alternative may beneficially affect T&E species and critical habitat, by protecting large areas of lands and habitats in the state from extensive development that might otherwise occur without roadless areas.

However, some or all of the listed species and critical habitats could be at a substantially increased risk of negative effect or adverse habitat modification due to the projected increase in roads and tree-cutting activities on those forests with older plans and no specific roadless area management direction, as previously listed.

Sensitive Species

Effects on sensitive species would be most similar to those described for alternative 2, based on the increased level of development in roadless areas under these two alternatives. Some sensitive species would be at higher risk where they occur in the roadless areas identified in appendix F, where the same roadless areas have projected road building or tree-cutting activities. As with any of the alternatives but especially so with alternative 3, the potential for disproportionately large adverse effects on species could occur at the project level, but mitigation measures to minimize the potential impacts would be applied. The boreal toad is one example where a single project if it overlapped populations or habitats could have substantial impacts on forest-wide viability. Based on the effects on sensitive species and habitats described for this alternative, alternative 3 may adversely affect individuals but would not likely result in a loss of viability or cause a trend toward federal listing for sensitive species populations on any of the national forests in Colorado.

Management Indicator Species

Some MIS could be at a substantially increased risk of adverse habitat modification or species impact from the projected increase in roads and tree-cutting activities (see Affected Environment for potentially affected MIS species). The risks of this least restrictive alternative are associated with direct habitat loss, reduction in habitat effectiveness, fragmentation, disturbance and increased risk of establishment and spread of invasive species and pathogens. Appendix F shows the roadless areas and substantially altered areas that are of high importance to MIS wildlife and include projected activities that differ by alternative. These are the areas where there would be a higher risk to terrestrial habitat landscape linkages; migration corridors; and breeding, nesting, birthing, rearing, and wintering areas.

Based on the effects described, there is a potential for change in population trends for MIS associated with this alternative depending upon the location, timing, intensity, and magnitude of activity. Some of these effects could potentially be avoided through design criteria and mitigation measures developed as a part of site-specific project analysis. Using that assumption, forests should be able to meet conservation objectives for MIS.

Migratory Birds

The status and protection of important bird areas within roadless areas differ with alternative 3 with respect to one designated IBA. The Alfred M. Bailey Bird Nesting Area IBA occurs within the Eagles Nest Wilderness Area but adjacent to the Maryland Creek Roadless Area on the White River National Forest. As described in the Affected Environment section, this IBA provides one of the most diverse bird breeding sites in Colorado. Because the actual IBA is

within the wilderness area outside the roadless area, this potential impact would not occur directly at the IBA location. However, under alternative 3, the Maryland Creek Roadless Area may experience some timber management because the area would be managed for general forest products.

Overall, alternative 3 would not be likely to affect the Forest Service's ability to adhere to requirements under the Migratory Bird Treaty Act or the executive order for protection of migratory birds.

Summary of Direct and Indirect Effects

Alternative 1 would afford terrestrial species and habitats the most protection because it is the most restrictive of roads and other activities in the roadless areas, and roads are associated with many detrimental impacts on T&E, sensitive, MIS, and migratory bird species. By comparison, alternative 2 offers a lower level of protection in roadless areas than alternative 1 because it allows and projects more road building miles and tree-cutting acres in roadless areas with potentially high-risk habitat for terrestrial species. Alternative 3 would have the highest potential for adverse impacts to terrestrial species and habitat as it allows and projects more road building miles and tree-cutting acres in potentially high-risk roadless areas. Refer to appendix F and the associated map in the map packet.

Environmental Consequences – Cumulative Effects

This cumulative effects analysis is based on how other factors might combine with the direct and indirect effects of alternatives just described, to have an additive impact on those same terrestrial animal species and habitats that occur in the roadless areas. Consideration was given to past, present, and reasonably foreseeable future actions, including those described in appendix D, Cumulative Effects Framework.

The effects of projected activities in roadless areas that result in habitat loss or degradation, fragmentation, disturbance, and/or increases in invasive species and pathogens were previously discussed as potential direct and indirect effects. Those are the effects that may combine with effects from other activities or land uses in or adjacent to roadless areas to result in a cumulative effect. The following discussion addresses the activities ongoing or expected in the next 15 years in the Colorado, especially those adjacent to or potentially affecting roadless areas.

Increasing Human Population Growth and Development

Colorado's residential population in 2006 was 4.8 million and is expected to be 7.3 million by 2030 (Colorado DOLA State Demography Office 2008). The increased demands these residents will place on the lands surrounding roadless areas will increase the value of the roadless areas to terrestrial and aquatic species. The higher resource demands placed on the land by a larger population could limit options for new roadless acres to be identified and protected in the future. In light of projected future population trends around roadless areas, roadless areas would continue to provide some of the best terrestrial and aquatic species habitat in Colorado into the future.

The effects of population growth on wildlife are evident in the amount of habitat that has been converted to human development or fragmented by it across the state. Housing developments

and malls are built on what used to be open space. Five-acre ranchettes have replaced large tracts of private land that used to belong to ranching families. Much of that development has been in lower elevation areas that have historically provided habitat that allowed species such as bears and ungulates to prepare for and survive winter. Providing for the intact structure and function of the limited low and middle elevation roadless areas with these types of high-value yet limited habitats is even more important now and into the future. This human-associated encroachment has resulted and is expected to continue to erode habitat availability and effectiveness, and increase disturbance and fragmentation.

Colorado's Comprehensive Wildlife Conservation Strategy provides a foundation for sustaining Colorado's wildlife and the habitats upon which they depend (Colorado DNR Division of Wildlife 2006a). The strategy provides general directions for wildlife conservation and a stimulus to engage partners in conservation of Colorado's wildlife resources. These efforts will increase the probability of terrestrial species habitats on non-federal land remaining stable over the long term. However, considering the growth rate of the state and the high demand for resources available in Colorado, some non-federal lands will continue to experience impacts on natural resources from urbanization and development, resource demands (for example, minerals), and recreation. Some effects that result in lower habitat quality on non-federal land may limit the potential effectiveness of habitat conservation and restoration on federal lands.

Increasing Recreation Demand

The growing population will continue to be drawn to the natural beauty, seclusion, and undeveloped nature of roadless areas in Colorado for enjoyment of outdoor recreation pursuits. Demand for additional snowmobile, hiking, mountain bike, and cross-country ski trails will continue to increase, thereby increasing the use of roadless areas. The trend in mountain bike use in particular has greatly increased in the past 10 years. Habitats and associated animals previously secluded and undisturbed now experience unpredictable, erratic occurrences with which they did not evolve and at a frequency they have never experienced. The physiological effects of these types of occurrences and impacts on survival have been discussed in previous sections. All these activities can affect the quality and quantity of habitat and can lead to fragmentation, loss of seclusion areas, disturbance, and increases in the establishment and spread of invasive species and pathogens. Increases in these types of recreational uses will compound the effects of increased roading and vegetation treatment for many wildlife species.

Increasing Energy Demand

Oil, gas, and coal reserves are among the valuable natural resources found within the roadless areas and surrounding lands in Colorado. The national focus on energy independence combined with the high demand for energy has resulted in a surge of exploration and development of those resources across the state. Many of the areas where exploration and development are occurring also provide valuable wildlife habitat and in some cases habitat critical to the survival of individuals and populations of species. Although most development occurs on non-federal lands, many areas are adjacent or in close proximity to NFS roadless areas. Development of non-federal lands displaces mobile animals to adjacent NFS lands, which increases the value of the federal lands and accentuates the need to provide effective habitat that is free from disturbance and that provides linkage and migration corridors and critical areas needed for reproductive success and winter survival. The Mamm Peak CRA is an example of that situation, with concentrated gas field development on adjacent private and BLM lands in

areas important for elk calving and winter range. Consequently, the Mamm Peak CRA, which provides irreplaceable habitat, is of even higher importance to the survival of that elk population.

The current interest in wood fiber and biofuels as economical energy sources is anticipated to increase, placing additional attention on NFS resources. It can be anticipated that harvesting wood fiber to meet increasing demand will increase as technology improves. Tree harvesting as discussed throughout this document requires road infrastructure, resulting in the associated impacts on wildlife that have been thoroughly discussed previously in this document.

Development of wind energy is another anticipated focus in the effort to become energy independent, and national forests are just beginning to receive inquiries about tower placement. Research has demonstrated mortality to migrating bats and to a variety of birds from wind towers. Like other intrusions into previously undisturbed habitats, these structures directly remove habitat and have the potential to modify habitat effectiveness, create disturbance, and fragment landscapes, thus adding to the cumulative effect of activities in the proposed alternatives. Some energy-related activities require pipelines to move the product off and through the national forests. Most of the electrical transmission lines have been generally concentrated along corridors adjacent to roadless areas, rather than going through roadless areas. Direct loss of habitat and disturbance created during construction may become permanent for above-ground structures.

Climate Change

Climate change and global warming are affecting terrestrial and aquatic animal species and habitats across Colorado and the U.S (USDA Global Change Program Office 2001). Average annual temperature increases due to increased carbon dioxide (CO_2) are affecting snowpack, peak runoff, and base flows of streams and rivers. Predictions indicate that spring snowpack will probably be less, that more precipitation will probably fall as rain rather than as snow, and that spring peak runoff will be earlier (Backlund et al. 2008)

Changes due to climate change and global warming could be compounded considerably in combination with other disturbances such as fire and beetle epidemics. Larger climate-driven fires might be expected in Colorado in the future.

Climate change is also affecting phenology (the biology of timing of organisms), involving aspects such as animal hibernation and migration. In addition, for species such as ptarmigan that require cold, snowy alpine environments to survive, warmer temperatures could lead to significant decreases in available suitable habitat. All these climate-related effects can combine with similar impacts previously discussed as being associated with each of the alternatives.

Non-native Invasive Species and Pathogens

In 2003, Forest Service Chief Dale Bosworth identified invasive species as being one of the four significant threats to our nation's forest and rangeland ecosystems. Invasive species have been characterized as a "catastrophic wildfire in slow motion" (USDA Forest Service 2004). Thousands of invasive plants, insects, fish, mollusks, crustaceans, pathogens, mammals, birds, reptiles, and amphibians have infested hundreds of millions of acres of land and water across the nation, causing massive disruptions in ecosystem function, reducing biodiversity, and degrading ecosystem health in the nation's forests, prairies, mountains, wetlands, rivers, and oceans (USDA Forest Service 2004). The Forest Service has developed a National Strategy and

Implementation Plan for Invasive Species Management (USDA Forest Service 2004), which sets the objective of protecting forest and rangeland ecosystems by preventing the release of non-native species and by controlling the spread of or eradicating invasive species. The Rocky Mountain Region has tiered to that strategy with the Rocky Mountain Region Invasive Species Management Plan (USDA Forest Service 2005).

Non-native invasive species are a problem throughout Colorado. Current estimates indicate that 3 percent of all lands in Colorado are occupied by invasive species at some density (Colorado Department of Agriculture 2001). Of particular concern is that the presence or spread of invasive species could potentially limit the effectiveness of habitat improvements or efforts to recover species. Roads often provide vectors for spread of invasive species. In general, areas with fewer roads have a lower risk of having invasive species populations established. There is particular concern regarding the spread of invasive pathogens, such as chytrid fungus, to naive populations. Roads providing ingress and the subsequent associated increase in human activity in wetlands and other sensitive habitats greatly increase the risk of introduction of such pathogens. Effects of climate change could result in stresses to systems and plants that allow greater invasive establishment and spread. All these effects can combine with similar effects in roadless areas described for each of the alternatives.

Insects and Fire

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.

At a landscape level, fires create and maintain habitat mosaics of different vegetation types (Mushinsky and Gibson 1991). These mosaics include various patch sizes, composition, and structures, as well as connectivity among patches. Smith (2000) identified the following landscape-level fire effects on fauna: (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.

The ability of individual members of a species to survive the direct effects of fire depends on their mobility and on the uniformity, severity, size, and duration of fire. While fires have the potential to injure and kill animals caught in their path (Bendell 1974, Singer and Schullery 1989), they generally kill and injure a relatively small proportion of animal populations (Smith 2000). Many adult vertebrate species are mobile enough to flee burning areas or seek refuge. The young of the year are often most vulnerable to injury and mortality from fire (Smith 2000).

Many amphibians live in moist habitats that are likely to burn less often and less severely than upland sites (Smith 2000). Nevertheless, fire-caused changes in plant species composition and habitat structure (for example, woody debris and down logs) and quantities of litter and woody material influence amphibian populations (Means and Campbell 1981, Russell et al. 1999, Smith 2000).

Forested types in Colorado are experiencing insect infestations of varying degrees that will likely affect the frequency and severity of fires. Severe mountain pine beetle and spruce beetle infestations are causing large areas of tree mortality in and around roadless areas, which will

likely increase the fire risk in those affected areas. The effects of tree mortality in relation to wildfire frequency and severity were discussed in the sections of this EIS on Forest Vegetation and Health, and Fuels and Fire.

Overall, as a result of the magnitude of dead and dying trees, there will likely be more frequent, larger, and more severe wildfire events, especially in lodgepole pine, ponderosa pine, and spruce-fir forests in and around the roadless areas. The increased severity and extent of wildfires may be amplified in light of global warming trend predictions. Animals associated with types that burned on regular intervals have evolved with and adapted to large-scale disturbance regimes. However, there are now other stressors on the landscape creating habitat loss, disturbance, and fragmentation that when coupled with the extreme disturbance events that characterize these systems, could create decreased ability to accommodate natural events for some species. These effects are likely to add to the potential for adverse effects on terrestrial animal species previously described for each of the alternatives.

Impacts of Existing Management Practices

Existing management practices within and outside inventoried roadless areas have the potential to affect terrestrial animal species and habitats. Land management activities such as tree-cutting, road construction and maintenance, ski area development, energy and mineral exploration and development, utility transmission, dams and diversions, livestock grazing, and various recreation activities—such as mountain biking, off-highway vehicle use, snowmobile use, cross-country skiing, and hiking—can result in changes to vegetation composition and structure; successional processes; nutrient cycling; water quality and quantity; and habitat complexity, connectivity, and disturbance. Limited agency budgets to provide for sufficient enforcement of travel management policies have resulted in a continual increase in the miles of unauthorized roads and trails on NFS lands, eroding roadless acreages, character and function. Other human activities related to urbanization can also have dramatic effects on terrestrial species and habitats.

The expected and cumulative increases in all these land use activities described in this cumulative effects section will reduce the extent that roadless areas provide areas where natural process can largely occur without human management influences. The areas that remain relatively undisturbed by human activity can continue to provide information to help us to gain a better understanding of cumulative effects occurring elsewhere on the landscape and how these effects affect terrestrial and aquatic species and habitats.

Biodiversity

Based on current literature (Flather et al. 1999, Noss and Cooperrider 1994, Stein et al. 2000), it is possible to conclude that with or without conservation of roadless areas, biodiversity is at an increased risk of adverse cumulative effects from increased population growth and associated land uses, land conversions, and non-native species invasions. Maintenance of roadless areas characteristics may lessen this risk at least in the short term (20 years). By reducing the level of potential adverse impacts on roadless areas, some of the last relatively undisturbed large blocks of land outside of designated wilderness areas that contribute to species biodiversity would be conserved.

Thus, conservation of roadless area characteristics could have beneficial effects on biodiversity conservation at local, regional, and national levels. There would be similar incremental

beneficial effects on biodiversity conservation when any of the roadless area prohibitions is combined with the past, present, and reasonably foreseeable land uses and conversions, laws, regulations, policies, and non-native species invasions. The local, regional, and national cumulative beneficial effects on TES species and biodiversity could include:

- Conserving and protecting large contiguous blocks of habitat that provide habitat connectivity and biological strongholds for a variety of terrestrial and aquatic plant and animal species including TES species
- Providing important local and regional components of conservation strategies for protection and recovery of listed TES species
- Providing increased assurances that biological diversity would be conserved at a landscape level, including increased area of ecoregions protected, improved elevational distribution of protected areas, decreased risk of additional timber harvest and road caused fragmentation, and maintenance and restoration of some natural disturbance processes
- Providing increased assurance that biodiversity would be supported within inventoried roadless areas including the maintenance of native plant and animal communities where non-native species are currently rare, uncommon, or absent.

The value of roadless areas in conserving biodiversity is likely to increase as habitat loss and habitat degradation increase in scope and magnitude elsewhere. With these increasing trends, the importance of roadless area conservation and other laws, regulations, and policies in the management of biodiversity is also likely to increase.

The value of roadless areas is even more important when considered in combination with other land conservation laws, policies, and strategies. For example, many roadless areas are adjacent to wilderness, national parks, and other designated areas that provide large contiguous habitat blocks with national significance for biodiversity conservation.

Whether the cumulative beneficial effects of the prohibitions and other past, present, and reasonably foreseeable actions would fully offset predicted future increases in land uses, land conversions, and non-native species invasions is difficult to assess. Yet it is possible to conclude that the more roads and other activities are allowed in roadless areas, the more the potential for adverse cumulative effects on biodiversity also increases.

At some point in the future, projected habitat loss and degradation from the direct and indirect effects of increasing population growth could potentially surpass the contribution of roadless areas to biodiversity conservation. Under this scenario, habitat loss and the loss of viable animal populations may be of a magnitude such that the beneficial effects of the prohibitions and other laws, regulations, and policies relative to biodiversity conservation may be lost or overwhelmed. Even in these circumstances, roadless areas would still likely convey some beneficial effects relative to conservation of individual TES species locally, regionally, and nationally.

Overall, as population growth and associated land uses and land conversions place pressures on both NFS and non-NFS lands, the value and importance of roadless areas in conserving biological diversity will probably increase. In the future, habitat loss and loss of viable animal populations may be of a magnitude such that the beneficial effects of the prohibition and limitations, and other laws, regulations and policies relative to the conservation of native

biodiversity may be lost or overwhelmed. Even under this scenario, roadless areas would likely still convey some beneficial effects relative to conservation of terrestrial and aquatic animal species and habitat in Colorado.

Assessment for the three alternatives was based largely on the following cumulative effects:

- The projected increasing trends in population growth, recreation demand, deleterious land uses, land conversion, and non-native species invasion are likely to contribute to increased risks to biodiversity.
- It is likely that federal, state, local, and private land laws, regulations, and policies will become more pivotal in conserving biodiversity. However, future laws, policies, and regulations could de-emphasize land conservation in the interest of meeting future social and economic values, thus placing biodiversity at risk.
- Climate changes may lead to less favorable habitat availability for some T&E and sensitive species, leading to more restricted ranges and some local extirpations of populations.

The following are some specific cumulative effects associated with each alternative:

Alternative 1, when considered with the effects of land uses, land conversions, laws, regulations and policies, and non-native species invasions, would be beneficial to biological diversity, including species habitats, populations, and landscape diversity. Some of the potential beneficial effects include:

- Protected large contiguous blocks of habitat providing habitat connectivity for a variety of species that need large connected landscapes
- Protected large contiguous blocks of effective habitat providing for solitude and freedom from disturbance that is required by some species
- Decreased risk associated with fragmentation and isolation from timber cutting, road construction and reconstruction, and leaseable minerals activities
- Conservation and protection of biological strongholds and other important habitats for terrestrial animals, including TES species
- Decreased risk associated with invasive species introductions and spread
- Maintenance of native animal communities where non-native-species are currently rare, uncommon, or absent
- Provision of increased assurances that biological diversity would be conserved, both within the area and the overall landscape in which it is found
- Provision of important components of conservation strategies for protection and recovery of federally listed proposed, threatened, and endangered species and NFS regional forester sensitive species
- Maintenance or restoration of some level of natural disturbance processes at local and landscape levels, which are important controls for ecosystem composition, structure, and function

Alternative 2, when considered with the effects of land uses; land conversions; laws, regulations, and policies; and non-native species invasions would be less beneficial and

potentially harmful (depending on the location of the activity) to biological diversity, including species habitats, populations, and landscape diversity. Some of the potential beneficial effects of protection of roadless acres under alternative 2 are listed below; they would be realized, however, to a lesser degree than alternative 1:

- Protected large contiguous blocks of habitat providing habitat connectivity for a variety of species that need large connected landscapes
- Protected large contiguous blocks of effective habitat providing for solitude and freedom from disturbance that is required by some species
- Decreased risk associated with fragmentation and isolation from timber cutting, road construction and reconstruction, and leaseable minerals activities
- Conservation and protection of biological strongholds and other important habitats for terrestrial animals, including TES species
- Decreased risk associated with invasive species introductions and spread
- Maintenance of native animal communities where non-native-species are currently rare, uncommon, or absent;
- Provision of increased assurances that biological diversity would be conserved, both within the area and the overall landscape in which it is found
- Provision of important components of conservation strategies for protection and recovery of federally listed proposed, threatened, and endangered species and NFS regional forester sensitive species
- Maintenance or restoration of some level of natural disturbance processes at local and landscape levels, which are important controls for ecosystem composition, structure, and function.

Alternative 2 protects about 4 million roadless acres including the addition of the unroaded acres not protected under the 2001 Roadless Rule. Some provisions allow for increases in roads, which would potentially affect terrestrial species. In addition, substantially altered acreage dropped from this alternative means that roadless area prohibitions for road building are removed from the substantially altered acres and could allow additional opportunity for unauthorized travel into the remaining roadless areas.

Alternative 3, because of less restriction of land use activities in roadless areas, would probably pose a higher risk of affecting biological diversity, species habitats, and populations. However, these effects will not be uniform across forests or roadless areas. As previously described, some forest plans are more restrictive of land uses in roadless areas than other forest plans. For forests with plans that are less restrictive on activities in IRAs, effects from activities outside the IRA boundary would add to the potential adverse effects described for this alternative.

Summary of Cumulative Effects

Threatened, Endangered and Sensitive Species

When compared with the absence of a defined roadless area designation, alternatives 1 and 2 maintain roadless areas that provide for considerably more secure habitat and protection for T&E and sensitive species and their habitats. The availability of many large tracts across the

state for maintenance of undisturbed areas for conserving species and biodiversity is increasingly important with the growing population and pressures on the land and resources that continues in Colorado and on the national forests. In this respect, both alternatives have many potential benefits to species conservation.

Alternative 2 does not provide as much conservation value as alternative 1, when considering the removal of substantially altered acres and exceptions for further ski area development, roads, and tree-cutting. However, when considering all cumulative factors operating on species and their welfare in the roadless areas, maintaining approximately 4 million acres of roadless area designation will represent a net benefit to T&E and sensitive species. Project-level impacts would be carefully considered to minimize local effects on species. Potential ski area expansions into defined landscape linkages for the Canada lynx could have potential impacts on lynx habitat quality. However, it is expected that proper precautions would be taken to ensure that further development in these areas would not compromise the viability of these linkages in providing necessary connecting corridors and opportunities for continued population expansion and free movement in the state.

Alternative 3 represents the greatest additive negative effects on T&E and sensitive species. As discussed earlier, some older forest plans do not have specific provisions for roadless areas and are more flexible in allowing further uses and development in roadless areas compared to the other alternatives. Overall, there are more forest plans in Colorado that have less restrictive management and potential for conflict with T& E and sensitive species than there are plans with more favorable management. Therefore, this alternative is likely to not result in a net benefit to T&E and sensitive species network-wide in Colorado, but local benefits may be realized that help offset continuing decline of habitats and other effects on these species occurring at the same time on other lands.

As noted earlier, projected habitat loss and degradation from increasing human populations could potentially surpass the contribution of roadless areas to species and biodiversity conservation, under any of the alternatives. Under this scenario, habitat loss and the loss of viable plant and animal populations regionally in the surrounding landscapes may be of a magnitude such that the beneficial effects of the prohibitions and other laws, regulations, and policies relative to biodiversity conservation may be lost or overwhelmed. Even in these circumstances, roadless areas would still likely impart some benefits to conservation of individual T&E and sensitive species locally and at state and regional scales.

Management Indicator Species (non-T&E or sensitive).

Road building and development activities have the potential to result in cumulative effects from decreased habitat quantity and quality, increased disturbance and fragmentation, and disruption of migratory corridors or landscape linkages. The extent of cumulative effects depends on the level of road building and other developments. Additional increased human demands including recreational access, increased potential for development within and adjacent to roadless areas, and probable natural and climatic events support that conclusion.

Migratory Birds

Road building and development activities have the potential to result in cumulative effects from increased recreational access as well as increased potential for development. The potential for cumulative effects on migratory birds would be similar to those of other wildlife species and would depend on the level of road building and development.

AQUATIC SPECIES AND HABITAT

This analysis evaluates potential effects of the alternatives on aquatic (water-based) habitat and species. The aquatic species evaluated in this analysis include fish, aquatic macroinvertebrates (such as crayfish, insect larvae, or others with no backbone), and aquatic mammals like the American beaver.

This analysis is organized to emphasize threatened and endangered species, Forest Service sensitive species, and management indicator species (MIS), and their associated habitats. This approach covers the full range of habitats potentially affected by differences among the alternatives analyzed in this EIS. The analysis focuses on the most significant differences in the potential for environmental consequences (effects) among the three roadless area management alternatives.

A separate section in chapter 3 evaluates the terrestrial (land-based) habitat and species, including amphibians (frogs, toads and salamanders). Another separate section in chapter 3 covers threatened, endangered and sensitive plant species.

Affected Environment

The fishery resources and associated aquatic habitat in Colorado are a result of evolution, migration, climatic changes, and most recently, influences from European settlers. The Continental Divide forms a "barrier" between fish migrations from the western United States and the Mississippi drainage to the east. Periodic changes in climate and topography have resulted in isolation, movement and subsequent evolution of the current native fish found in the state. Relatively few fish species are able to survive the varying and often harsh conditions associated with the mountain streams in the higher elevations of the roadless areas in Colorado. However, there is a wide range of aquatic habitats and species in the roadless areas in Colorado, which range from approximately 7,000 to 14,000 feet in elevation. The aquatic species in the roadless areas are adapted to the wide range of physical, chemical and biological conditions that have been shaped by past and ongoing natural events in Colorado (Wohl 2000).

At the higher elevations in roadless areas, there is a general reduction in species diversity and aquatic productivity. This is due to reductions in temperature, stream size, nutrient input and "growing season" in streams at higher elevations. Historically, native fish populations were greatest in the mid to large size streams in lower elevations in Colorado, with headwater streams containing relatively fewer fish populations.

However, historic and ongoing management activities have occurred more frequently and extensively in the lower elevations of the roadless areas in Colorado. Historic management activities in the larger rivers and lower elevation streams in Colorado included stocking of non-native fish species, mining, road construction, and other activities that resulted in a loss of habitat and native fish species, and it is unlikely that they can be restored to their pre-settlement condition (Behnke 2002). As a result of the numerous human activities along these larger, lower elevation streams, these areas are typically not considered for restoration efforts (USDI Fish and Wildlife Service 1998b).

Historically, aquatic habitat quality is inversely proportional to elevation in the Colorado Rockies, however the influence of human settlements and land uses has changed this relationship (Wohl 2001). The largest impacts on aquatic habitats have been occurring where streams are adjacent to human population centers, roads, and other human activities. A recent assessment of ecological conditions on the White River National Forest revealed that there was a close correlation between population centers and the distribution of paved roads, with most roads having a direct or indirect influence on stream systems and their habitats (Winters and Staley 2008). Conversely, unpaved roads are more evenly distributed on NFS lands, being more closely associated with a variety of historic and current management activities such as timber harvest, mining claims, and recreation. Where roads occasionally occur in roadless areas, they are mostly unpaved, low standard roads, and are at relatively low densities. Recreational activities and land management activities are also generally concentrated at the lower to mid elevation portions of roadless areas that are more accessible (Winters et al. 2004). Therefore, while historically the highest quality aquatic habitats in Colorado would have occurred at the lower elevations, aquatic habitat has been degraded from proximity to human population centers, roads, and other activities that occur more frequently in the lower elevations. Thus, currently, higher elevations in Colorado provide the highest quality aquatic habitats. Similar results were found in Idaho (Carlson et al. 2007).

Native fish species populations have declined from their historic levels on all national forests in Colorado, even those further from large population centers. For example, on the Rio Grande National Forest, the Rio Grande cutthroat trout has been severely reduced from its historic range. On the San Juan National Forest, the migration of two sensitive sucker species populations is now restricted to a portion of the Rio Blanco due to water developments along San Juan River tributaries. On the White River National Forest, the amount of roads crossing streams may be restricting movement of native and non-native fish throughout a considerable portion of this national forest, particularly in the southern and eastern portions of the forest (Winters and Staley 2008).

The effects of human influences on aquatic habitats and biota have been well documented (Furniss et al. 1991). The focus of this analysis is to address the activities that are identified as part of the Roadless Rule alternatives for Colorado and associated risks. Specific activities, including vegetation management; road construction; oil, gas and mineral development; and ski area development have been identified as possibly effecting aquatic habitat and associated biota between alternatives.

Threatened, Endangered and Sensitive Species

Threatened, endangered (T&E) and proposed species are evaluated in accordance with requirements set forth under Section 7 of the Endangered Species Act (ESA), in the Code of Federal Reguations (50 CFR 402), and in Forest Service Manual 2670.31-2672.42. The ESA "candidate" species are discussed as Forest Service sensitive species; they are automatically included on the regional list of sensitive species.

Based on ESA requirements, the Forest Service initiated informal consultation with the U.S. Fish and Wildlife Service on this proposed rulemaking action, and will continue consultation throughout the development of this EIS and rule. In addition, a biological assessment will be prepared on the potential effects of the agency's preferred alternative on T&E species after the draft EIS has been completed and a preferred alternative has been identified.

There is one T&E fish species that is known or likely to occur in roadless areas. It is the greenback cutthroat trout, and it occurs on two of the national forests in Colorado: (1) Pike and San Isabel, and (2) Arapaho and Roosevelt National Forests. One federally listed fish species, yellow fin trout, historically occurred in the Arkansas River basin on the Pike and San Isabel National Forest, but has become extinct in Colorado, and will not be analyzed further in this analysis. There are no fish species identified as proposed under ESA, and there is no designated critical habitat for T&E fish in Colorado.

Forest Service sensitive species are species identified by a regional forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density, or in habitat capability that would reduce a species' existing distribution (Forest Service Manual 2670.5). The Forest Service policy for sensitive species is to conserve sensitive species so that they do not become T&E species and their habitats remain well distributed throughout their geographic range on NFS lands (Forest Service Manual 2670.22). The list of sensitive species includes federal candidate species.

There are five sensitive fish species that occur or are likely to occur in roadless areas: two trout species (in addition to the threatened greenback cutthroat trout) and three sucker species (see table 41).

Table 41. Threatened, endangered or sensitive fish species that occur or are likely to occur in roadless areas in Colorado

Common name	Scientific name	Major river drainage(s)	National forest occupied	Status (T, E, S)
Greenback cutthroat trout	*Oncorhynchus clarki stomias*	Arkansas and South Platte	AR, PSI	Threatened
Rio Grande cutthroat trout	*Oncorhynchus clarki virginalis*	Rio Grande	RG	Sensitive (+candidate)
Colorado River cutthroat trout	*Oncorhynchus clarki pleuriticus*	Colorado	GMUG, MLS Routt, SJ, WR	Sensitive (+candidate)
Flannelmouth sucker	*Catostomus latippinis*	Colorado	GMUG, SJ, WR	Sensitive (+candidate)
Bluehead sucker	*Catostomus discobolus*	Colorado	GMUG, SJ, WR	Sensitive
Mountain sucker	*Catostomus platyrhynchus*	Colorado	GMUG, Routt, SJ, WR	Sensitive

Abbreviations:
T, E, S: threatened, endangered or sensitive
AR: Arapaho and Roosevelt National Forests
GMUG: Grand Mesa, Uncompahgre and Gunnison National Forests
MLS: Manti-La Sal National Forest
PSI: Pike and San Isabel National Forests
RG: Rio Grande National Forest
SJ: San Juan National Forest
WR: White River National Forest

The three native trout species listed in table 41 (one threatened and two sensitive) represent some of the very few fish that are historically found in high elevation portions of Colorado. These native cutthroat trout currently inhabit only a small fraction of their historic range. In the past, most year-round streams in Colorado that were not impeded by natural barriers and

elevated stream temperatures harbored populations of native cutthroat (Behnke 2002). Through a variety of human influences, including stocking of non-native trout and habitat fragmentation and reduction, these trout populations are now primarily limited to areas such as wilderness, roadless, national parks, and other relatively remote areas of the state. More recently, human activities have introduced invasive species such as the whirling disease parasite, other diseases, and possibly mollusks, such as the New Zealand mud snail, which threaten the sustainability of native fisheries.

Populations of all three native suckers that are listed as sensitive species appear to be declining. Bluehead and flannelmouth suckers generally tend to inhabit larger stream and river habitats, while mountain suckers are found sporadically throughout the west slope of Colorado in small streams. All three of these suckers are apparently being out-competed by more common western white suckers (*Catostomus commersoni*) and longnose suckers (*Catostomus catostomus*) that have been introduced west of the Continental Divide. While the exact mechanism for this replacement is only beginning to be understood, it appears that competition, hybridization, habitat fragmentation and stocking have contributed to this problem. Although these fish have minimal recreational or human food value, they contribute to biodiversity and play an important ecological role in these aquatic ecosystems of Colorado.

Other T&E Fish

In addition to T&E and sensitive fish species that may be directly influenced by the activities that vary by alternative in the roadless areas, there are four T&E fish species that occur downstream of NFS lands in the Colorado River and some of it's larger tributaries that could be indirectly affected by those same activities in the roadless areas. Table 42 shows those T&E fish species that occur downstream of the roadless areas in Colorado. These residents of relatively large river systems have become increasingly rare, mostly due to dramatic changes in hydrology, water quality, and habitat conditions (Sublette et al. 1990). Water quantity changes on NFS lands in Colorado and other states have been closely monitored by the U.S. Fish and Wildlife Service to ensure any future development would not negatively affect these fish. Although these fish do not occur in rivers in Colorado, they could be affected by the combination of different activities that are likely to occur in the roadless areas that affect their habitat conditions. In addition to the T&E species shown in table 42, there are sensitive species and MIS of fish that also occur in some of the rivers downstream from the roadless areas.

Table 42. Federally listed fish found downstream of the roadless areas in Colorado that could be influenced by upstream activities on NFS land.

Common name	Scientific name	Federal status
Razorback sucker	*Xyrauchen texanus*	Endangered
Bonytail chub	*Gila elegans*	Endangered
Colorado pike minnow	*Ptychocheillus lucius*	Endangered
Humpback chub	*Gila cypha*	Endangered

Special Aquatic Habitats

There are aquatic habitats in many of the roadless areas in Colorado that have been identified as being ecologically important as well as "rare". In particular, fens (peat-forming wetlands) are considered irreplaceable, as they have taken thousands of years to form, and contain many

unique forms of flora and fauna (Winters et al. 2004). Fens act as carbon sinks, are typically produced at the toes of slopes, and are often associated with high elevation glaciated valleys. Wetlands are also an important habitat for many species and have been reduced in Colorado by as much as 50 percent of their historic extent through numerous management activities (Dahl 1990). In some areas in Colorado, conversion of riparian forest and shrub dominated ecosystems to unvegetated and grass dominated habitat has resulted in a loss of important habitat for a variety of plants and animals (Dahl et al. 1991).

Management Indicator Species

Management Indicator Species (MIS) are species identified in forest plans for each national forest operating under the 1982 National Forest Management Act Planning Rule as indicators of the effects of management activities on specific habitat types or features. Forests with plans revised under the 2008 Planning Rule are not required to identify MIS. There are 36 MIS animal species identified for the national forests in Colorado, excluding those selected for national grassland ecosystems: 11 mammals, 23 birds, 1 amphibian (toad), and 1 invertebrate (insect). All 36 MIS are likely to occur in one or more roadless areas, and therefore are relevant to this analysis.

Forest plans for the national forests in Colorado identify six specific species of fish (trout), one mammal (American beaver), and an array of benthic (bottom-dwelling) macroinvertebrates (such as insects, mollusks, or crayfish) as MIS (table 43). While native species would be ideal to use as MIS, aquatic biologists are faced with several problems when attempting to use native species, such as the fact that most native species were eliminated from most of their original range; have very general ecological requirements; do not respond to management activities (e.g. western white suckers); are limited in their distribution; or are not well understood and may be considered a "nuisance" in some situations (e.g. beaver). For these reasons, non-native trout are often chosen as MIS in Colorado and meet the National Forest Management Act 1982 regulations. In addition to being indicators of environmental stress, non-native trout species represent an economic benefit to Colorado as an important game species.

American beaver was previously discussed as an MIS in the Terrestrial Species and Habitat section due to the fact that it lives on both land and in water. It is a species that plays an important ecological role and has a major influence on aquatic ecosystems and the species of plants and animals within them (Wohl 2001). Historically, beaver dams played an even more important role in reducing the effects of flooding and increasing the extent and quality of aquatic habitats. Today, as roads encroach on numerous stream systems, beavers are often perceived as a "nuisance" as the water backed up from their dams spreads across floodplains and roads.

Table 43. Aquatic management indicator species for national forests in Colorado

Forest	Common name	Scientific name
AR	brook trout	*Salvelinus fontinalis*
	brown trout	*Salmo trutta*
	greenback cutthroat trout	*Oncorhynchus clarki stomias*
	Colorado river cutthroat trout	*Oncorhynchus clarki pleuriticus*
GMUG	all trout	*(multiple species)*
MLS	benthic macroinvertebrates	*(multiple species)*
PSI	brook trout	*Salvelinus fontinalis*
	greenback cutthroat trout	*Oncorhynchus clarki stomias*
RG	Rio Grande cutthroat trout	*Oncorhynchus clarki virginalis*
	brook trout	*Salvelinus fontinalis*
	brown trout	*Salmo trutta*
	rainbow trout	*Oncorhynchus gairdneri*
Routt	common trout	*(multiple species)*
	American beaver	*Castor canadensis*
SJ	cutthroat trout	*(multiple species)*
	brook trout	*Salvelinus fontinalis*
	brown trout	*Salmo trutta*
	rainbow trout	*Oncorhynchus gairdneri*
	American beaver	*Castor canadensis*
WR	all trout	*(multiple species)*
	American beaver	*Castor canadensis*
	benthic macroinvertebrates	*(multiple species)*

Abbreviations:
AR: Arapaho and Roosevelt National Forests
GMUG: Grand Mesa, Uncompahgre and Gunnison National Forests
MLS: Manti-La Sal National Forest
PSI: Pike and San Isabel National Forests
SJ: San Juan National Forest
RG: Rio Grande National Forest
WR: White River National Forest

General Effects of Activities That Would Differ By Alternative

This general effects discussion provides the background for understanding the environmental consequences that are subsequently described in more detail for each alternative. It is intended to minimize the need to reiterate effects of activities associated with the roadless area management alternatives by providing a general discussion of potential effects of road construction and reconstruction (i.e. roading), tree-cutting and removal activities, and energy resource exploration and development operations on aquatic species and their habitats. These activities differ by alternative and would potentially affect aquatic species or habitat. Many of these effects descriptions are reproduced from Winters et al. 2004.

The effects of livestock grazing, recreational activities, prescribed burning, fire suppression, road maintenance, ski area operations, mining hardrock minerals, and other authorized activities expected to continue to occur in roadless areas that do not significantly differ by alternative are not analyzed, except as part of the cumulative effects analysis at the end of this section. While large ski resorts are known to alter natural hydrological cycles and increase traffic congestion and land use activities that can impair water quality and aquatic species, the projected activities in roadless areas related to ski area development are not anticipated to vary appreciably by alternative, despite the differences in IRA and CRA boundaries in relation to those ski areas. Therefore, the effects of ski area developments on aquatic habitat and species in roadless areas do not warrant detailed discussion in this EIS (refer to Developed Ski Areas section).

Effects of Road Construction, Reconstruction and Use

The amount of oil, gas, and coal operations that are projected to occur in roadless areas varies by alternative, and can influence aquatic habitat and species (see Analysis Framework regarding projected activities). 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. As human populations continue to grow adjacent to roadless areas, there will be increasing demand for management activities on NFS lands in those areas that require road access, such as to conduct wildfire hazard reduction treatments. In addition, there will always be unwanted, illegal, user-created roads that must be removed.

Road-related impacts on water quality and aquatic habitat include the following (Elliot 2000, Elliot and Hall 1997, Elliot et al. 1996, Furniss et al. 1991, Morrison et al. 1995, Waters 1995):

- Sedimentation and organic material in aquatic systems from road surfaces or cut/fill slopes can lead to increases in turbidity and water temperature, and decreases in dissolved oxygen concentrations, which can lead to decreased fish spawning success and alterations in the health of macroinvertebrate communities.
- Chemical contaminants entering aquatic systems from vehicle oils, grease, fuel, and antifreeze can alter water chemistry parameters such as conductivity, acidity, and alkalinity, and can negatively affect riparian and wetland plant and animal species (direct mortality or decreased fitness).

- Contaminants associated with road dust abatement treatments and road de-icing (including salts and sand) can enter adjacent aquatic and wetland ecosystems.
- Road construction and use can remove, displace, or destroy riparian and wetland vegetation (Waters 1995); and vehicles can crush aquatic organisms and associated plant communities.
- Riparian soils can be compacted and riparian vegetation characteristics can be affected by heavy equipment and vehicle traffic on riparian and wetland soils (Mortensen 1989).
- Roads can block and rerouting surface and subsurface water flows 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.
- Road construction and use can reduce rates of primary production by algae, phytoplankton, and riparian and wetland plants.
- Road sediment input can result in a reduction or loss of preferred fish spawning substrate size classes.
- Stream channel form and function can be adversely modified by roads, particularly at stream crossings (Hagans et al. 1986, Heede 1980, Waters 1995). Roads adjacent to or crossing streams can affect stream channels in many ways, including altering channel geometry and profiles; altering substrate armoring at stream crossings; changing substrate size distribution at culverts and low-water fords; altering substrate embeddedness and bed aggradation from sediment input; and decreasing average pool depth and abundance.
- Roads can facilitate the spread of pathogens and diseases such as whirling disease and bacterial kidney disease in aquatic systems.
- Roads can contribute to reducing the distribution and abundance of aquatic plants and organisms due to increased fishing and collecting activities.

Another important effect from road construction and use as well as other land management activities that differ by alternative is the resulting increase in invasive and/or non-native plant and animal species in riparian and aquatic systems. Invasive species often cause declines in native species abundance and diversity. This includes invasive or non-native aquatic organisms (e.g. fish, amphibians, crustaceans, mollusks, and insects), which are known to be a pervasive impediment to maintaining intact natural aquatic ecosystems (Rahel 2000). 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).

Non-native fish species such as rainbow, brook, and brown trout have affected native trout populations in Colorado (Behnke 2002), although colder water temperatures limit the expansion

of those non-native trout species into upper elevation streams in the roadless and wilderness areas in Colorado (Vincent and Miller 1969). This is one reason why higher elevation roadless and wilderness areas are often selected for native species reintroduction projects. However, managing for native fisheries must be balanced with the high recreational and economic value of non-native fish species. While fishing pressures have greatly contributed to the reduced range of native trout, roadless areas generally do not contain roads open to public vehicular use. Therefore, there is a reduced risk of over-fishing in roadless areas.

While water temperature limits the invasion of non-native fish in roadless area streams, the whirling disease parasite continues to threaten native and non-native trout throughout the Rocky Mountains (Behnke 2002). However, in the less altered, higher elevation stream systems in roadless and wilderness areas, the whirling disease parasite does not appear to be becoming well established.

Roads authorized by the Forest Service can be designed, constructed and managed to reduce or eliminate many of the negative impacts on aquatic, riparian, and wetland ecosystems listed above. Forest Service road engineering standards include requirements for minimizing impacts on soil and water quality. In addition, a beneficial effect of the presence of roads in roadless areas is that they provide easier access to remote locations so that natural resource managers can collect data and implement aquatic habitat restoration projects. In addition, road dust and road-surface sediment can transport cations, hydrocarbons, and heavy metals to aquatic and wetland ecosystems, sometimes with beneficial results.

Effects of Tree-cutting and Removal Activities

The amount of tree-cutting and removal activities projected to occur in roadless areas varies by alternative and can influence aquatic habitat and species (see Analysis Framework regarding projected activities). The results of largely indiscriminate historic logging practices in the Colorado Rockies have influenced current aquatic habitat conditions (Allan 1995). However, commercial timber harvesting in the roadless areas has been limited.

Many trout species spawn and rear in forested watersheds, often utilizing small streams with linkages to adjacent forests (Chamberlin et al. 1991). Where these habitats are occupied by threatened and endangered trout, such as species of inland cutthroat trout, land use activities like tree harvests can have implications for their persistence. Tree-cutting with wood product removals in the roadless areas can cause a hierarchy of effects to aquatic habitat and species (modified from Chamberlin et al. 1991), such as biophysical changes in the water, energy, nutrients and sediment; structural changes in soil, vegetation, stream networks, and channel morphology; habitat changes in water depth and velocity, water quality, streambed composition, riparian vegetation, and amount of woody material in streams; and aquatic biota changes in food web integrity, abundance, and composition of producers and consumers.

Tree-cutting with removal (harvesting) activities typically involve site preparation, skid trails, landings, and temporary roads, which alter the vegetation and soil where those activities occur. Inappropriate harvest practices have been known to result in a number of negative consequences to aquatic species and habitat (Davies and Nelson 1994, Garman and Moring 1994, Hartman et al. 1996, Holtby 1988, Kedzierski and Smock 2001, Scrivner and Brownlee 1989), often due to the modification of upslope or streamside vegetation. Harvest practices with the greatest potential for causing erosion and stream sedimentation are road construction, tractor skidding, and intensive site preparation. These activities can contribute to surface, gully,

and large mass soil movements. Generally, as the number of acres of harvest and ground disturbance increase, soil erosion rates increase (Stednick 2000), as does the potential for other impacts.

Tree-cutting and removal activities vary widely in magnitude and intensity, and therefore in resulting consequences. Projected tree-cutting activities for fuel reduction purposes anticipated to occur in roadless areas would involve thinning, while forest health treatments may involve removing groups of dead and dying trees that are a result of insect or disease infestations (see Analysis Framework for details). While cutting larger acreages can affect water yield and nutrient loading (Windell et al. 1986), the removal of dead trees that would likely occur in the roadless areas under some alternatives would not be expected to be of sufficient magnitude and extent to measurably change water yield (water yield is further described in the Water Resource section).

Tree-cutting with wood product removals has other effects on aquatic systems, as the activity (Chamberlin et al. 1991):

- Alters hydrologic functions; reduces the amount of precipitation captured and evaporated from the forest canopy, and alters snow accumulations and the rate at which snow melts, which then adds to the amount of surface runoff; overall alters timing or magnitude of water runoff events, and can lead to channel scour and fish embryo mortality.
- Increases erosion and sediment in streams, causing reduced oxygen levels in spawning gravels.
- Changes stream channel structure and sediment storage capacity by weakening channel banks, removing sources of large woody debris, and altering the frequency of channel-modifying flows and sediment supply.
- Decreases woody material in the stream that can lead to reduced cover, loss of habitat complexity, and loss of pools.
- Increases stream temperature by removing shade along streams; this in turn can increase abundance of non-native warm-water species, increase susceptibility to disease, increase food production, and delay egg development for some aquatic biota.
- Reduces macroinvertebrate and fish diversity, such as through increases in stream sediment, turbidity, or temperatures (Bisson et al. 1992; Hartman et al. 1996); increases physiological stress or reduces favorable conditions for native cool-water fisheries (Barton et al. 1985).
- Decreases frequency of large, deep pools critical to fish (McIntosh et al. 1994).
- Changes the physical and ecological structures and functions of nearby wetlands that can persist for decades (Batzer et al. 2000).
- Removes streamside vegetation, resulting in changes to water quality in terms of temperature, suspended sediment, and nutrients.
- Changes wetland and riparian structure and function; areas between wetlands and uplands are particularly sensitive to hydrologic changes associated with harvesting (Dube et al. 1995); harvest activities can also reduce the abundance of amphibians and other wetland fauna (Perison et al. 1997).

- Alters pools, riffles, spawning gravel, obstructions, and side channel characteristics required by native fish; pools are very susceptible to tree cutting and log moving operations that influence the amount of large woody material in or near the channel margins; increases in sediment increase the number and extent of riffles; removal of instream structures and increases in sediment can affect spawning gravels.

As was discussed with the road-related effects, tree-cutting and removal activities would similarly increase the prevalence of invasive plant and animal species, which in turn would result in declines in native species abundance and diversity.

Forest Service authorized tree-cutting and removal activities projected to occur in the roadless areas are more restrictive and sensitive to environmental concerns than what occurred in the past. Most potential effects would be minimized or avoided, by avoiding major ground-disturbing activities in and near waterbodies, riparian areas, and wetlands. The bigger impacts on aquatic habitat and species would be primarily related to the associated road construction or reconstruction activities previously described. The main concern regarding future harvest activities in the roadless areas would be how the roads act as vectors for invasive species and sediment or increase the amount of unauthorized motorized access into roadless areas.

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 events in those areas. 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 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 activities can also 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).

Because the magnitude, frequency and number of severe wildfires in roadless areas is not expected to vary substantially by alternative (based on descriptions in the Fire and Fuels section), these general effects are not discussed further. In addition, the amount of prescribed fire in roadless areas is not anticipated to substantially vary by alternative, and prescribed fire would not be likely to substantially affect aquatic habitat due to mitigation measures that would be applied to minimize adverse effects.

Effects of energy resource exploration and development (oil, gas, coal)

The amount of oil, gas, and coal operations that are projected to occur in roadless areas varies by alternative, and can influence aquatic habitat and species (see Analysis Framework and Leaseable Minerals section). Additionally, oil and gas exploration and development activities usually include infrastructure that can affect aquatic habitat, such as fluid transport pipelines, well heads, pumping stations, power generating stations, electrical transmission lines, fluid storage facilities, and roads. Developing oil and gas fields can result in soil erosion, air pollution, surface and groundwater pollution, damaged vegetation, and dramatic changes in

land use patterns. In addition, oil spills and the dissolution of methane in groundwater (during well drilling) can negatively affect water quality. Coalbed methane development is not occurring in the roadless areas, nor is it expected to occur in the roadless areas.

Specific effects of energy resource exploration and development can include:

- Groundwater byproducts alter water temperatures in receiving surface waters
- Built structures alter stream channels, increase erosion and sediment rates, degrade riparian and wetland vegetation, and affect other aquatic structures and processes
- Oil and gas spills damage soil productivity and kill riparian and wetland vegetation, and can negatively affect aquatic biota
- Discharges of warm wastewater from oil or gas operations alters chemical composition in a way that can negatively or positively affect the growth of aquatic biota; often alters aquatic biodiversity and community structure.

In addition, as was discussed with the roading and tree-cutting effects, energy resource operations would similarly increase the prevalence of invasive plant and animal species, which in turn would likely result in declines in native aquatic species abundance and diversity.

Environmental Consequences – Direct /Indirect Effects

Alternative 1 – 2001 Rule (No Action)

Under alternative 1, the 2001 Roadless Rule provisions would continue to provide limitations on road building in IRAs, which constrains the feasibility of implementing oil, gas, and coal development and several other management activities within most of the IRAs (as described in the Leaseable Minerals section and other sections). Compared to other alternatives, there would be fewer tree-cutting and wood removal activities, energy resource operations, and other ground-disturbing activities that would continue to occur in the roadless areas. These would generally occur in areas where there are existing roads or road building was previously authorized (see Analysis Framework).

There are existing roads in IRAs that would continue to contribute to impacts on aquatic habitat. In addition, where new roads are projected to occur in IRAs, they would have a deleterious effect on aquatic species and habitat, especially if they occur in or near riparian areas and wetlands. Roads can have a big influence on riparian areas and wetlands even where roads are located a distance away. The general effects of roads on aquatic resources were previously described. However, Forest Service authorized road construction and reconstruction (as well as the projected tree-cutting activities) would be designed to avoid or mitigate direct impacts on aquatic habitat and species. Thus, the main threat to T&E species, sensitive species, and MIS would be from the potential increase in invasive species associated with the new roads and other activities projected to occur under this alternative.

The roading and tree-cutting restrictions under this alternative would be expected to adequately protect the roadless area characteristics and the T&E species, sensitive species, and MIS found in the IRAs. In addition, the constraints on new roads in IRAs would limit the amount of future oil, gas, and coal development activities in IRAs as well, especially compared to the other two alternatives. The potential for impacts on aquatic species and habitat in IRAs would be less than for the other two alternatives.

The acres of IRAs that are substantially altered by roads and past timber harvest would likely continue to cause some degradation of aquatic habitat. However, the majority of the IRAs would continue to provide adequate protection for aquatic ecosystems and the species that inhabit them. The road restrictions that apply to portions of ski areas in IRAs that are not under permits issued prior to January 12, 2001 could continue to limit ski area expansion and development outside those ski area permit boundaries. This would reduce the potential risks to fens, wetlands and other rare aquatic habitat in those particular locations just outside the ski area permit boundaries, compared to the other two alternatives. The unroaded areas located just outside the IRAs would continue to be governed by forest plan direction rather than a roadless area rule.

Table 44 displays the relative percentage of roadless areas on each national forest in Colorado that contains T&E or sensitive fish species, and indicates the key reason for those relatively high or low percentages. The specific T&E or sensitive species found on each national forest were previously displayed in table 41. The downstream fish species of greatest concern were displayed in table 42, and the MIS found on each forest were shown in table 43. The human activities and invasive organisms that are primary contributors to the declines in those fish species populations are summarized in the affected environment and cumulative effects descriptions.

Table 44. Number of roadless areas with known or likely aquatic threatened, endangered, or sensitive species for each national forest in Colorado, and the overall effects of alternative 1 on key aquatic species and habitat

National forest	No. of roadless areas with T&E or sensitive species	Effects of alternative 1
AR	12 of 48. This relatively high percentage indicates that these areas function as "strongholds" for native populations and/or are native trout reintroduction areas.	No adverse effect on T&E and sensitive species and MIS that occur here, downstream T&E species, or wetlands and riparian areas.
GMUG	21 of 103. This relatively high percentage reflects the state's aggressive program to increase Colorado River cutthroat trout populations.	No adverse effect on sensitive species and MIS that occur here, downstream T&E species, fens and other wetlands, or on use of IRAs for future native fish species recovery.
MLS	1 of 1. Roc Creek is the only roadless area on this forest that occurs in Colorado.	No adverse effect on sensitive species and MIS that occur here, downstream T&E species, or fens and other wetlands and riparian areas.
PSI	7 of 57. This relatively low percentage is mostly due to the large human population centers nearby and other land use activities that limit the ability to reestablish native greenback populations, despite recovery efforts.	No adverse effect on T&E species and MIS that occur here, downstream T&E species, or wetlands and riparian areas.
RG	4 of 73. The low number may be due to relatively less effort put into recovery of Rio Grande cutthroat compared to other native trout species.	No adverse effect on the sensitive species and MIS that occur here, especially Rio Grande cutthroat trout; downstream T&E species; or ability to use these roadless areas as future recovery areas for this native fish.
Routt	10 of 29. This relatively high percentage indicates that these areas function as "strongholds" for native populations and/or are native trout reintroduction areas.	No adverse effect on the sensitive species and MIS that occur here, or downstream T&E species.
SJ	11 of 56. This relatively high percentage reflects that these areas function as "strongholds" for native populations and are native trout reintroduction areas.	No adverse effect on the sensitive species and MIS that occur here, downstream T&E species, fens and other wetlands, or the ability to use these roadless areas as future recovery areas for native fish.
WR	27 of 91. This relative high percentage reflects the aggressive program to increase Colorado River cutthroat trout populations.	No adverse effect on the sensitive species and MIS that occur here, downstream T&E species, or the ability to use these roadless areas as future recovery areas for native fish.

Abbreviations:
AR: Arapaho and Roosevelt National Forests
GMUG: Grand Mesa, Uncompahgre and Gunnison National Forests
MLS: Manti-La Sal National Forest
PSI: Pike and San Isabel National Forests
RG: Rio Grande National Forest
SJ: San Juan National Forest
WR: White River National Forest

Based on information shown it the table, together with previous effects described and the additional details contained in the specialist report in the EIS record, this alternative would be expected to have no adverse impacts on threatened, endangered or sensitive species within roadless areas or downstream from roadless areas. Additionally, there would be no adverse impact on MIS, the wetlands, or other aquatic habitat characteristics. This assumption presumes that appropriate mitigation measures and best management practices would help avoid or minimize impacts from the activities allowed to occur in roadless areas under alternative 1.

Alternative 2 – Colorado Rule (Proposed Action)

The primary difference between this alternative and alternative 1 (no action) is related to the amount of new roads allowed and projected to occur in the roadless areas, as well as in the differences in the CRA boundaries compared to IRA boundaries (refer to appendix A, IRA and CRA acres and names, for details on the differences in acreage between IRAs and CRAs). This alternative has approximately 500,000 fewer acres in roadless areas with general road building prohibitions, where no roadless rule restrictions would apply. The forest plan direction for those areas not included in CRAs is generally less restrictive than either of the roadless area rules (see appendix G, roadless areas with important aquatic habitat and projected road building or tree-cutting, and the alternative 3 map for more information about forest plan direction for the acres not included in CRAs). Thus, in the substantially altered and other IRA acres located outside the CRAs, there would be a greater potential for impacts on aquatic habitat and species compared to alternative 1. However, this alternative includes unroaded acreage in CRAs that is outside IRAs, which would afford greater protection from potential impacts from new roads in those additional CRA acreages.

The effects of roads and increased vehicle traffic in the CRAs would be the same as described in the general effects and effects for alternative 1, with the main risk being associated with potential increases in invasive species. Mitigation and best management practices would protect aquatic habitat and species from the direct effects of new roads and tree-cutting activities. The risk of impacts on individual fish populations is predicted to be greater in the roadless areas where oil, gas, and coal development activities are projected to increase under alternatives 2 and 3 (forest plans), such as on the Grand Mesa, Uncompahgre, and Gunnison National Forest unit, as well as the San Juan and White River National Forests (see appendix G, roadless areas with important aquatic habitat and projected road building or tree-cutting, and the Leasable Minerals section).

The temporary nature of many of the new roads likely to occur in CRAs would help minimize the risk of long term road-related impacts on aquatic habitat. The projected increase in long-term energy-related roads would result in the risk of impacts from those roads to be longer lasting.

The increases in activities projected in CRAs and substantially altered areas (removed from roadless area protections under the proposed Rule) would be expected to increase risks to individual fish populations but 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. This is due to the relatively small amount of ground-disturbing activity likely to occur in or close to aquatic habitat in these areas, and best management practices and other mitigation measures that would be applied where needed to minimize impacts on aquatic habitat. The unroaded acres added to CRAs that are not in IRAs would provide more protection of aquatic habitat compared to alternatives 1 and 3 for those acres, due to the limitations on roads and tree-cutting in those areas.

Some of the IRA acres that are not included in CRAs under this alternative would likely have more new roads and associated management activities under the governing forest plans. The IRA acres and stream miles that are not included in CRAs are greatest on the Grand Mesa, Uncompahgre, and Gunnison National Forest administrative unit. Table 45 shows the total perennial stream miles on each national forest unit in Colorado, along with the change in those

stream miles that would be under roadless area protections in alternative 2 compared to alternative 1.

Table 45. Changes in stream miles in roadless areas between the IRA and CRA boundaries, for each national forest unit in Colorado

National forest	Total stream miles in IRAs	Total stream miles in CRAs	Net difference
AR	493	470	-23
GMUG	1,473	1,106	-367
MLS	13	12	-1
PSI	767	804	+37
RG	650	610	-40
ROUTT	733	725	-8
SJ	716	722	+6
WR	910	901	-9
Total	**5,756**	**5,350**	**-406 mi.**

Source: Roadless Areas GIS database, May 2008

Note: The Manti-La Sal National Forest is not included due to the insignificant number of streams and change in stream miles (1 mile) for the portion of this forest that occurs in Colorado

Abbreviations:

AR: Arapaho and Roosevelt National Forests

GMUG: Grand Mesa, Uncompahgre and Gunnison National Forests

MLS: Manti-La Sal National Forest

PSI: Pike and San Isabel National Forests

RG: Rio Grande National Forest

SJ: San Juan National Forest

WR: White River National Forest

For analysis purposes, an assumption was made for this programmatic level of analysis that if a T&E or sensitive fish species occupies a stream within a roadless area, the activity projected as likely to occur in that roadless area would occur within that watershed where the fish population occurs. In table 45, the number of perennial stream miles on each national forest was used to evaluate change in habitat between alternatives and for analyzing potential risk to the MIS. The risk of potential impact on aquatic fisheries is presumed to increase in roadless areas that contain T&E or sensitive fisheries and have a likelihood of additional roads and other management activities. Appendix C of this EIS, road building and tree-cutting projections, displays the relative likelihood of new roads and tree-cutting activities in each roadless area that varies by alternative.

Appendix G, roadless areas with important aquatic habitat and projected road building or tree-cutting, shows those roadless areas where projected roading and tree-cutting activities differ by alternative and overlap areas where aquatic T&E or sensitive species occur. The effects discussed in this section are largely based on those areas of key concern for aquatic species and habitat.

Table 46 briefly summarizes the specific concerns, considerations, and effects on aquatic species and habitat. It is based on the CRAs (and national forests) of highest concern in terms of aquatic species. These are the areas where aquatic species and habitat occur in the same areas where

projected roading and road-related activities are projected to occur. Refer to appendix G, roadless areas with important aquatic habitat and projected road building or tree-cutting, which shows the CRAs and substantially altered and other IRA acres outside CRAs where projected activities are known or likely to occur. The specialist report in the EIS record contains further details for each national forest and specific roadless area.

Table 46. Specific concerns, considerations, and effects of alternative 2 (proposed action)

In CRAs on this national forest	Specific concerns and effects considerations	Effects of alternative 2
AR	Low percentage of CRAs with T&E and sensitive species, but some CRAs have threatened greenback trout. The Loveland ski area (Bard Creek IRA) not included in CRAs has projected activities and greenback cutthroat trout; but no ski area expansions are projected.	No adverse effect on T&E species (greenback trout), sensitive species, and MIS population trends; downstream T&E species; or wetlands and riparian areas.
GMUG	Low percentage of CRAs with sensitive species, and no T&E species in CRAs. Minor difference from alternative 1 in projected activities in the few roadless areas with sensitive species. More oil and gas roads and operations result in less protection to the abundant riparian areas, wetlands, and fens for this alternative, but more protection than alternative 3.	No long-term adverse effects on sensitive species and MIS population trends, or downstream T&E species, or wetlands and riparian areas (unless major oil spills, pipeline ruptures or similar events occur). But, increased risk of impact on individual populations from increases in new roads and associated coal mining activities.
MLS	No projected activities in CRAs with aquatic T&E or sensitive species. Oil and gas activities would continue in some portions of the CRA, but lease stipulations would avoid or minimize risk to aquatic habitat.	No adverse effect on T&E species, sensitive species, and MIS population trends; downstream T&E species; or wetlands and riparian areas.
PSI	No oil, gas, or coal roads or activities in CRAs with T&E or sensitive species. Tree-cutting activity is projected in nearly all CRAs, including those with a threatened fish species. Mitigation would likely be adequate for those tree-cutting activities in CRAs.	No adverse effect on T&E species (greenback trout), sensitive species, and MIS population trends; downstream T&E species, or wetlands and riparian areas.
RG	No projected activities in CRAs with sensitive species (Rio Grande cutthroat). Some tree cutting in substantially altered areas, but no new roads.	No adverse effect on sensitive species and MIS population trends, downstream T&E species, or wetlands and riparian areas.
ROUTT	Very limited amount of projected activities in one CRA with sensitive fish; no new roads.	No adverse effect on sensitive species and MIS population trends, downstream T&E species, or wetlands and riparian areas.
SJ	Considerable increase in roading, oil-gas activities, and tree-cutting in CRAs with multiple activities would likely occur in the same CRAs (and especially in SJ substantially altered area). The sensitive species is already restricted in this area, and mitigations may not be adequate in this substantially altered area. The unroaded additions into CRAs may offer increased protection for aquatic habitat on those acres.	No long-term adverse effects on sensitive species and MIS population trends, downstream T&E species, or wetlands and riparian areas. Increased risk of impacts on individual populations from increased roading and associated oil and gas activities where aquatic sensitive species occur.
WR	About 11 CRAs or substantially altered areas outside CRAs have roading, oil and gas, and other projected activities where sensitive fish species occur. Roadless area acreage reduction is mostly due to removal of ski areas.	No long-term adverse effects on sensitive species and MIS population trends, downstream T&E species, or wetlands and riparian areas (unless major oil spills, pipeline ruptures or similar events occur). Increased risk of impacts on individual populations and wetlands from increased roading and associated oil and gas activities in many areas where aquatic sensitive species occur.

Source: Roadless Areas GIS database, May 2008

Abbreviations:

AR: Arapaho and Roosevelt National Forests
GMUG: Grand Mesa, Uncompahgre and Gunnison National Forests
MLS: Manti-La Sal National Forest
PSI: Pike and San Isabel National Forests
RG: Rio Grande National Forest
SJ: San Juan National Forest
WR: White River National Forest

Compared to alternative 1, where projected activities increase for this alternative and T&E or sensitive species occur there would be an increased risk of negative effects. The roadless areas on the Grand Mesa, Uncompahgre and Gunnison ; San Juan; and White River National Forests are where this risk may be highest due to the increases in roads to support additional oil, gas, and coal development activities, in addition to other fuels or forest health projects projected in those same affected areas. Having a higher likelihood for multiple activities and roads in the same CRA where native aquatic species occur poses this increased risk of impact on those species. However, when projects are planned, mitigation measures and best management practices are expected to avoid or minimize those potential impacts to the extent practical.

No population declines in MIS would be expected, although there would be some limitations on ability for populations to interact due to habitat fragmentation from roads and other activities. The MIS or sensitive species population viability would not be significantly affected on any of the national forests, assuming that appropriate mitigation and best management practices would be applied at the project level.

There would be a potential increased risk of adverse impact on those streams and the associated wetlands and riparian areas, compared to alternative 1, related to the change in boundaries between IRAs and CRAs. However, those potential impacts on the acres not included in CRAs and included in IRAs would not measurably differ from effects under alternative 3, because alternatives 2 and 3 do not significantly differ in the amount of projected activities in those particular areas. The biggest potential effect of not including those acres in CRAs that are in the IRAs would be to the wetlands and fens that may be affected by increased human activity on those acres.

Overall, population trends would not be negatively affected, although there would be impacts in roadless areas where invasive species are introduced, human activity increases, or inadvertent accidental damage to aquatic habitat occurs as a result of management activities.

Alternative 3 – Forest Plans

Under this alternative, the forest plan direction related to roading and tree-cutting activities in roadless areas varies widely for each national forest and roadless area. Appendix B, forest plan management area direction, together with the alternative 3 map in the map packet, provide information regarding the degree to which each forest plan is more or less restrictive than the 2001 Rule or Colorado Rule. There are four national forests in particular where forest plan direction for roadless areas is less restrictive than the current 2001 Rule on nearly 100 percent of IRA acres: Grand Mesa, Uncompahgre, and Gunnison; Manti-La Sal; Pike and San Isabel; and San Juan National Forests. The Rio Grande National Forest's forest plan is more restrictive than alternative 1 (no action) on over 80 percent of the IRA acres.

Most of the effects under this alternative would be the same as previously described for alternative 2 (proposed action). The general effects of the projected roading, tree-cutting and road-related oil, gas, and coal development activities would have effects similar to those described in the general effects discussion and similar to alternative 2. However, the extent of those projected activities in IRAs would be greatest under this alternative. Thus, this alternative poses the greatest risk of impact on aquatic species and habitat.

One beneficial effect of this alternative would be associated with the increased amount of fuel reduction treatment acres in IRAs, which could reduce wildfire severity in the IRAs resulting in beneficial effects on aquatic habitat and species.

Overall, this alternative would result in reduced "resiliency" and population fitness of some MIS species, potentially affect populations of aquatic T&E and sensitive species, and further reduce wetland and riparian abundance and health. This alternative could potentially create more impacts on aquatic species and ecosystems compared to the other two alternatives, as the forest plans are generally less restrictive on more acres of IRAs, and there are more projected activities in IRAs under this alternative.

Table 47 summarizes the specific concerns, considerations and effects on aquatic species and habitat. It is based on IRAs (and national forest units) of highest concern in terms of aquatic species. These are the IRAs where aquatic species and habitat occur in the same areas where roading and road-related activities are projected to occur and differ by alternative. Refer to appendix G, roadless areas with important aquatic habitat and projected road building or tree-cutting, which shows the CRAs and substantially altered and other IRA acres outside CRAs where projected activities may occur in roadless areas with aquatic T&E or sensitive species. The specialist report in the EIS record contains further details for each national forest and specific roadless areas.

Table 47. Specific concerns, considerations, and effects of alternative 3 (forest plans)

National forest	Specific concerns and effects considerations	Effects of alternative 3
AR	Low percentage of IRAs with T&E and sensitive species, but some IRAs have threatened greenback trout. The Loveland ski area (Bard Creek IRA) has projected activities and greenback cutthroat trout; but no ski area expansions are projected. Slightly more activities are projected in same roadless areas as alternative 2. Potential impacts on wetlands and riparian areas would likely be mitigated.	No adverse effect on T&E species (greenback trout), sensitive species and MIS population trends; downstream T&E species; or wetlands and riparian areas.
GMUG	Low percentage of IRAs with sensitive species, and none with T&E species. Limited projected activities in IRAs with sensitive aquatic species. IRAs on GMUG have the most projected roading, oil and gas, and coal mining in IRAs with sensitive fish. Wetlands and riparian areas could be affected in six IRAs with projected activities.	No long-term adverse effects on sensitive species and MIS population trends, downstream T&E species, or wetlands and riparian areas (unless major oil spills, pipeline ruptures or similar events occur). But, increased risk of impact on individual populations from increases in new roads and associated coal mining activities.
MLS	No projected roading or tree-cutting or future oil and gas development in the one IRA with T&E and sensitive fish that is on this forest.	No adverse effect on T&E species, sensitive species, and MIS population trends; downstream T&E species; or wetlands and riparian areas.
PSI	Relatively high number of IRAs with projected activities. Many IRAs with threatened trout species have roads and tree-cutting projected. More activities in IRAs with T&E and sensitive species under this alternative compared to others, increasing the risk of adverse impacts on individual populations.	No long-term adverse effect on T&E species (greenback trout), sensitive species, and MIS population trends; downstream T&E species; or wetlands and riparian areas. Higher risk than other alternatives for impacts on individual threatened species habitat, wetlands, and riparian areas.
RG	No new roads in IRAs, and no major difference in potential effects to sensitive species, as forest plan direction is generally more restrictive than other alternatives. No difference from alternatives 1 or 2.	No adverse effect on sensitive species and MIS population trends, downstream T&E species, or wetlands and riparian areas.
ROUTT	Limited amount of projected activities relative to size of IRAs, and no T&E species occur in these IRAs.	No adverse effect on sensitive species and MIS population trends, downstream T&E species, or wetlands and riparian areas.
SJ	Considerable increase in projected roading, oil and gas, and tree-cutting activities in IRAs where sensitive species occur, some in the same areas (especially in SJ substantially altered area). The sensitive species is already restricted in this area. Mitigations would not eliminate impacts in this portion of the IRA. Hermosa IRA used for sensitive species recovery would be more affected in this alternative. Wetlands and riparian areas in many IRAs could be affected by extent of projected activities.	No long-term adverse effects on sensitive species and MIS population trends, downstream T&E species, or wetlands and riparian areas (unless major oil spills, pipeline ruptures or similar events occur). Increased risk of impacts on individual populations from increased roading and associated oil and gas activities where aquatic sensitive species occur.
WR	Forest plan direction is less restrictive than other alternatives on majority of IRA acres. Considerably more projected roading, oil and gas, and tree-cutting in IRAs with sensitive fish species. Retaining ski area acres in IRAs would be beneficial for long-term protection on those acres.	No long-term adverse effects on sensitive species and MIS population trends, downstream T&E species, or wetlands and riparian areas (unless major oil spills, pipeline ruptures or similar events occur). Increased risk of adverse impacts on individual populations and wetlands from increased roading and associated oil and gas activities in many areas where aquatic sensitive species occur.

Source: Roadless Areas GIS database, May 2008

Abbreviations: AR: Arapaho and Roosevelt National Forests; GMUG: Grand Mesa, Uncompahgre and Gunnison National Forests; MLS: Manti-La Sal National ForestPSI: Pike and San Isabel National Forests; RG: Rio Grande National Forest ; SJ: San Juan National Forest; WR: White River National Forest

Summary of Effects

The large geographic scale and programmatic nature limits the ability to draw site-specific conclusions. However, based on the available data and projections of expected differences in activities in each roadless area, there is sufficient information from which to compare alternatives in terms of relative risk of effects.

Considering the overall effects of each alternative, regardless of the differences on each forest, alternative 1 (no action) would pose the least risk of adverse effects, 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. Alternative 2 (proposed action) would have more potential for adverse impacts on aquatic species due to projected activities in roadless areas occupied by aquatic species. Alternative 3 (forest plans) would have the highest potential for adverse impacts on aquatic species due to the higher number of projected activities that would likely occur in the IRAs occupied by aquatic species.

The greatest concern for potential impacts on aquatic species and habitat is where aquatic species and habitat occur in the same roadless areas where projected roading and tree-cutting activities would occur, especially where combined with projected oil, gas, or coal activities. This risk would be highest under alternative 3, slightly less under alternative 2, and lowest under alternative 1. This conclusion holds true when considering risk of adverse impacts on rare aquatic wetlands (including fens) and riparian areas, to MIS, and to downstream aquatic species. The roadless areas of highest concern occur on the Grand Mesa, Uncompahgre, and Gunnison National Forests; San Juan National Forest; and White River National Forest, as shown in the previous tables.

Environmental Consequences – Cumulative Effects

The effects on aquatic habitat and species from past, ongoing, and foreseeable future activities were considered, including all those listed in appendix D, cumulative effects framework. Consideration was given as to whether those effects of other activities and land uses would combine with the effects just described for each roadless management alternative.

There are a number of cumulative effects on aquatic species and habitat from the additive influences from other human activities, such as historic settlements and ongoing land uses. The cumulative effects of management activities on native fishery resources have resulted in most of Colorado's native fish having special regulatory considerations because of their rarity (Behnke 2002). While non-native trout such as browns, brooks, and rainbows appear to be thriving on most national forests in Colorado, continual change in human influences suggests that in some areas aquatic populations may be suppressed or non-viable. Historic activities have resulted in a considerable loss of wetlands and riparian areas in Colorado. Colorado has lost approximately 50 percent of its natural wetlands (Dahl 1990).

Throughout the last 100 years of managing NFS lands in the roadless areas, numerous types of management activities have been conducted. Some have ongoing effects, such as building dams or (placer) mining in streambeds and riparian areas. The dramatic reduction in native trout as well as other fish species is an indication that past management activities have resulted in reduced populations and species of fish in Colorado. Additionally, there are fish populations that are being suppressed in many areas where cumulative influences have degraded water quality and aquatic habitat.

Where there are more roadless area acres in close proximity to large population centers in Colorado, such as on the Arapaho and Roosevelt or Pike and San Isabel National Forests, there is a higher potential for cumulative impacts on aquatic species and habitat. The roadless areas on these forests that are close to large population centers experience a wide array of recreational, developmental, and municipal uses that affect the associated streams, wetlands, and other aquatic habitat within those areas. These various land use activities, when they occur in the same vicinity, may cumulatively limit the potential for reestablishment of threatened greenback cutthroat trout, a threatened fish species that only occurs on these two national forest units in Colorado. Additionally, portions of roadless areas on the Pike and San Isabel experienced some large fires within the last decade, resulting in a dramatic reduction in aquatic MIS habitat and populations in those areas.

Where oil and gas development or coal mining occur in the same roadless areas as developed ski areas, other recreational uses, fuel reduction projects, and other land management activities, there can be cumulatively adverse impacts on aquatic habitat. This would be most likely to occur in roadless areas on the Grand Mesa, Uncompahgre, and Gunnison National Forests, as well as the San Juan or White River National Forests. In roadless areas on the Grand Mesa, Uncompahgre, and Gunnison and San Juan National Forests, unique features like fens and wetlands are relatively more abundant and therefore more vulnerable to cumulative effects from the many activities expected to occur over the next 15 years. Additive impacts on aquatic resources on the White River may be related to roadless area proximity to populated areas that continue to experience rapid growth. Recreation use is considered very high in several areas, with Summit County having the highest concentration of ski areas in the state. The White River National Forest contains numerous roads, including roads that cross streams. Road crossings and multiple use activities on the White River may be limiting movement of native and non-native fish throughout a considerable portion of the forest, particularly in the southern and eastern portions.

On the Manti-La Sal National Forest, the Roc Creek roadless area contains an eligible wild and scenic river based on its scenic, geologic, and hydrologic values, along with waterfalls and riparian vegetation complexes. There are several oil and gas leases in the area that may add to recreational uses and other ongoing activities to additively affect the unique riparian resources in this roadless area.

There are roadless areas on the national forests that are not adjacent to large population centers and are not expected to have oil, gas, or coal operations in the next 15 years, such as areas on the Rio Grande and Routt National Forests. Despite those expectations, there would still be a variety of human developments and land use activities that continue to increase over time and have additive effects on the streams that historically supported Rio Grande cutthroat trout or other sensitive or MIS fish, as well as riparian areas and wetlands.

Considering all past, ongoing, and projected future activities within the same watersheds as the roadless areas in Colorado, cumulative effects are clearly evident and would be likely to continue to occur. The increase in predicted adverse effects associated with alternatives 2 (proposed action) or 3 (forest plans) would add to the existing cumulative effects from all the other land use activities discussed. While alternatives 2 or 3 would not individually result in highly significant adverse effects, they would contribute negatively to cumulative effects in these aquatic ecosystems in the roadless areas. Alternative 2 would have less potential for adverse effects due to having more restrictions on road building or tree-cutting activities in the

CRAs. Alternative 1 (no action) would not contribute measurably to adverse cumulative effects because it generally prohibits future road building and limits tree-cutting to a large degree in the IRAs.

REFERENCE LANDSCAPES

This section addresses the effects of alternatives on changes in opportunities to use roadless areas as reference landscapes. One of the nine roadless characteristics is the ability for roadless areas to be used as 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.

Affected Environment

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. Widespread interest exists in obtaining information about large-scale ecological patterns, processes, and management activities (Bormann et al. 1999). Issues such as viability of wide-ranging animals, watershed cumulative effects, and restoration of fire dependent ecosystems, require research and monitoring at large scales to significantly address this interest. Roadless areas enable monitoring of long-term environmental change; provide the opportunity to gain an improved understanding of the effect of past events and activities on the landscape; help to establish emerging management policies, programs, and activities; and help to evaluate the effects of past policies.

Unique opportunities to gather information about ecological systems and human-related impacts exist in these areas because, unlike wilderness, national parks, and other restrictive areas, roadless areas provide large expanses where a range of management treatments may be applied and tested. Gathering this information is possible through research and monitoring activities conducted in partnerships between scientists, the public, and managers (Bormann et al. 1999). In the Rocky Mountain Region, scientists are studying the effects of anthropogenic (human-induced) activities on aquatic, riparian, and wetland resources at a broad scale. This type of research relies on including some national forest landscapes that are largely undeveloped, in order to make comparisons of ecological consequences (Winters et al. 2004).

Thus, roadless areas in Colorado provide large areas for the long-term study of trends in ecosystem conditions. Roadless areas in Colorado are being included in various monitoring and research studies on changes in neo-tropical migratory bird populations, drought conditions, carbon emissions (greenhouse gases), invasive species populations, threatened and endangered species populations and recovery efforts, and other effects on natural ecosystems. This type of research and monitoring typically involves establishment of measurement plots and installation of equipment to periodically measure change. Roadless areas also serve as valuable reference points for comparison of the effects of past activities on adjacent lands, especially in larger areas adjacent to wilderness or parks. Comparison of long-term effects that roads have had on watersheds, recreation, forest health, and other resources is only possible if roadless areas are available as a basis for comparison.

Roadless areas provide an opportunity for research and monitoring efforts to help agencies understand the consequences of their land management policies. Public land management policies have a history of change. Future policies will likely be different from present and past

policies. Future choices, to a large degree, will be dependent on the results of trials and knowledge gained through research and monitoring as policies and programs change. Currently, landscape-scale management experiments are needed to evaluate methods for restoring historical fire regimes in the Rocky Mountain Region. Roadless areas will continue to play an important role in answering questions about the ecological effects of large high-severity wildfires and how they can be abated, whether managers should use an active or "natural" approach to restoring fire regimes, the effects of roads and tree cutting on wildfire behavior, and similar questions.

Long-term commitment to learning is essential to achieve sustainable ecosystem management. The next generation of scientists, citizens, and managers may benefit from the information derived from today's land management experiments. Working collaboratively with scientists, managers, and the public in development of research and monitoring activities could help ensure that the right questions and values are considered and that long-term commitments to learning are made.

Environmental Consequences – Direct/Indirect Effects

Alternative 1- 2001 Roadless Rule (No Action)

Alternative 1 would retain the greatest acreage of inventoried roadless areas (IRAs) that can provide reference landscapes for long-term study where comparisons of natural settings are needed. Average annual projections of activities in IRAs under this alternative are minimal relative to the 4.31 million roadless acres (see Analysis Framework section). Where additional roading, tree-cutting, and energy resource development activities are projected to occur in IRAs, the quality of those roadless areas as reference landscapes would be degraded or lost. Also, the IRAs that contain substantially altered acreages and developed ski areas currently provide minimal value as reference landscapes.

Alternative 2- Colorado Roadless Rule (Proposed Action)

Alternative 2 would reduce the opportunity for using roadless areas for long-term study where comparisons of natural settings are needed, as many roadless areas would be subject to roading and tree cutting. Alternative 2 would cause a decline in this particular roadless area characteristic in portions of some roadless areas. Average annual projections of activities in CRAs under this alternative are outlined in the Analysis Framework section. Where additional roading and associated tree-cutting and energy resource development activities are projected to occur in CRAs, the quality of those roadless areas as reference landscapes would be degraded or lost. Also, the substantially altered acres and other IRA acres not included in CRAs would not add to or subtract from the value of the CRAs as reference landscapes. However, the additional unroaded acres included in CRAs (and not included in IRAs) would enhance the acreage of CRAs that provide potential reference landscapes with natural settings.

Alternative 3- Forest Plans

Alternative 3 would retain the least IRA acreage that can provide reference landscapes for long-term study where comparisons of natural settings are needed. This is because forest plan direction applicable to the IRAs generally allows new roads and other road-related activities. Alternative 3 would result in the greatest decline in this particular roadless area characteristic in portions of some roadless areas. Average annual projections of activities in IRAs under this

alternative are greatest. Specific activity levels are outlined in the Analysis Framework section. Where additional roading and associated tree-cutting and energy resource development activities are projected to occur in IRAs, the quality of those roadless areas as reference landscapes would be degraded or lost. The substantially altered acres and other IRA acres where roads and tree-cutting have already occurred in IRAs would continue to be of little value as reference landscapes where natural settings are needed. Not including the unroaded acres that are included in CRAs would exclude this opportunity to enhance the acreage of potential reference landscapes.

Summary of Effects

Alternative 1 would retain the most roadless area acreage available to provide natural ecosystem settings and functions for ecological research and monitoring. Alternative 2 would reduce the roadless area acreage available to provide natural ecosystem settings and functions for ecological research and monitoring. Alternative 3 would result in the greatest reduction of roadless area acreage available to provide natural ecosystem settings and functions for ecological research and monitoring.

Environmental Consequences – Cumulative Effects

This evaluation considered the past, ongoing, and foreseeable activities that are likely to have effects that overlap roadless areas and influence their value as reference landscapes. Refer to appendix D, the cumulative effects framework, for a description of those actions and associated effects most relevant to this EIS.

Most of the roadless areas border congressionally designated wilderness or similarly designated areas (e.g. protection areas, as described in the Other Congressionally Designated Areas and Trails section). Cumulatively, this adds to the total acreage that can be used for large scale research and monitoring, using these combined areas as reference landscapes. The cumulative benefits of having roadless areas adjacent to wilderness and other protected areas would be greatest under alternative 1 due to the greater acreage where human activities would be limited. This cumulative benefit would be less under alternative 2, and even less under alternative 3, based on the direct and indirect effects previously described for those alternatives.

Residential populations are continuing to expand along the borders of roadless areas, which is detracting from their value as reference landscapes. Human land use activities, particularly recreation activities including some illegal motorized use, are expected to continue to become more prevalent in portions of some roadless areas that are within those wildland-urban interface zones. This cumulatively would result in fewer roadless area acres being suitable as reference landscapes for research and monitoring of natural ecological processes. The cumulative effect would be most evident under alternative 3, where the least amount of roadless area acreage would be available in the long term as a reference landscape representing natural ecosystem processes.

DISPERSED RECREATION

Dispersed recreation refers to recreational activities that do not require constructed facilities such as toilets, camping pads, tables and grills, and other structures. Dispersed recreation includes non-motorized activities such as hiking, biking, and backcountry skiing, as well as motorized activities such as snowmobiling and OFF-HIGHWAY VEHICLE use.

This section discusses the affected environment and environmental consequences related to those outdoor recreational activities in roadless areas, focusing on the differences among alternatives regarding projected or foreseeable road construction or reconstruction, tree-cutting, and energy resource operations in roadless areas (see Analysis Framework section).

Separate sections of this EIS describe effects of alternatives on developed recreation opportunities and sites, including ski areas, as well as the effects on recreation special use authorizations such as outfitter-guide permits.

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.

In general, roadless area characteristics and values, as described in the preamble to the 2001 Roadless Rule and chapter 1 of this EIS, include primitive, semi-primitive non-motorized, semi-primitive motorized, and various classes of dispersed recreation opportunities. Some portions of roadless areas in Colorado provide more of a roaded natural ROS environment because of the presence of roads or other constructed facilities, off-highway vehicle (OHV) trails, and higher concentrations of visitors. The number of acres in each ROS class within the roadless areas is not known at this time because of incomplete ROS class inventory mapping. Although areas with these recreation opportunities may have many wilderness-like attributes, they often allow the use of mountain bikes and other mechanized means of travel, in contrast to designated wilderness areas. Primitive, semi-primitive non-motorized, and semi-primitive motorized areas can also take pressure off heavily used wilderness areas by providing additional solitude and quiet, and dispersed recreation opportunities.

Definitions of the ROS classes are as follows:

Primitive—an area that is essentially an unmodified natural environment of large size. Interaction between users is very low and evidence of other users is minimal. The area is managed to be essentially free from evidence of human-induced restrictions and controls. Motorized use within the area is not permitted.

Semi-primitive non-motorized (SPNM)—an area that has a predominantly natural or natural-appearing environment of moderate to large size. Interaction between users is low, but there

is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but they are subtle. Motorized use is not permitted.

Semi-primitive motorized (SPM)—an area that has a predominantly natural or natural-appearing environment of moderate to large size. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present but is subtle. Motorized use is permitted.

Roaded natural—an area that has predominantly natural-appearing environments with moderate evidences of the sights and sounds of humans. Such evidences are usually in harmony with the natural environment. Interaction between users may be low to moderate, but evidence of other users is prevalent. Resource modification and practices are evident but harmonize with the natural environment. Conventional motorized use is provided for construction standards and facilities design.

Rural—an area with a substantially modified natural environment. Sights and sounds of humans are readily evident, and the interaction between users is moderate to high. A considerable number of facilities are designed for use by large numbers of people. Facilities for intensified motorized use and parking are available.

Urban—a substantially urbanized environment, although the background may have natural-appearing elements. Affiliation with individuals and groups is prevalent, as is the convenience of sites and opportunities. Large numbers of users can be expected, both on-site and in nearby areas. Facilities for highly intensified motor vehicle use and parking are available. Regimentation and controls are obvious and numerous.

Affected Environment

Dispersed recreation generally occurs in ROS settings classified in the Forest Service as primitive, semi-primitive non-motorized, and semi-primitive motorized classes. The remaining ROS classes typically reflect higher levels of development. Thus, dispersed recreation activities occur primarily outside developed campgrounds, picnic grounds, ski areas, and other developed recreation sites that have constructed facilities.

Much of the dispersed recreational value of roadless areas lies in the unique primitive, SPNM, and SPM recreation opportunities and settings they offer. They provide settings for dispersed recreational activities that are prohibited in designated wilderness areas and not readily available in developed or modified settings with NFS roads. For example, wilderness areas prohibit mechanized and motorized uses (other than for persons with disabilities) such as off-highway vehicles, mountain bikes, and snowmobiles. In addition, roadless areas generally have a low level of human-induced change. However, some portions of IRAs have been substantially altered by past roading and timber harvesting; therefore, these portions of the IRAs provide a different type of dispersed recreation.

Nationally, the top five activities pursued on NFS lands are viewing natural features, general relaxation, hiking, viewing wildlife, and driving for pleasure (Cordell et al. 2004). Roadless areas in Colorado often provide outstanding dispersed recreation opportunities, such as camping, canoeing, cross-country skiing, fishing, hiking, hunting, picnicking, wildlife viewing, and OFF-HIGHWAY VEHICLE trail use. While hunting and fishing can occur in roaded areas

on NFS lands, roadless areas typically provide a semi-primitive to primitive (unroaded) setting, which is important to some hunters and anglers.

Environmental Consequences – Direct and Indirect Effects

Alternative 1- 2001 Rule (No Action)

Under this alternative, new roads would not be constructed or reconstructed within most of the IRA acres over the next 15 years, based on projections described in the Analysis Framework section. Without adding new roads, the level of development within the IRAs would remain relatively stable. Thus, no significant change in ROS setting would be expected in the vast majority of IRA acres. The ROS setting may change to a higher level of development in the few portions of IRAs where additional roads and energy resource development are projected to occur (see Analysis Framework).

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 IRA 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.

The 6 miles of roads that are projected to be constructed or reconstructed in IRAs under alternative 1, as described in Analysis Framework, are most likely to be constructed/reconstructed in areas previously roaded. This is because the areas projected for treatments would likely be closest to the boundary of IRAs, and because forest plan direction in these ROS classes would allow for motorized use and roading. These areas would typically be in roaded natural or semi-primitive motorized ROS settings. The 6 miles of new road each year would be spread over many different IRAs and would not likely make a noticeable difference in the semi-primitive motorized or roaded natural setting or recreation opportunities in those roaded portions of IRAs.

In some portions of IRAs, it is expected that unauthorized roads would be rehabilitated to reduce resource damage. In addition, approximately 12.8 miles per year of existing NFS roads would be projected to be decommissioned in IRAs. Reducing existing unnecessary roads in portions of IRAs would improve the natural appearance of the affected landscape in those areas. Decommissioning more road miles than would be built in IRAs would help maintain the semi-primitive to primitive settings and recreational opportunities.

The constraints on tree-cutting and wood removal activities within IRAs under alternative 1 would help retain the semi-primitive to primitive ROS settings in roadless areas where they exist in the majority of IRA acreage, especially after a number of years, depending on specific conditions, when the vegetation has regrown. Tree cutting is projected to occur on about 800 acres per year, spread out over many different IRAs. Most of this activity would occur in the substantially altered portions of IRAs. This amount of activity would not measurably alter existing ROS settings and recreation opportunities identified in those areas, especially in the long term.

None of the projected activities would be expected to reduce the quality of hunting and fishing opportunities.

Substantially altered areas and developed portions of ski areas inside IRAs would continue to contain more developed features such as roads, parking lots, ski lodges, and facilities within IRAs compared to other portions of IRAs. Those developments and amount of human activities within those portions of IRAs would detract from the semi-primitive setting that generally characterizes roadless areas.

Alternative 2 – Colorado Rule (Proposed Action)

The 21 miles of roads projected to be constructed/reconstructed in CRAs each year under this alternative would be expected to change some of the semi-primitive ROS settings in the CRAs toward roaded natural settings, depending on the timeframe that the road is in place. Temporary roads would be expected to be short-term and would not change the ROS setting. Roads built in CRAs to support energy resource development activities would be more likely to result in a longer term change in the recreation setting. In the portions of CRAs where new roads along with tree-cutting and removal activities or energy resource development activities occur, 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 CRAs 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.

Most of the roads expected to be built in CRAs under this alternative would be temporary roads not open to public vehicular use, and would be decommissioned after that specific road use has terminated. Thus, the change in the ROS setting from those roads would be temporary in nature. However, about half the total miles of road construction or reconstruction in CRAs would be constructed in support of oil and gas operations, and those roads would be long-term, typically lasting several decades or longer (see Leasable Minerals).

Tree-cutting on 7,600 acres per year may change the natural appearance of some CRAs for a period of time until the area regenerates. Based on the projected level of tree cutting, a small percentage of CRAs would be affected over the next 15 years. Dispersed recreation opportunities would not likely change as a result of tree-cutting activities, but the feeling of remoteness and solitude may change in some portions of CRAs for a period of time.

Hunting and fishing opportunities likely would not change under alternative 2 in areas where tree-cutting and associated road construction occur because of the dispersed nature of these activities and because of the large amount of NFS lands not altered by these activities. Additionally, the small change expected in hunting and fishing opportunities is due to the amount of CRA acres that would remain unaltered by those activities and by the temporary nature of roads and the expected vegetative recovery of disturbed acres over time.

The additional roadless acreage added into CRAs under alternative 2 would help maintain the semi-primitive setting and associated dispersed recreation opportunities in the total roadless acreage over time. The substantially altered acres and developed ski areas that are not included in CRAs would allow the roadless areas to appear more natural, less developed, and more consistent with the typical roadless area characteristics and values described in chapter 1.

Alternative 3 – Forest Plans

This alternative would incur the highest degree of risk of changing the existing semi-primitive recreation setting and opportunities to ROS settings that reflect a higher level of development or human activity. This is because this alternative allows for the most additional road construction

or reconstruction, tree-cutting, and energy resource activities in IRAs. However, based on the forest plan restrictions on activities within the IRAs, together with topographic or economic constraints, projections are for 30 miles of road construction or reconstruction and 16,300 acres of tree-cutting each year, spread out over many different IRAs.

Where forest plans prohibit, limit, or discourage roading in IRAs—covering approximately 30 to 40 percent of the IRA acres—the primitive, semi-primitive non-motorized, and semi-primitive motorized settings would likely remain unchanged. In some portions of the IRAs where roads and tree-cutting are not restricted, recreation settings could shift from semi-primitive toward roaded natural.

As most of the roading projected to occur in IRAs would be for one-time, single-purpose uses, they would mostly be temporary, short-term, and closed to public vehicle traffic while in use. However, about 15 miles of new roading each year are projected to be needed to support of energy resource operations; those new roads would likely remain on the road system for a longer period of time.

Tree-cutting on 16,300 acres per year may change the natural appearance of some areas for a period of time until the trees and other vegetation regenerate. The type of cutting would depend on the existing forest plan prescriptions and visual quality requirements (see the Scenic Resources section). Based on this level of cutting, a small percentage of the 4.25 million acres in IRAs would be affected over the 15-year period. Dispersed recreation opportunities would not change as a result of tree-cutting, but the feeling of remoteness and solitude may change for a period of time.

Summary of Direct and Indirect Effects

Alternative 1 would retain the greatest proportion of roadless area acreage 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. Substantially altered areas and developed ski area portions would reflect higher levels of development that may differ from public expectations for roadless area characteristics and values.

Alternative 2 would retain the most 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 more roaded natural settings. On the other hand, because CRAs would not include substantially altered areas and developed ski areas, the CRAs would 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 within generally unroaded and semi-primitive settings.

Alternative 3 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 alternative 1; 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 occur in IRAs.

Environmental Consequences – Cumulative Effects

Currently, roadless areas are seen as important places where dispersed motorized and mechanized uses may sometimes occur. As populations increase in Colorado, there would likely be more unauthorized motorized use in roadless areas, and more pressure for authorized land use activities in roadless areas. Nonetheless, the roadless areas would be expected to generally retain roadless area characteristics, and visitors would find places in roadless areas to seek quiet and solitude.

Decisions made through travel planning could affect the amount of area available for motorized and non-motorized travel and indirectly affect dispersed recreation settings and opportunities in roadless areas. If road construction is constrained in roadless areas under one of the roadless rulemaking alternatives, additional pressures to build roads would be placed on NFS lands outside roadless areas.

No other past, ongoing or foreseeable future activities in or around the roadless areas, described in appendix D, would combine with effects of any of the roadless rulemaking alternatives to result in a significant cumulative effects.

DEVELOPED RECREATION

This section addresses the effects of alternatives on developed recreation opportunities and settings. Developed recreation refers to activities that occur at sites with developed or modified settings. Developed recreation sites are those with constructed facilities, such as campgrounds; picnic or day-use sites; trailheads and scenic overlooks with parking areas; interpretive sites; ski areas; and visitor centers. Developed recreation sites typically provide semi-primitive motorized, roaded natural, rural, and urban ROS class opportunities and settings.

While some visitors prefer dispersed recreation opportunities and settings that are farther away from the sights and sounds of people and development, others prefer settings that offer more developed amenities such as picnic tables, trash receptacles, roads, parking lots, boat ramps, and other built features.

A separate section of the EIS analyses the effects of alternatives on developed ski areas.

Affected Environment

There are about 1,820 developed recreation sites on NFS land in Colorado (Region-2 INFRA-Recreation Facilities database, April 2008). Most of these sites are along roads that provide motorized access to the public. Roadless areas in Colorado do not generally contain developed recreation sites, except for portions of developed ski areas, discussed in the subsequent section of this EIS. However, access roads, campgrounds, and trailheads along the outer boundaries of many of the roadless areas provide public services and entry points into the roadless areas.

Environmental Consequences – Direct and Indirect Effects

All Alternatives

The effects on developed recreation opportunities in roadless areas do not substantially differ among the alternatives being evaluated in this document. Thus, the effects are described for all three alternatives at once.

Developed sites may be built adjacent to roadless areas in order to facilitate specific demands for recreation activities within the area. However, aside from trail construction (motorized and non-motorized), developed recreation sites would not be constructed within roadless areas under alternatives 1 or 2. Alternative 3 projects 1 mile of road would be constructed for recreational access for development of a new campground, over the next 15 years.

Other than the above-mentioned 1 mile of road, roads projected to be constructed in a roadless area for the foreseeable uses identified for each alternative would not be expected to remain open for public vehicle travel (see Analysis Framework). Therefore, there would be no measurable increase in motorized road access for recreation opportunities within roadless areas under any alternative. However, under alternative 3 there would potentially be additional opportunities for development of recreational sites or facilities within IRAs in accordance with forest plan direction.

Environmental Consequences – Cumulative Effects

Generally, the most popular forms of outdoor recreation are activities that can be enjoyed without traveling far from home, do not require the purchase of additional gear, and do not require specialized skills to enjoy (Cordell and Overdevest 2001). The outdoor recreation activities with the highest growth in the past 20 years nationally include birding, day hiking, backpacking, snowmobiling, outdoor concerts/plays, walking for pleasure, camping in developed sites, canoeing or kayaking, running or jogging, downhill skiing, and swimming in natural waters (Cordell et al. 2004). These activities generally take place at developed recreation facilities or require a constructed road or trail to facilitate the activity. It is expected that regardless of the activity, participation in outdoor recreation would continue to increase on public lands (Cordell et al. 2004).

Increases in demand for recreation opportunities by the public will likely continue on public lands. Actions by other land management agencies can be important factors in providing for some types of recreation opportunities within Colorado. Many types of recreational opportunities can also be provided on NFS lands outside of roadless areas. However, development of recreational sites outside roadless areas can also increase use of and access to roadless areas, creating a need to develop trails or other infrastructure in roadless areas to prevent resource damage caused by high recreation use.

Conserving roadless areas would have mixed effects on recreation activities. Roadless areas have traditionally been viewed as places where future developed recreation, such as resort development, ski areas, or campgrounds may potentially expand. Restrictions on road construction and reconstruction in roadless areas would constrain where developed recreation facilities would occur of NFS lands in Colorado.

RECREATION SPECIAL USE AUTHORIZATIONS

This section describes the effects of the alternatives in relation to recreation special use authorizations within roadless areas. Recreation special use authorizations consist of permits, leases, or other written instruments that administratively authorize a broad range of commercial recreational activities, both motorized and non-motorized, in dispersed and developed recreation settings. Special use authorizations, usually permits, are issued for almost every type of outdoor recreational activity and facility, and can occur in every ROS class setting, from primitive to urban (see Recreation Special Use Authorizations section).

A separate section of this EIS discusses lands special use authorizations, which are similar authorizations that may be issued for non-recreation land uses on NFS lands.

Affected Environment

Visitors to national forests frequently turn to tourism providers to facilitate their recreation experience, which may come in the form of lodging, rental equipment, or outfitters and guides. Recreation special use permits are used by Forest Service managers to authorize commercial operators to provide desired services on NFS lands. Generally, aside from existing developed sites, little infrastructure is needed for the permitted activity, with the exception of hut systems.

Those operating under a special use permit help visitors enjoy high quality recreation experiences as an extension of the Forest Service's mission. These services allow people with limited time and skills or experience to safely participate in various activities.

There are about 1,390 recreation special use permits currently authorized within NFS lands in Colorado (Region-2 INFRA-SUA database, April 2008). These permits include outfitters and guides for hunting, fishing rafting, backpacking, sightseeing, jeep tours, day hiking, ATV tours, and educational tours, as well as huts systems, educational camps, resorts/lodges, recreation events, and others. Outfitter and guide permits account for about 75 percent of all the recreation special uses on NFS lands in Colorado, and some are likely to occur within roadless areas.

Environmental Consequences – Direct and Indirect Effects

All Alternatives

There is little difference among alternatives with respect to recreation special use authorizations in roadless areas, because limitations on roading and tree-cutting under any alternative would not be likely to affect the ability to obtain or use a recreation use authorization.

In general, recreation special use permits allow for commercial operations of activities that require the use of facilities (huts, resorts, shelters) along with activities not requiring facilities (many outfitters and guides). Because alternatives 1 and 2 do not allow for road construction or reconstruction to facilitate recreation activities, the special use authorizations in IRAs or CRAs would be limited to uses that do not need new roads. Under alternative 3, recreation use authorizations could include activities facilitated by new roads in IRAs. Currently, there are no such road developments for recreation special uses projected to occur.

Environmental Consequences – Cumulative Effects

As there are no measurable direct or indirect effects of any alternative on recreation special use authorizations, there would be no cumulative effects.

DEVELOPED SKI AREAS

This analysis evaluates effects of the alternatives on developed ski area recreation opportunities and experiences. Developed ski areas are all those areas authorized under the Ski Area Permit Act of 1986 and have constructed facilities.

Affected Environment

Ski resorts are one of the major land use authorizations permitted on NFS lands in Colorado. Ski areas provide an important developed recreation experience on NFS lands. There are 134 resorts operating on national forests nationally that receive an estimated 30 million or more skier visits per year (National Ski Areas Association 2008). Colorado has the highest number of ski areas under permit on national forests (22 areas listed in table 48) and the highest number of annual skier visits on national forests of any state, with 12.56 million skier visits for the 2006–07 season. Skiing is big business in Colorado, reflected by the 2.6 billion dollars spent by skiers annually in the state, which is one third of annual tourist dollars spent. All ski areas operating under permit on National Forest System lands in Colorado have been withdrawn from mineral entry.

Table 48. Colorado ski areas on National Forest System lands

	Ski area	National forest
1	Arapahoe Basin	White River
2	Aspen Highlands	White River
3	Aspen Mountain	White River
4	Beaver Creek	White River
5	Breckenridge	White River
6	Buttermilk	White River
7	Copper Mountain	White River
8	Crested Butte	Grand Mesa, Uncompahgre, and Gunnison
9	Durango Mountain Resort	San Juan
10	Eldora	Arapaho and Roosevelt
11	Keystone	White River
12	Loveland	Arapaho and Roosevelt
13	Monarch	Pike and San Isabel
14	Powderhorn	Grand Mesa, Uncompahgre, and Gunnison
15	Ski Cooper	White River; and Pike and San Isabel
16	Ski Sunlight	White River
17	Snowmass	White River
18	Steamboat	Routt
19	Telluride	Grand Mesa, Uncompahgre, and Gunnison
20	Vail	White River
21	Winter Park	Arapaho and Roosevelt
22	Wolf Creek	Rio Grande

Ski areas not listed are not within National Forest System lands, or not operational.

During the 2005–2006 season, the number of skier visits in the United States hit an all-time record of 58.8 million visits, up 3.3 percent from the previous season and up 2 percent from the previous record set in 2002–2003 (RRC Associates 2006). With the population growth in many of the key western ski states, as well as overall income growth, the rising ski area visitor trend is projected to continue into the foreseeable future. The settings, experience, and activities usually associated with ski areas are more in line with the developed end of the ROS. Some National Forest System lands adjacent to developed ski areas in Colorado are roadless and fall into the semi-primitive non-motorized, or semi-primitive motorized ROS classes. This means expansions of ski areas may directly affect adjacent national forest lands roadless characteristics and move these areas into the more developed end of the ROS spectrum in the winter. Summer use in and around ski resorts is also growing, which may also push the ROS class in the summer to the more developed end of the spectrum.

The IRAs and CRAs differ in whether they include ski areas, and those differences are described under alternatives 1 and 2 in the Environmental Consequences section. Appendix H contains maps showing the ski areas that occur in IRAs.

Environmental Consequences – Direct and Indirect Effects

Alternative 1 – 2001 Rule (No Action)

By maintaining the restrictions on future road construction or reconstruction and tree-cutting activities within roadless areas, opportunities for ski area development and expansion at some ski areas would be limited. In other ski areas this alternative would have no effect on developed ski area recreation. For the ski area acreage in IRAs that was authorized prior to January 12, 2001—totaling 3,200 acres—road building and tree-cutting activities may occur within permit areas (see table 49). Ski area acreage in IRAs that was authorized after that date—totaling 5,000 acres—does not allow for new roads or tree-cutting (other than incidental) (see table 50).

In the case of Loveland Ski Area and Durango Mountain Resort, the forest plan allocation for the ski area is larger than the existing permit area. Under alternative 1, no road construction or reconstruction or tree-cutting (other than incidental) may occur outside the permit boundary established before January 12, 2001. This limits potential for expansion outside that boundary.

Table 49. Ski area permit boundaries established area before January 12, 2001 and within inventoried roadless areas

National Forest Ski Area(s)	Roadless Area(s)	Ski Area Permit Acres
Arapaho and Roosevelt National Forests		
Loveland	Bard Creek, Mount Sniktau	1,370
Grand Mesa, Uncompahgre, and Gunnison National Forests		
Crested Butte	Gothic	900
Pike and San Isabel National Forests		
Ski Cooper	Mad Creek DB and DB1	560
Routt National Forest		
Steamboat Springs	Long Park	180
White River National Forest		
Arapahoe Basin	Porcupine Peak	60
Copper Mountain	Ptarmigan Hill	80
TOTAL		**3,200**

Acres rounded to nearest 10 acres for individual ski areas and nearest 100 acres for total; total may not add due to rounding.

Some people may perceive a conflict in having permitted ski areas available for development with a roadless area. However, ski area development may occur without roads.

Under alternative 1, although there would be limitations on ski area expansion, backcountry skiing would continued to be enjoyed by those users who prefer roadless opportunities.

Alternative 2 – Colorado Rule (Proposed Action)

Under this alternative, ski areas that are part of IRAs are not included within CRAs. Road construction or reconstruction and tree-cutting in those ski areas (outside CRAs) would be allowed as prescribed in the forest plans, ski area master plans, and/or project-level NEPA documents. Any future ski area proposed projects beyond existing permit boundaries or forest plan allocations into CRAs after the date of the Colorado Rule would not be allowed if the project or allocation would require road building or tree cutting. The ski resorts and their associated roadless acres are displayed in table 50.

Table 50. Ski area acreage in the IRAs but not included in CRAs

National Forest Ski Area(s)	Colorado Roadless Area(s)	Ski Area permitted Acres Prior to Jan. 2001[1]	Additional Ski Area Allocation Acres[2]	Ski Area Permitted Acres After Jan. 2001[3]	Total Ski Area Acres Excluded from CRAs
Arapaho and Roosevelt National Forests					
Loveland	Bard Creek, Mount Sniktau	1,370	1,620	0	2,990
Grand Mesa, Uncompahgre, and Gunnison National Forests					
Crested Butte	Gothic	900	0	0	900
Pike and San Isabel National Forests					
Ski Cooper	Mad Creek DB & DB1	560	0	0	560
Routt National Forest					
Steamboat Springs	Long Park	180	0	0	180
San Juan National Forest (Draft Revised Forest Plan)					
Durango Mountain Resort	San Miguel	0	0	90[4]	90[4]
White River National Forest					
Arapahoe Basin	Porcupine Peak	60	0	990	1,050
Aspen Mt	McFarlane	0	0	50	50
Beaver Creek	Meadow Mountain A, B	0	0	510	510
Breckenridge	Tenmile	0	0	150	150
Buttermilk	Burnt Mountain	0	0	50	50
Copper Mountain	Ptarmigan Hill	80	0	640	720
Snowmass	Burnt Mountain	0	0	80	80
Vail	Game Creek	0	0	900	900
TOTAL		**3,200**	**1,600**	**3,500**	**8,200**

Acres rounded to nearest 10 acres and total acres rounded to nearest 100 acres. Totals may not add due to rounding.

Ski areas on NFS lands in Colorado that are not listed here do not contain roadless acres within their permit or allocation boundary, or are not currently operating.

[1] Ski area permit acres within IRAs where permit acres were authorized prior to January 12, 2001.

[2] Acres allocated in forest plans to ski area management that adjoin permitted ski areas but are outside the current permit boundary.

[3] Ski area permit acres within IRAs where permit acres where authorized after January 12, 2001.

[4] Expansion of Durango Mountain Resort is included within the draft revised forest plan for San Juan National Forest, draft preferred alternative. There are 90 IRA acres that would be excluded from the CRA acres.

The ski areas listed in table 50 could have some increase in development of ski area facilities under alternative 2, because of the number of ski areas outside CRAs where roading and tree-cutting would be governed by forest plan direction. Therefore, more of those ski areas would have the potential for further development and expansion, compared to alternative 1. Opportunities for backcountry skiing adjacent to developed ski areas would continue to be enjoyed.

Alternative 2 would have a positive impact on the developed ski area recreation resource by removing some of the limitations to constructing ski area facilities imposed by the inability to build roads and cut trees. Additionally, the authorization of roads in developed ski areas would facilitate the implementation of required ski area vegetation management plans to improve forest health, remove hazard trees, and manage fuel hazards associated with the

current mountain pine beetle epidemic affecting lodgepole pine within developed ski areas. This potential increase in road construction and tree removal is not certain.

If road building and tree removal are authorized in these developed ski areas and a decision is made to expand the permit boundary at Durango Mountain Resort and Loveland Ski Area, there would likely be a change of the recreation setting from semi-primitive non-motorized to semi-primitive motorized or roaded natural within those areas.

One difference between alternative 2 and alternative 3 is that alternative 2 constrains the ability to build roads for ski area expansion of a permit boundary into the CRA.

Alternative 3 – Forest Plans

Under this alternative the potential to add roads, cut trees, and develop more ski facilities in the ski areas would be the same as under alternative 2. If a currently undeveloped ski area is developed in the future under alternative 2 or 3, there would be a higher potential for semi-primitive non-motorized setting to shift to semi-primitive motorized or roaded natural setting. Benefits to the developed ski area recreation resource would be the same as described in alternative 2.

The difference between alternative 2 and alternative 3 is that under alternative 3, ski areas could potentially build roads to expand their permit boundaries in any direction, without a rule-related roadless area constraint. Under either alternative 2 or 3, forest plan management direction may still constrain roading or tree-cutting activities related to ski area development or expansion.

Summary of Direct and Indirect Effects

Alternative 1 would limit the potential to develop or expand ski areas beyond the boundaries permitted prior to January 12, 2001, because of the limitations on new roads and tree-cutting (other than incidental tree-cutting).

Alternatives 2 and 3 would have a more positive effect on developed ski area opportunities, by allowing more opportunity for roads and tree-cutting in those areas. There may also be public benefits such as accommodation of more people in developed ski recreation settings and increased quality of the developed skiing recreation experience. Further ski area development and expansion could change the ROS setting and user experience to semi-primitive motorized or roaded natural, depending on the amount of new facilities and increases in visitor use.

Environmental Consequences – Cumulative Effects

The growth of populations and skier visitation in Colorado is likely to continue in the foreseeable future and would contribute to pressure for ski areas in the state to expand. Under alternatives 1 and 2, there would be less potential for ski area expansions, which would add to the pressures to expand ski areas on other surrounding lands.

The potential increases in level of development in ski areas under alternatives 2 and 3 would combine with increases in developed recreation facilities on other NFS lands outside IRAs or CRAs. Otherwise, no other activities within or adjacent to roadless areas, described in appendix D- Cumulative Effects Framework, would combine with the direct and indirect effects described for the roadless area alternatives to result in a significant cumulative effect.

WILDERNESS AND RECOMMENDED WILDERNESS

This section describes the effects of alternatives on congressionally designated wilderness as well as recommended wilderness (allocated in forest plans). Many wilderness areas are located adjacent to the roadless areas.

The subsequent section of this EIS addresses other congressionally designated areas that lie outside roadless areas, as well as congressionally designated trails that may be affected by the alternatives.

Another section that follows in the EIS addresses administratively designated areas such as research natural areas and special interest areas that occur within or immediately adjacent to roadless areas.

Affected Environment

In 1964, Congress established a National Wilderness Preservation System, composed of areas congressionally designated as wilderness, or wilderness areas (P.L. 88-577). The Wilderness Act states that a wilderness is an area "where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain." In addition, a wilderness is said to generally appear to be affected by the forces of nature; have opportunities for primitive and unconfined recreation; are of sufficient size (typically greater than 5,000 acres) to be managed as wilderness; and contain other ecological, geological, scientific, educational, scenic, or historical values. Wilderness areas are managed to protect natural conditions and primeval character; motorized equipment and transport, developments, and commercial enterprise are prohibited.

As part of the forest planning process, potential wilderness areas are identified using a three-step process outlined in the Forest Service handbook (FSH 1909.12, Chapter 70). The handbook direction requires an evaluation of roadless areas for their potential to be recommended for further wilderness evaluation and possible designation.

Of the 702 wilderness areas designated on NFS lands in the United States, there are 35 in Colorado, comprising 3,200,000 acres (see maps of each alternative in the map packet). Wilderness character, often used to describe a wilderness area, is defined as untrammeled, natural, undeveloped, and having opportunities for solitude or a primitive and unconfined recreation (Landres et al. 2005).

Those wilderness characteristics or attributes are used to measure the potential effects of the alternatives evaluated in this EIS on the wilderness resource. The Wilderness Act does not constrain projects proposed adjacent to wilderness boundaries because of the mere presence of wilderness. The effects from projects adjacent to wilderness areas should not be the sole reason for deferring or declining a project proposal.

Recommended wilderness areas are lands identified in forest plans as having undeveloped character and wilderness potential through forest planning. Forest plan management direction calls for managing recommended wilderness areas to maintain wilderness characteristics and values until such time as Congress acts upon the agency recommendation or a different agency recommendation is made. Forest plan direction for those areas is to maintain their wilderness characteristics. Road building is generally prohibited in those areas based on forest plan

direction (subject to some exceptions or emergency uses). Forest plans also generally prohibit tree-cutting in areas recommended as wilderness.

Table 51 shows roadless areas that are identified in whole or in part as a recommended wilderness, by national forest in Colorado.

Table 51. National Forest System recommended wilderness acres in Colorado by forest

Roadless areas recommended for wilderness	Acres	Year created
Arapahoe and Roosevelt National Forests		Forest plan 1997
Indian Peaks Addition	9,000	
Grand Mesa, Uncompahgre, and Gunnison National Forests		Forest plan 1983, appealed, ROD signed 1991
Fossil Ridge	47,000	
Powderhorn	4,000	
Cannibal Plateau	14,000	
Pike and San Isabel National Forests		Forest plan 1984
Sangre de Cristo	187,000	
Buffalo Peaks	36,000	
Greenhorn	22,000	
San Juan National Forest		Forest plan 1993
Hermosa	51,000	
Lizard Head Adjacent	3,000	
Weminuche Adjacent	1,000	
Turkey Creek	600	
White River National Forest		Forest plan 2002
Assignation Ridge	12,000	
Red Table/Gypsum Creek	50,000	
(Additions to existing wilderness)	20,000	
TOTAL RECOMMENDED	**457,000**	

Names of roadless areas are IRA names. Appendix A contains a crosswalk to CRA names.
Totals may not add due to rounding.
Source: Website for wilderness areas and acres: www.wilderness.net, accessed April 2008.

Environmental Consequences – Direct and Indirect Effects

Alternative 1 – 2001 Rule (No Action)

This alternative, like the other two alternatives, would have no direct effect on wilderness because the wilderness areas are all located outside the roadless areas that are the subject of each alternative. Therefore, there would be no direct effects on the wilderness characteristics such as the untrammeled, natural, undeveloped, or unconfined opportunities within a wilderness area.

Alternative 1 generally prohibits tree-cutting and road building in IRAs and therefore retains the existing roadless area characteristics, so it would not detract from wilderness characteristics in the adjacent wilderness areas. However, the amount of projected roading and tree-cutting activities and road-related increases in energy resource operations within roadless areas under alternative 1 would affect some wilderness characteristics in wilderness areas adjacent to

activity areas, because of the increases in noise and human disturbances in the IRAs may be heard or seen by people in the adjacent wildernesses.

The effects on areas allocated in forest plans as recommended wilderness within roadless areas would not differ by alternative. Forest plans generally prohibit roading and tree-cutting and removal activities in those areas. However, the restrictions on activities in IRAs under alternative 1 provide a greater opportunity to maintain future options for recommending roadless acres as wilderness in the future, compared to alternatives 2 or 3.

Alternative 2 – Colorado Rule (Proposed Action)

Like alternative 1, the general prohibitions on roading and tree-cutting under alternative 2 would minimize the potential risk of impacts on surrounding wilderness areas compared to other more intensively managed NFS lands. However, the risk of potential impacts would be higher in alternative 2 than in alternative 1 because of the additional circumstances and projections for roading, tree-cutting, and energy resource operations in CRAs.

The increased amount of projected roading and tree-cutting activities and road-related increases in energy resource operations within roadless areas under alternative 2 would affect some wilderness characteristics in wilderness areas adjacent to activity areas, because the increases in noise and human disturbances in the CRAs may be heard or seen by people in adjacent wildernesses. In particular, the projected activities within the North Fork coal mining area would potentially affect the solitude and other wilderness experience opportunities within the adjacent West Elk Wilderness.

Effects on areas allocated in forest plans as recommended wilderness within roadless areas would not differ by alternative, because forest plans generally prohibit roading and tree-cutting and removal activities in those areas. However, by allowing more roading and tree-cutting activities in IRAs under alternative 2, this alternative would reduce the number of roadless acres that would be capable for recommending as wilderness in the future, compared to alternative 1.

Alternative 3 – Forest Plans

Where forest plans restrict roading and tree-cutting activities in IRAs, alternative 3 would minimize the potential risk of impacts on adjacent wilderness areas. However, the risk of potential impacts would be highest under this alternative because of the additional projections for roading, tree-cutting, and road-related energy resource operations in CRAs.

Similar increases in the amount of projected roading and tree-cutting activities and road-related increases in energy resource operations would occur under alternative 3 within roadless areas (see Analysis Framework section). This higher level of human activities and roads in IRAs would affect some wilderness characteristics in wilderness areas adjacent to those activity areas, because of the disturbances that may be heard or seen by people in the adjacent wildernesses. The projected activities within the North Fork coal mining area would have the same negative impact on the adjacent West Elk Wilderness as described for alternative 2.

Effects on areas allocated in forest plans as recommended wilderness within roadless areas would not differ by alternative, as forest plans generally prohibit roading and tree-cutting and removal activities in those areas. However, by allowing more roading and tree-cutting activities

in IRAs, alternative 3 would reduce the number of roadless acres that would be capable for recommending as wilderness in the future, compared to alternative 1.

Environmental Consequences – Cumulative Effects

Past, ongoing, and future activities outside roadless areas and adjacent to wilderness would further compromise wilderness character and the untrammeled attribute of wilderness, in addition to effects described for each alternative. This would primarily occur from: (1) increased population growth and residential and commercial developments, (2) increased highway and secondary roads and traffic, and (3) increased motorized recreation uses.

Oil, gas, and coal development activities occurring or likely to occur adjacent to the same wilderness areas that would be affected by one or more alternative, may contribute to cumulative effects on those wilderness areas.

Recommended wilderness within the roadless areas would not be directly affected by other activities occurring or foreseeable to occur outside the roadless areas. None of the other potential cumulative actions would affect the acreage capable of being recommended for wilderness.

OTHER CONGRESSIONALLY DESIGNATED AREAS AND TRAILS

This section addresses other congressionally designated areas in Colorado that occur adjacent to roadless areas, as well as designated trails, such as the Continental Divide Trail. Management direction contained in the statutes associated with these designated areas and trails overrides any existing forest plan direction or rule and would not be altered by the outcome of this rulemaking process.

Affected Environment

Congressionally Designated Areas

There are six congressionally designated areas in Colorado, established by the 1980 or 1993 Colorado Wilderness Acts and the James Peak Wilderness and Protection Area Act of 2002 (P.L. 107-216). These areas include about 165,500 total acres; 147,600 acres are within the 2001 Roadless Rule IRA boundaries (table 52). Each area has special provisions in legislative language that clarifies the level of activities that can occur within the areas, include the level, if any, of tree-cutting and road building that would be allowed. These provisions for road construction and tree-cutting are summarized in table 52.

Table 52. Congressionally designated protection areas on National Forest System lands in Colorado

Congressionally designated protection areas by national forest	Date and public law	Total acres	2001 roadless acres	Special provision
Arapaho and Roosevelt National Forests				
Bowen Gulch Protection Area	1993, Public Law 103-77	10,700	8,600	Prohibits timber harvesting (sec 6(d)), new road building (sec 6(f)) and includes withdrawal from mineral entry (sec 6(c)). Allows motorized travel on established routes (sec. 6(g)) during periods of adequate snow cover. Mechanized travel shall be permitted (sec. 6(f)).
James Peak Protection Area	2002, Public Law 107-216	16,000	11,300	Allows for tree-cutting for fuel treatment, control of fire, and insect and disease control projects. No road building is allowed.
Grand Mesa, Uncompahgre, and Gunnison National Forests				
Fossil Ridge Recreation Management Area	1993, Public Law 103-77	39,800	39,800	Prohibits tree-cittomg (sec 5(d)) and new road building (sec 5(f)), and includes withdrawal from mineral entry (sec 5(c)). Allows motorized travel on established routes (sec. 5(g)).
Roubideau Area	1993, Public Law 103-77	20,000	18,600	Prohibits tree-cutting or road building. Includes withdrawal of mineral entry (sec. 9(b)), managed to maintain presently existing wilderness character and potential inclusion in the National Wilderness Preservation System (sec. 9(3)).
Tabeguache Area	1993, Public Law	17,000	8,900	Prohibits tree-cutting or road building. Withdrawal of mineral entry (sec. 9(b)),

Congressionally designated protection areas by national forest	Date and public law	Total acres	2001 roadless acres	Special provision
	103-77			managed to maintain presently existing wilderness character and potential inclusion in the National Wilderness Preservation System (sec. 9(3)).
San Juan National Forest				
Piedra Special Management Area	1993, Public Law 103-77	63,000	60,400	Prohibits tree-cutting or road building. Allows motorized use (snowmobiles) and motorized trail maintenance on Trail 535 (sec. 9(4)).
TOTAL ACRES		**166,500**	**147,600**	

Totals may not add due to rounding.

Wild and Scenic Rivers

Colorado has only one river congressionally designated as part of the national wild and scenic rivers system- the Cache la Poudre River, on the Arapaho and Roosevelt National Forests. A small portion of this river occurs within the Comanche Peak Adjacent Area IRA and Green Ridge East CRA. The river was designated by Congress as a study river in 1975 and recommended for wild and scenic designation in 1986 (P.L. 99-590). The designation protects 61 miles of river under Forest Service administration in the following classifications: 16 miles of wild classification (no new roads are allowed) and 45 miles as recreation classification.

Continental Divide National Scenic Trail

Congress enacted the National Trails System Act (P.L. 90-543) on October 2, 1978, which established a nationwide trail system and designated the Appalachian Trail and Pacific Crest Trail. The act describes that national scenic trails "will be extended trails so located as to provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas through which such trails may pass."

A congressionally mandated Continental Divide National Scenic Trail (Trail) study report was completed in 1976. The legislative final environmental impact statement for the proposed Trail to accompany the study report was completed in 1977. The Trail study report identifies that: "The primary purpose of this trail is to provide a continuous, appealing trail route, designed for the hiker and horseman, but compatible with other land uses…. To provide hiking and horseback access to those lands where man's impact on the environment has not been adverse to a substantial degree and where the environment remains relatively unaltered."

Congress amended the National Trails System Act with Public Law 95-625, on November 10, 1978, to establish and designate the Trail. The Trail traverses approximately 800 miles through Colorado along the Continental Divide.

Forest plans provide direction aimed at protecting the values for which the Trail was designated. Under forest plan direction, the Trail is managed to provide for primarily primitive and semi-primitive non-motorized recreation opportunities and settings, and a scenic integrity level of high to very high. This direction would be followed under any of the three alternatives.

Environmental Consequences – Direct and Indirect Effects

Congressionally Designated Areas

Congressionally designated areas are not included in IRAs being analyzed in this EIS. There would be no difference in management of these protected areas under any of the alternatives. In addition, none of the alternatives would directly affect any congressionally designated areas located outside roadless areas.

However, there could be indirect effects of the projected activities that vary by alternative on the characteristics in adjacent congressionally designated areas. These effects would be similar to the effects of each alternative on adjacent wilderness. The main difference is that the Fossil Ridge Recreation Area, James Peak Protection Area, and Bowen Gulch Protection Area allow some motorized and mechanized travel and some other activities. Thus, increases in noise and human activities in the roadless areas would not be expected to significantly detract from the values for which those areas were designated. The other three congressionally designated areas listed in table 52, earlier, may be indirectly affected by the increases in noise and human activities projected to occur in the adjacent roadless areas. This indirect impact would be minimal under alternative 1, greater under alternative 2, and greatest under alternative 3, based on the relative amounts of roading, tree-cutting, and road-related energy development activities likely to occur in the roadless areas.

Wild and Scenic Rivers

None of the alternatives would directly affect the stretch of the wild and scenic river corridor classified as wild, because the statute designating the river is more restrictive than any of the alternatives—no roading or tree-cutting are allowed in that wild corridor. However, in the recreation section of the wild and scenic river corridor, some roads and other activities may occur as long as the outstandingly remarkable values remain protected. Because the law does not allow activities that would degrade those values for which the river corridor was designated, and the law's restrictions take precedence over regulations and forest plan direction, none of the alternatives would directly affect the wild and scenic values in this corridor.

However, as described for wilderness and other congressionally designated areas, activities allowed to occur on surrounding roadless area acres may indirectly affect the values associated with the wild river designation. Alternative 1 would have the least potential to affect wild river values in that river corridor; alternative 2 would increase the potential to affect those values; and alternative 3 would have the highest potential to affect those values. These differences are due to the amount of projected roading and tree-cutting allowed and projected to occur on the acres directly adjacent to this river corridor within the Comanche Peak Adjacent Area IRA (under alternatives 1 and 3) and Green Ridge East CRA (alternative 2).

Continental Divide National Scenic Trail

None of the altenatives would alter the management of the Trail. None of the alternatives would directly affect the scenic values for which the Trail was designated because those are protected by statute, which takes precedence over regulations and forest plans.

However, potential indirect impacts on the high to very high scenic values along this trail could vary by alternative. Among the alternatives, alternative 1 would have the least potential to

affect those scenic values on the Trail from adjacent land management activities that would be allowed or projected to occur. Altenative 2 would allow for increased amounts of roads and tree-cutting activities compared to alternative 1, which could indirectly degrade the scenic quality within views from along the Trail corridor. Alternative 3 would allow for even higher amounts of roads and tree-cutting activities compared to the other two alternatives, which could similarly degrade the scenic quality within views from along the Trail corridor.

ADMINISTRATIVELY DESIGNATED AREAS

This section evaluates potential effects of the alternatives on administrative designated areas that are located within one or more roadless area under any alternative. Administratively designated areas are those designated by the Secretary of Agriculture or a designated officer, such as the Forest Service Chief, a regional forester, or a forest supervisor.

There are two types of administratively designated areas in the roadless areas: research natural areas (RNAs) and special interest areas (SIAs).

Affected Environment

Research Natural Areas

The RNAs in Colorado form a long-term network of ecological reserves designated for non-manipulative research, education, and the maintenance of biodiversity. The RNAs are selected to preserve a spectrum of relatively pristine areas that represent a wide range of natural variability within natural ecosystems and environments and may have special or unique characteristics of scientific importance. The desired condition for RNAs is to maintain natural conditions by allowing ecological processes to prevail with minimal human intervention. However, under some circumstances, deliberate manipulation may be used to maintain the ecosystem or unique features for which the RNA was established or to re-establish natural ecological processes. Information collected from RNAs is often used for educational purposes, but most RNAs are not generally used as interpretive sites for general public visitation. There are RNAs within roadless areas on seven of the eight national forests in Colorado; the small portion of the Manti-La Sal National Forest that occurs on the Colorado border is the exception.

Table 53 lists the RNAs on each national forest fully within or partially within a roadless area, along with the roadless area name (the CRA name is in parenthesis where it differs from the IRA name).

Table 53. Research natural areas within roadless areas

National forest	Research natural area	Roadless area
Arapaho and Roosevelt	Boston Peak Fen	Green Ridge West
Arapaho and Roosevelt	Mt. Goliath	Mt. Evans Adjacent Area
Arapaho and Roosevelt	Lone Pine	North Lone Pine
Arapaho and Roosevelt	North St. Vrain	North St. Vrain
Grand Mesa, Uncompahgre, and Gunnison	Gothic	Gothic Mountain Elk Mountains-Collegiate (Gothic)
Pike and San Isabel	Hurricane Canyon	East Pikes Peak (Pikes Peak East)
Rio Grande	Finger Mesa	Pole Mountain Finger Mesa
Rio Grande	Mill Creek	Crestone
Routt	Kettle Lakes	Kettle Lakes
San Juan	Williams Creek	Poison Park (Graham Park)
White River	Main Elk Creek	Elk Creek B
White River	Hoosier	Hoosier Ridge
White River	Battlement Mesa	Housetop Mountain

Management direction for specific RNAs differs among the various national forests. Table 54 lists the management direction in each forest plan concerning road construction and tree cutting in RNAs. Where road construction is restricted, the specific direction from the forest plan is shown in italics.

Table 54. Research natural area forest plan direction

National forest	Road construction or reconstruction	Tree-cutting
Arapaho and Roosevelt	Roads prohibited	No tree-cutting
Grand Mesa, Uncompahgre, and Gunnison	Roads restricted; *generally, physical improvements, such as roads not permitted*	No tree-cutting
Pike and San Isabel	Roads restricted; g*enerally, physical improvements, such as roads*, *not permitted*	No tree-cutting
Rio Grande	Roads restricted; *motorized and mechanized use prohibited, except when it provides necessary access for scientific, administrative, emergency, or educational purposes*	No tree-cutting
Routt	Roads prohibited	No tree-cutting
San Juan	Roads restricted; *generally, physical improvements, such as roads, not permitted*	No tree-cutting
White River	Roads restricted; *motorized and mechanized use* prohibited, *except when it provides necessary access for scientific, administrative, emergency, or educational purposes*	No tree-cutting

For all forests, the forest plan direction for RNAs is for no tree-cutting. Under all alternatives, the most restrictive roadless area management direction must be followed. Thus, there would be no tree-cutting allowed in RNAs under any alternative. Although there is some variability in forest plan direction for road construction in RNAs, no road construction in RNAs is projected to occur in roadless areas under any alternative. There are no oil, gas, or coal leases within the RNAs, and no mining sites or other land uses that are subject to reserved or outstanding rights.

Special Interest Areas

The SIAs in roadless areas are identified in the forest plans for each national forest. SIAs are designated for their unique or outstanding botanical, geological, historical, paleontological, cultural, scenic, recreational, zoological (species or habitat diversity), or other significant values. The SIAs may be managed as interpretive sites for public recreation or education. They may be relatively small or fairly large.

The desired condition in SIAs is to maintain or restore the natural or near-natural conditions and protect the significant values for which the SIA was established. Losses of vegetation in SIAs as a result of insect-disease outbreaks or wildfires are generally accepted. If activities are allowed in SIAs, they usually must maintain or restore the natural conditions and protect threatened, endangered, or sensitive species habitat and the values of the SIA. Generally, roads and facilities may be constructed in SIAs to enhance the values for which the SIA was designated, for interpretive or educational purposes, or to correct resource damage.

There are 21 SIAs within all or portions of roadless areas on five of the eight national forests in Colorado; they do not occur in roadless areas on the Manti-La Sal, Pike and San Isabel, or San Juan National Forests. Table 55 lists the SIAs on the five national forests where they occur in all or portions of a roadless area. Roadless area names are the same for IRAs and CRAs, except where the different CRA name is shown in parenthesis.

Table 55. Special interest areas within roadless areas

National forest	Special interest area	Roadless area
Arapaho and Roosevelt	Homestead Meadows	Lion Gulch
Arapaho and Roosevelt	Grays Peak	Mt. Sniktau
Arapaho and Roosevelt	Niwot Ridge	Indian Peaks Adjacent Areas
Arapaho and Roosevelt	Arapaho National Recreation Area	Indian Peaks Adjacent Areas
Grand Mesa, Uncompahgre, and Gunnison	Ophir Needles	Ophir Needles (not in a CRA)
Grand Mesa, Uncompahgre, and Gunnison	Slumgullion Earthflow	Cannibal Plateau (not in a CRA)
Grand Mesa, Uncompahgre, and Gunnison	Alpine Tunnel	Canyon Creek/Romley (Canyon Creek/Mirror Lake)
Rio Grande	Bachelor Loop	Wason Park
Rio Grande	Blowout Pass	Wightman Fork/Upper Burro
Rio Grande	Devil's Hole	Alamosa River
Rio Grande	John Charles Fremont	Deep Creek/Boot Mountain
Rio Grande	Wagon Wheel Gap Watershed Experiment Station	Snowshoe Mountain
Routt	California Park	Sugarloaf North and South Nipple Peak North and South Shield Mountain
Routt	Black Mountain	Sugarloaf South
Routt	Little Snake	Elkhorn
Routt	Windy Ridge	Barber Basin
Routt	Teller City	Never Summer South
White River	Main Elk Creek	Elk Creek B
White River	Porcupine	Tenderfoot Mountain
White River	Independence Pass	Independent B
White River	Colorado Midland Railroad	Wildcat Mountain C

Management direction for SIAs differs among the various forests. Table 56 summarizes the management direction concerning road construction and tree-cutting in SIAs for the five forest plans with SIAs in roadless areas. More specific forest plan direction related to road construction or tree-cutting in the SIA is shown in italics. Although there is some variability in forest plan direction in SIAs, no roading or tree-cutting activities are expected to occur in SIAs or differ by alternative. There are no oil, gas, or coal leases within the RNAs, and no mining claims, federal highways, or other developments in SIAs subject to reserved or outstanding rights.

Table 56. Special interest area forest plan direction

National forest	Road construction or reconstruction	Tree-cutting
Arapaho and Roosevelt	Roads restricted; *new facilities may be constructed to enhance interpretive or educational purposes or to correct resource damage; most SIAs are non-motorized*	Tree-cutting restricted
Grand Mesa, Uncompahgre, and Gunnison	Roads restricted	Tree-cutting prohibited
Rio Grande	Roads restricted; *motorized travel allowed on designated routes; developed facilities must meet management objectives of the SIA*	Tree-cutting prohibited
Routt	Roads generally allowed but only under certain circumstances; *new roads to be constructed only when consistent with SIA values or to meet other resource objectives such as oil and gas leasing*	Tree-cutting generally allowed, primarily for non-timber purposes; *use only those vegetation management practices necessary to meet specific resource objectives of maintaining or restoring the values for which the SIA was established*
White River	Roads restricted; *new roads to be constructed only when necessary for interpretive or educational purposes; long-term maintenance of roadless characteristics emphasized*	Tree-cutting restricted; *vegetative manipulation allowed when necessary to reduce fuel loads, maintain or restore natural conditions, or enhance the values for which the SIA was established*

Environmental Consequences – Direct and Indirect Effects

All Alternatives – RNAs and SIAs

None of the alternatives project any road construction or reconstruction, or any tree-cutting activities within the RNAs or SIAs. Thus, there would be no difference in effects predicted to occur in roadless area RNAs or SIAs under any of the alternatives.

Under all alternatives, roads may be built in RNAs and SIAs in roadless areas if necessary to protect public health and safety, or meet other statutory obligations or reserved or outstanding rights (described in chapter 2, Alternatives Considered in Detail section). However, none of those types of activities currently occur in the RNAs or SIAs, and none are foreseeable in the next 15 years.

Under alternative 3, road building could potentially occur in the future in RNAs or SIAs in roadless areas, where it is not entirely prohibited. Some forest plans allow roads or facilities to be built in RNAs or SIAs, although the values for which the area was established would need to be maintained. Roading and tree-cutting (other than for incidental uses) would be unlikely to occur in those particular areas, in order to protect the special values for which these areas are administratively designated. As there are no direct or indirect effects to RNAs or SIAs expected within the roadless areas under any alternative, there would be no potential for cumulative effects.

SCENIC RESOURCES

This section describes how the alternatives would affect the visual or scenic quality within roadless areas.

As described in the preamble to the 2001 Roadless Rule and chapter 1 of this EIS, roadless area characteristics and values typically include "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. Quality scenery contributes directly to real estate values in neighboring communities and residential areas."

Affected Environment

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 quality of a forest is not static; it changes over time. To varying degrees, roads and tree-cutting and removal activities in a roadless area can affect the scenic integrity of that landscape. The positive effects on scenic quality that can result from management activities that reduce insect and disease mortality or the severity of a wildfire, may be offset by the negative effects of road construction and vegetative treatments. However, 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.

All resource management activities in roadless areas in Colorado strive to achieve long-term sustainable landscape character goals within the scenic integrity objectives identified in the land management planning process using the Scenery Management System (SMS) (USDA Forest Service 1996) or with establishment of visual quality objectives using the Visual Management System (VMS) (USDA Forest Service 1974). These visual or scenic management objectives define allowable levels of change on specific land areas.

The original VMS process applied to all management activities on National Forest lands to set visual goals and assist in final management decisions. It provided the groundwork for visual assessments that evaluated the visual resources, character types/variety classes, and sensitivity levels based on public concerns; visual quality objectives (VQO) were ultimately assigned. These VQOs establish degrees of acceptable alterations to the natural landscape found in various management units.

The current basis for describing scenic quality is the SMS, as described in *Landscape Aesthetics* (USDA Forest Service 1996). This document defines a system for inventory and analysis of the aesthetic values of NFS lands and replaces the old Visual Management System. The analysis evaluates how the prohibitions and permissions for tree-cutting, road construction/reconstruction, and discretionary mineral activities would affect the ability to maintain or enhance the supply of high scenic quality.

The SMS 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. Similar to VQOs, scenic integrity objectives (SIO) 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 following list shows a cross-walk of the SMS/SIOs and the VMS/VQOs:

SMS – Scenic integrity objectives

Very high (unaltered)—refers to landscapes where the valued landscape character is intact with only minute, if any, human-induced deviations; the existing landscape character and sense of place are expressed at the highest level.

High (appears unaltered)—refers to landscapes where the valued landscape character appears intact.

Moderate (slightly altered)—refers to landscapes where the valued landscape character appears slightly altered; noticeable deviations must remain visually subordinate to the landscape character being viewed.

Low (moderately altered)—refers to landscapes where the valued landscape character appears moderately altered; deviations begin to dominate the valued landscape but they borrow valued attributes from the surrounding landscape.

Very low (heavily altered)—refers to landscapes where the valued landscape character appears heavily altered; deviations may strongly dominate the valued landscape.

VMS – Visual quality objectives

Retention—provides for management activities that are not visually evident.

Partial retention—management activities remain visually subordinate to the characteristic landscape when managed.

Modification—management activities may visually dominate the original characteristic landscape; however, activities of vegetative and land form alteration must borrow from the naturally established form, line, color, or texture and must remain visually subordinate to the proposed composition.

Maximum modification—management activities of vegetative and landform alterations may dominate the characteristics landscape.

Unacceptable modification—overall extent of management activities is excessive or poorly related to scale of landform and vegetative patterns in the characteristic landscape.

The original VMS process is considered a visual "snapshot in time" reflecting established acceptable levels of management activities. In comparison, the current SMS process creates a visual inventory and acceptable levels of management activities, and focuses on future desired visual conditions. The following shows which national forests in Colorado have converted from VMS to SMS, and which remain under the VMS:

Scenery Management System—Grand Mesa, Uncompahgre, and Gunnison National Forests; Rio Grande National Forest; San Juan National Forest; White River National Forest.

Visual Management System – Arapaho and Roosevelt National Forests and Manti-LaSal National Forest; Pike and San Isabel National Forests; Routt National Forest.

Generally, the current condition of roadless areas in Colorado does not show extensive evidence of management activities. Thus, roadless areas currently have a high degree of scenic integrity. There is evidence of some roads, past tree-cutting and other management activities in portions of the IRAs. In many of those areas, scenic integrity has likely been modified and the resulting scenic integrity is considered moderate to low. These substantially altered areas in IRAs do not meet the desired scenic quality conditions for maintaining roadless area characteristics and values.

Environmental Consequences – Direct and Indirect Effects

Alternative 1 – 2001 Rule (No Action)

The 2001 Roadless Rule is anticipated to maintain the current high levels of scenic integrity in the IRAs. By maintaining the restrictions or limitations on future road construction or reconstruction, tree-cutting activities, and leaseable minerals development within roadless areas, the scenic quality would remain substantially unaltered by future management activities, consistent with very high to high SIOs or retention to partial retention VQOs, especially in those IRAs acres that have not been substantially altered.

Based on the projected roading miles and tree-cutting acres (see Analysis Framework section) it is anticipated that the amount of change in scenic quality would have a negligible change on the existing scenic integrity in the vast majority of roadless areas. As there would only be approximately 6 miles of roads projected to be constructed or reconstructed in IRAs, spread out across many different IRAs, there would not likely be a change in the scenic integrity level in any of the IRAs.

It is anticipated that existing road density in IRAs would gradually be reduced over time, as more miles of road are projected to be decommissioned (12.8 miles per year) than constructed (6 miles per year). As a result, these actions could maintain or improve scenic quality. Retaining the substantially altered areas and portions of developed ski areas inside the IRAs would potentially allow portions of the roadless areas to continue to depart from very high scenic integrity levels.

By not allowing new road construction or reconstruction to improve forest health or reduce hazardous fuels, this alternative would pose a higher risk of having large-scale insect-disease outbreaks and high-severity wildfires, compared to the other alternatives. However, natural disturbance events that change the landscape appearance would not change the scenic integrity level.

The 2001 Roadless Rule also allows limited tree-cutting of small-diameter material for specific purposes. The intensity of change associated with such activities is not expected to create a measurable change in scenic integrity. The magnitude or amount of area that would potentially be affected is also expected to be relatively minor. However, the amount and types of tree-cutting allowed would enhance vegetative health and reduce fuel loading, thereby providing protection from pests, insects, diseases, and large fires. However, large-scale insect outbreaks and wildfires are not considered to adversely affect the scenic integrity level.

Alternative 2 – Colorado Rule (Proposed Action)

Continuing to limit human activities in roadless areas would help minimize adverse modifications to existing scenic quality within these areas. Removing the substantially altered areas and developed ski areas from the CRAs and redefining the roadless boundaries to include areas with roadless characteristics would increase roadless area values regarding scenic quality.

Many of the new roads would be temporary roads, others would be longer term roads associated with energy development. All these roads would be closed to public vehicle use and would be decommissioned following the specific permitted use.

Tree-cutting under alternative 2 could modify scenic integrity at least in the short term, but past practices indicate that at least a moderate level of scenic quality would be maintained, based on standard scenic quality mitigations typically applied. In the long term, the scenic integrity (or visual quality) objectives that are modified from these tree-cutting treatments would gradually return to high scenic integrity (visual quality) levels. Tree-cutting activities projected to occur in CRAs would be spread across multiple CRAs, thus reducing the potential change in any one area (see appendix C regarding the roadless areas with projected tree-cutting activities). Also, potential effects would be moderated because of priority treatment of hazardous fuels around communities and by applying scenic integrity or visual quality objectives from forest plans.

Alternative 3 – Forest Plans

Relative to all alternatives, alternative 3 would have the highest degree of increased adverse impacts on existing scenic quality because this alternative would have the potential for the most road construction or reconstruction, tree-cutting, and discretionary mineral activities in IRAs. Management prescriptions that generally allow natural processes to dominate (such as backcountry, special interest areas, and research natural areas) limit management activities and access; areas within IRAs that overlap with those prescriptions are likely to retain their high to very high scenic integrity. Management prescriptions that generally permit road construction or reconstruction and tree-cutting for a variety of purposes (such as general forest, rangeland, wildlife habitat) are likely to reduce scenic quality overall (see appendix B for details about forest plan direction).

There would be no change in scenic quality related to reducing the potential magnitude of natural events such as insect infestations and wildland fires, based on the SMS.

Potential effects in all IRAs would be moderated because of priority treatment of hazardous fuels around communities and by applying scenic integrity or visual quality objectives from forest plans

Summary of Direct and Indirect Effects

Alternative 1 would retain the greatest number of roadless area acres that reflect high to very high scenic integrity levels, compared to the other alternatives. However, many of the acres in the substantially altered areas in the IRAs would continue to reflect moderate to low scenic integrity levels, inconsistent with general roadless area characteristics and values.

Alternative 2 would retain most of the 4.03 million acres of CRAs at high to very high scenic integrity levels, with the scenic integrity level of some areas being lowered. The amount of projected roading, tree-cutting and removal activities, and energy resource operations would result in a higher potential than alternative 1 for portions of roadless areas to shift to a moderate

to low scenic integrity level. However, the areas of substantially altered landscapes would not be included in the CRAs so they would not detract from the expected scenic integrity level within the designated roadless areas. The unroaded areas included in CRAs would likely continue to add to the number of areas at a high to very high scenic integrity level compared to what could occur in those same areas under alternative 3.

Alternative 3 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 because of the levels of projected road construction or reconstruction, tree-cutting and removal, and energy resource operations that would be likely to occur in IRAs.

Environmental Consequences – Cumulative Effects

Past actions and events have shaped the current scenic quality in and around the roadless areas. Considering all the past, ongoing, and foreseeable future activities in and around roadless areas as described in appendix D, the increasing population growth and development adjacent to roadless areas has the most potential to contribute to cumulative impacts on scenery. The greater amount of roading, tree-cutting, and other activities allowed under alternatives 2 and 3 could add to effects of higher levels of development adjacent to roadless areas, thereby cumulatively reducing the acreage at high to very high scenic quality at a larger landscape scale.

CULTURAL RESOURCES

This section focuses on potential effects of the alternatives on cultural resources, also known as heritage resources. Cultural resources refer to areas, sites, buildings, art, architecture, memorials, and objects that have scientific, historic, or cultural value. They link people to their cultural history, provide insight into how people lived in the past, and reveal past and ongoing relationships between people and the natural world. Many of the nation's cultural resources are located on public lands, with National Forest System (NFS) lands containing more than 330,000 known sites nationally.

Affected Environment

The Forest Service inventories and takes actions to protect historic properties in accordance with the National Historic Preservation Act, Archaeological Resources Protection Act, Executive Order 11593 (Protection and Enhancement of the Cultural Environment), Executive Order 13007 (Indian Sacred Sites), and other related legal requirements. When the Forest Service authorizes actions on NFS lands, the agency must assess the potential effects of those actions on historic properties and seek ways to avoid or minimize adverse effects. Inventories and evaluations of effects of land management activities on cultural resources are completed during analysis of the proposed site-specific activities (undertakings), which is when measures are designed to avoid or minimize harm to those resources. If human remains are discovered before or during project implementation on NFS lands, the Forest Service consults with culturally affiliated tribes and takes appropriate actions, in accordance with the Native American Graves Protection and Repatriation Act.

Of the more than 30,000 cultural resource sites on NFS lands in Colorado, more than 17,600 (approximately 59 percent) are either considered significant and eligible for inclusion or listed on the National Register of Historic Places (NRHP), or their significance is unknown and they are managed as though eligible for inclusion on the NRHP (based on the USDA Forest Service Region-2 INFRA-heritage database 2008). Of the 30,000 sites identified on NFS lands in Colorado, more than 1,500 are currently known to exist within IRAs in Colorado. Many of these cultural resource sites are eligible for inclusion on the NRHP. Sites include historic, prehistoric, and traditional cultural properties. Additional cultural resources undoubtedly exist within these roadless areas but have yet to be discovered or documented.

The Forest Service also stabilizes and restores cultural resource sites that have been damaged or neglected, interprets sites for public education, and provides sites for public use and enjoyment through historic cabin rentals. It is important to maintain the integrity of and sometimes interpret cultural resource sites for future generations. NFS lands contain many of the best-preserved heritage sites that remain in the United States, in some of the least disturbed natural settings. These sites provide opportunities for Americans to learn about their cultural heritage (USDA Forest Service 1999). Heritage tourism is one of the fastest growing sectors of the tourism industry, and it is ranked among the top two or three reasons that people take vacations (USDA Forest Service 1999).

The laws, regulations, and executive orders previously listed, along with several others, require the Forest Service to consult with federally recognized tribes, based on a unique government-to-

government relationship and trust responsibility. There are two resident tribes in Colorado, both retaining some of their traditional land base as reservations via a series of treaties, agreements, and laws. The Ute Mountain Ute and Southern Ute Tribes (consisting originally of the Weeminuche, Capote, Tabeguache, and Mouaches Bands)—each a "domestic sovereign" nation—have reserved some specific off-reservation hunting rights in Colorado and retain inherent aboriginal rights throughout their traditional territory. Many other tribes located outside Colorado maintain tribal interests, including aboriginal and ceded territories, and retain inherent aboriginal rights within the state.

The Forest Service has been consulting with Colorado-affiliated tribes regarding this proposed rulemaking action and analysis process (see chapter 1). Concerns raised by some tribes regarding tribal land uses and access in roadless areas, and temporary road authorizations and decommissioning, would not vary by alternative. For example, under all alternatives, existing tribal uses and rights of access would not change under any alternative. If access or land ownership adjustments are proposed in the future in a roadless area, such proposals would require additional tribal consultation and analysis before a decision is made. In addition, construction and use of temporary roads would be limited to a specific authorized use only and would be decommissioned when that specific authorization is terminated. Because the concerns raised would not vary by alternative, they are not discussed further in this analysis.

Traditional cultural properties and sacred sites are also considered cultural resources and may exist within roadless areas in Colorado. Traditional cultural properties are places, sites, structures, districts, or objects that are historically significant in the beliefs, customs, and practices of a community. Effects from federal activities on traditional cultural properties are considered under the National Historic Preservation Act. 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. Past consultations with tribes and rural communities in Colorado indicate that certain tribes and ethnic groups have some specific traditional use areas within the roadless areas. For example, members of the various Ute Tribes are known to use some roadless areas in Colorado for traditional plant gathering and hunting. Because of cultural sensitivities and the desires of traditional tribal practitioners, exact areas for these types of activities often are not publicly disclosed. Evaluating the existence and significance of traditional cultural properties and sacred sites requires consultation with tribal members who possess traditional knowledgeable of specific areas. Traditional cultural properties and sacred sites have not yet been extensively inventoried on NFS lands, especially in roadless areas.

Environmental Consequences – Direct and Indirect Effects

Alternative 1 – 2001 Rule (No Action)

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, compared to the other alternatives, alternative 1 would result in the lowest risk of adverse effects on cultural resources from ground-disturbing activities such as road construction and use, tree-cutting and removals, or energy resource development activities. Further, effects on historic landscapes, potential sacred sites, and traditional cultural properties would also be minimized. The overall risk of adverse impacts from authorized activities in roadless areas would be quite low. This estimate is based on the very limited extent of management activities projected to occur in roadless areas over the next 15 years, as described in the Analysis Framework. In addition, impacts would be avoided or mitigated following appropriate inventories, laws, and regulations, including consultations with the State Historic Preservation Officer, tribes, and other interested parties. Overall, this alternative would provide for better maintenance of the current condition of cultural resources in the roadless areas.

In addition, this alternative would result in the least amount of human development or land use activities that could affect traditional uses by tribes or rural communities, such as traditional gathering of plants, hunting, fishing, or spiritual practices that may occur in roadless areas.

On the other hand, alternative 1 would provide less opportunity to the public for heritage tourism or educational and interpretive opportunities. There would be a slightly greater risk of roadless areas experiencing large, stand-replacing wildfires, which pose a risk of adverse effects on cultural resources. Fires 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.

There may be small, localized impacts from a number of ongoing activities, although the magnitude of human activities in roadless areas would continue to be much lower than on other NFS lands. Recreation activities—including dispersed camping, mountain biking, illegal off-road vehicle use, and other activities—would continue to pose a risk of damage, destruction, or loss of cultural resources, or impacts on sacred sites. Ongoing permitted and authorized uses that may continue to incur some impacts on cultural resources include livestock grazing, ski area developments and uses, outfitter-guide tours, prescribed burning, emergency response activities, and other permitted uses. However, these activities do not differ among the alternatives and therefore do not warrant detailed analysis.

Impacts on tribal governments and tribal practices from the Colorado roadless rulemaking process are not expected because of consultation requirements with individual tribes. Prehistoric cultural resources, traditional cultural properties, and sacred sites would be protected by the laws, regulations, and executive orders described in the Affected Environment section.

Alternative 2 – Colorado Rule (Proposed Action)

Compared to the other alternatives, alternative 2 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. This estimate is based on the limitations on how much roading, tree-cutting, and energy development activities could occur in the Colorado roadless areas over the next 15 years, as described in the Analysis Framework. This alternative maintains a number of prohibitions and limitations on development activities in roadless areas.

In addition, impacts would be avoided or mitigated following appropriate inventories, laws, and regulations, including consultations with the State Historic Preservation Officer, tribes, and other interested parties. Overall, alternative 2 would provide for satisfactory maintenance of the current condition of cultural resources in the roadless areas.

Alternative 2 would provide a slight potential increase in heritage tourism and interpretation opportunities compared to alternative 1 in those substantially altered acres removed from CRAs. By allowing for more treatments for hazardous fuels and forest health purposes, this alternative would also reduce the chance of roadless areas experiencing large, stand-replacing wildfires, which can cause adverse effects on cultural resources, as described for alternative 1.

Otherwise, effects on cultural resources from ongoing activities that do not differ among alternatives would be essentially the same under alternative 2 as under the other alternatives, and as previously described for alternative 1.

Alternative 3 – Forest Plans

Compared to the other alternatives, alternative 3 would result in the highest 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. Potential impacts on traditional uses by tribes or rural community groups would also be higher under this alternative. More roading, tree-cutting, and energy development activities would likely occur in the roadless areas over the next 15 years, as described in the Analysis Framework. Thus, there would be more potential for damage or loss of cultural resources. However, the risk of adverse impacts from authorized activities in roadless areas would still be relatively low, based on the limitations on certain activities within roadless areas due to forest plan management area constraints, budgets, and lack of access and required mitigation measures under existing forest plans. Impacts from authorized activities would be avoided or mitigated following appropriate inventories, laws, and regulations, including consultations with the State Historic Preservation Officer, tribes, and other interested parties. Overall, it is expected that activities authorized under alternative 3 would continue to provide for satisfactory maintenance of the current condition of cultural resources in the roadless areas.

Alternative 3 would provide the greatest opportunity to increase heritage tourism and interpretation, compared to the other two alternatives. By allowing for more treatments for hazardous fuels and forest health purposes, this alternative would also reduce the chance of roadless areas experiencing large, stand-replacing wildfires, which can cause adverse effects on cultural resources, as previously described.

Otherwise, effects on heritage resources from ongoing activities that do not differ among alternatives would be essentially the same as described under the other alternatives.

Summary of Direct and Indirect Effects

Effects on cultural resources are not significant among the three alternatives. Alternative 1 offers the most protection from development in roadless areas, which translates to fewer potential effects to historic properties; this is offset somewhat by a slightly increased potential for catastrophic wildfire. Alternative 2 offers fewer acres of roadless protection, so there is an increase in potential development activities that may have an effect on cultural resources; wildfire risk is slightly reduced in this alternative. Alternative 3 has the most potential for direct

effects on cultural resources; this alternative may also have the lowest risk of catastrophic wildfire.

Environmental Consequences – Cumulative Effects

Given the widespread destruction of cultural resources located on private lands and the rapidly growing interest in heritage tourism nationwide, cultural resources on NFS lands can be expected to become increasingly valuable resources in the future.

Bark beetle epidemics in Colorado will contribute to cumulative effects, in the form of an overall increase in vegetation management over the next 15 years. Specifically, areas not covered by roadless designation will see an increase in vegetation management activities.

Similarly, an overall upward trend in oil and gas development, as well as other energy-related activities such as geothermal leasing, will occur on adjacent lands surrounding roadless areas. These activities will contribute to an overall increase in ground-disturbing activities and alteration of natural and cultural landscapes, which in turn will add to potential for damage to cultural resources.

LIVESTOCK MANAGEMENT

This section evaluates effects of the alternatives on management of livestock grazing authorizations (permits) in roadless areas. Livestock grazing is authorized on lands identified through agency planning processes to be suitable and capable for such use. Management of livestock grazing in roadless areas is based on site-specific analysis, allotment management plans, permit requirements, and forest plan management direction, in accordance with statute, regulations, and agency policies.

Rangeland vegetation and health were previously addressed in a separate section of this chapter called Vegetation and Forest Health.

Affected Environment

Livestock grazing is managed in portions of many of the roadless areas, as displayed in Table 57. In addition to actively grazed allotments (lands allocated to grazing management), there are a number of vacant allotments where there is no current grazing permit in effect but where livestock grazing may be permitted in the future. Permitted livestock may include cattle, sheep, or other kinds of livestock such as horses.

Table 57 shows the acres of active and vacant allotments in roadless areas by national forest administrative unit.

Table 57. Livestock grazing allotment acres within roadless areas

National forest	Acres in IRAs (alternatives 1 and 3)	Acres in CRAs (alternative 2)	Difference
Arapaho and Roosevelt	136,00	126,000	-10,000
GMUG	1,068,000	794,000	-274,000
Manti-La Sal	11,000	8,000	-3,000
Pike and San Isabel	238,000	225,000	-12,000
Rio Grande	434,000	424,000	-11,000
Routt	421,000	412,000	-9,000
San Juan	591,000	539,000	-52,000
White River	502,000	500,000	-2,000
Total	3,400,000	3,028,000	-372,000

GMUG – Grand Mesa, Uncomphagre, and Gunnison.
Totals may not add due to rounding.
Includes active and vacant allotments.

Livestock grazing use in roadless areas occurs on open grasslands, meadows, riparian areas, shrublands, or to a lesser degree in forested areas containing sufficient herbaceous (grassy or non-woody) understory vegetation. More than 70 percent of the roadless areas are dominated by forest cover types where there is less forage available for livestock grazing. Roadless areas contain relatively small portions of open grasslands, meadows, and other expanses of herbaceous vegetation. Thus, authorized livestock grazing use occurs less extensively in the

roadless areas compared to many other portions of the national forests and national grasslands in Colorado.

Livestock management is an important traditional and cultural use of these lands. In addition, proper management of livestock grazing plays a critical role in rangeland ecosystem health and sustainability, offering potential beneficial effects such as maintaining soil quality, biodiversity, wildlife forage habitat, water retention and release processes, and some visual and recreational qualities. On the other hand, depending on the timing, location, and intensity of permitted livestock grazing, this use can result in detrimental impacts on the abundance and diversity of native plant communities; soil, water and riparian conditions; wildlife and fisheries habitat features; and visual and recreational resources.

Roading and tree-cutting activities that differ by alternative can affect rangeland vegetation, as described in the Vegetation and Forest Health section. Those activities can also affect the proper management of livestock in the roadless areas. However, those who have grazing permits for allotments in roadless areas have been effectively managing their livestock in those areas over long time periods without the necessity of additional roads. They typically rely on pack and saddle stock to manage the livestock and maintain their range improvement structures. In specific instances, their permit may include authorized use of motorized vehicles to access specific locations for specific needs associated with their permit. Such actions would not require construction of a road, but would allow one-time, over-ground motorized access to the area. Range management personnel on the national forests in Colorado do not foresee a need for additional roads in roadless areas in support of livestock grazing management in those areas over the next 15 years under any alternative.

The limited roads available in most roadless area grazing allotments can cause increases in operating costs for permit holders because of the increased costs of transporting livestock and allotment management materials into unroaded portions of the allotment. However, most permit holders operating in these areas have already factored in these costs and are accustomed to operating under the given conditions and restrictions in roadless areas. For some permittees, the added costs of operating in roadless areas are offset by lower costs associated with operating in other more roaded areas outside the roadless areas. Roads can also increase livestock management costs because they increase the potential for the public to leave livestock gates open, cut down fences, damage water developments, harass or shoot livestock, or disrupt grazing systems.

Environmental Consequences – Direct and Indirect Effects

All Alternatives

In general, the more potential for roading, tree-cutting, and related management activities in roadless areas, the greater potential there may be for the detrimental effects on grazing management just described (such as leaving gates open, cutting fences, etc.). Alternatives 1, 2, and 3 allow roading in roadless areas for specific purposes, and they all limit roading for other purposes. The maximum amount of road construction and reconstruction projected to occur under any of those alternatives ranges from 6 to 30 miles of road per year, distributed among many different roadless areas. Thus, under all alternatives, the roadless areas would be expected to continue to contain lower road densities than adjacent NFS lands (other than wilderness areas).

Under all alternatives, new roads would generally be closed to public motorized access, and most of those roads would be decommissioned after the specific intended use has ended. Although increases in road miles in roadless areas under any alternative would potentially increase unauthorized public motorized use in roadless areas, illegal public use of single-use roads in roadless areas would not be likely to occur extensively or frequently in any specific roadless area grazing allotment. Therefore, under any alternative, there would be a low likelihood that the projected new roads would significantly affect authorized livestock management use in the roadless areas. There may be a slightly higher risk of road-related impacts on livestock grazing management under alternative 3 (forest plans), because of the higher number of projected road miles under that alternative, but this difference between alternatives would not be considered significant.

Tree-cutting and removal activities in roadless areas also vary by alternative, affecting from approximately 800 to 16,000 acres per year, distributed among many of the roadless areas. These activities have the potential to disturb livestock and alter their distribution patterns, as well as the potential for fences to be cut or gates to be left open. Immediately after some forest management treatment projects, livestock grazing may be restricted from the disturbed areas that are being reseeded and revegetated. However, recent past tree-cutting activities such as for fuel reduction or forest health treatments have not typically resulted in significant adverse impacts on permitted grazing management in those affected allotments.

Tree-cutting activities tend to open forest canopies, which leads to increases in the abundance of forage vegetation for livestock (and grazing wildlife species). The prescribed burning that typically accompanies forest management projects involving tree-cutting usually results in further increasing the growth and abundance of herbaceous forage vegetation. In addition, if forest treatments in roadless areas reduce the severity and size of a wildfire, the treatments would likely have beneficial effects in protecting fences and other grazing management facilities in the treated area. Overall, the agency has found that forest management activities to improve forest health or reduce fuel accumulations can be conducted in a manner that is compatible with permitted livestock grazing, although some permit adjustments are sometimes needed during certain forest management operations or during post-project rehabilitation activities.

Therefore, while alternative 3 would pose the highest potential for adverse impacts on livestock grazing management in roadless area allotments, there would be no substantial difference in risk to livestock operations under any of the alternatives. Under all alternatives the risk would be low for the potential tree-cutting activities to result in significant adverse impacts on livestock management in roadless areas.

Summary of Direct and Indirect Effects

Minor and discountable differences among the alternatives in the restrictions on roading and tree-cutting in roadless areas have been described. Overall, none of the roadless area management alternatives would be expected to have any substantial beneficial or adverse impacts on livestock management operations in roadless area grazing allotments.

Environmental Consequences – Cumulative Effects

Other public land use activities that occur in roadless areas would have similar effects on livestock grazing operations in those roadless area allotments. For example, motorized and non-motorized recreation activities have a similar potential for incidences of leaving gates open,

cutting fences, harassing or killing livestock, and other effects previously described. Trends in recreational use, along with trends in oil, gas, and coal activities, are expected to increase over the next 15 years, which would increase potential risks to livestock operations in the roadless areas. However, human activity in roadless areas would likely continue to be less frequent and less extensive compared to activities on more intensively managed lands outside roadless areas. Thus, overall, those other activities in roadless areas that are not expected to differ by alternative would not substantially affect ongoing or future livestock operations that are authorized in the roadless areas.

Because of the low risk of measurable direct and indirect effects of the alternatives on permitted livestock operations, and the low magnitude and frequency of other activities in roadless areas likely to substantially alter permitted livestock operations, no significant cumulative effects would be anticipated under any of the alternatives.

OTHER LAND USE AUTHORIZATIONS

This section evaluates potential effects of the alternatives on facilities that are not owned by the Forest Service but are currently authorized on National Forest System (NFS) lands in Colorado by special use authorizations, including permits, term permits, leases, and easements. Particular attention is given to special use authorizations that need road access to support construction, operation, or maintenance of special use authorization facilities. These facilities may also need some incidental tree removal periodically for continued safe operation or under certain emergency conditions. In addition, this section specifically addresses oil and gas pipelines, utilities, water conveyance structures[20], and other lands-related special use authorizations that would likely occur in roadless areas and differ by alternative.

Recreation special use authorizations, including ski area permits and permits for outfitter-guides, are described in a separate section. Livestock grazing permits, mineral permits and leases, timber sale contracts, and other land uses are also addressed in separate sections of this chapter.

This EIS does not address the topic of land ownership adjustments (land exchanges or acquisitions) that could potentially occur in roadless areas in Colorado. The proposed Colorado Rule and other alternatives analyzed in this EIS would not have any affect on land ownership adjustments in the roadless areas.

Affected Environment

There are approximately 140 different types of lands uses that can be authorized on NFS lands. In Colorado, there are approximately 3,900 lands special use authorizations on NFS lands authorized to individuals, business entities, state and local governments, and other federal agencies (INFRA-Special Use Authorizations database, April 2008). These uses include roads, reservoirs, weather and climate monitoring stations, telephone and fiber optic lines, communication lines and sites (e.g. television, microwave, and others), railroads, service buildings of all types, electric transmission and distribution lines, oil and gas pipelines, and ditches and other water conveyance facilities. Authorized uses provide a variety of products to individuals and the general public and are part of the multiple-use management mission of the Forest Service. The number of land use authorizations within the roadless areas in Colorado is not known due to incomplete GIS spatial (map) information for each authorization. However, personnel from each national forest in Colorado provided projections for new roads that would likely be needed to support current or anticipated land use authorizations in roadless areas.

Where these kinds of special land use authorizations occur within roadless areas, they can result in both beneficial and detrimental effects on roadless area characteristics and values, depending on the type of use, the requirements and administration of the authorization, the responsibility taken by the holder of the authorization, environmental conditions, and personal values. Those who request such an authorization on NFS lands are required to submit a detailed proposal that

[20] *Utilities are defined in the Colorado Roadless Rule as existing and future electrical transmissions lines. Water conveyances are defined as existing and future water diversion structures, headgates, pipelines, ditches, canals, and tunnels (does not include reservoirs).*

includes an explanation of the purpose and need for the project or facility, a justification for the need to use NFS lands, the public need for and benefit from the facility, and the appropriateness of the use for that particular management area based on forest plans or other planning documents. The agency accepts proposals only for facilities where the proponent has satisfied the criteria that they are not able to accomplish that land use activity on non-NFS lands according to the Forest Service handbook and the Code of Federal Regulations [FSH 2709.11, chapter 10, 12.32a – Appropriate Use of National Forest System Lands; and regulations at 36 CFR 251.54(e)(5)(i) and (ii)]. There are privately owned facilities currently authorized on NFS lands, including lands in portions of the roadless areas.

The Alaska National Interest Lands Conservation Act (ANILCA) requires the agency to provide access to private properties surrounded by public lands (inholdings) based on the reasonable use and enjoyment of the property. Currently, there are private properties that require road access authorizations through portions of roadless areas. Roads built to access private properties are constructed to minimum standards, based on site-specific analysis and resource conditions, and the planned use of the property. These roads are sometimes closed to public vehicle traffic.

As people continue to build at higher elevations on private land inholdings within NFS land areas, the agency anticipates increased proposals for improving and upgrading existing access roads. In addition, as private land within or immediately adjacent to roadless areas is developed, demand for special use authorizations on adjacent NFS lands will continue to grow. Future proposed uses may include irrigation ditches, wells and other water systems, fences, access roads, powerlines, or other facilities.

The Department of Energy and Bureau of Land Management are leading the preparation of an EIS regarding designated energy corridors on federal lands in 11 contiguous western states including Colorado. In July 2008, the draft EIS was available for public comment. The draft EIS does not include any energy corridor designations that would go through inventoried roadless areas (IRAs) or Colorado roadless areas (CRAs).

As research on alternative energy sources continues, proposals for wind energy testing may become more prevalent. Proposals for wind energy testing and development appear to be adjacent to private land that is already being developed on ridgetops and on the national grasslands. Additionally, a few national forests in Colorado have received expressions of interest in developing wind energy facilities in one or more of the roadless areas.

As water needs increase throughout the country and drought cycles continue, water holders are asking for authorization to expand and enlarge existing reservoirs and water transmissions systems. The agency anticipates an increase in proposals for new reservoirs and associated water conveyance systems on NFS lands in the future. There is also the potential for proposals for new microwave, radio, or television facilities on NFS lands in roadless areas.

Incidental tree removal occurs in roadless areas as needed to support special use authorizations for pipelines, utilities, water conveyance systems, and all other authorized facilities. Incidental tree-cutting would continue to be allowed in roadless areas under all alternatives.

Environmental Consequences – Direct and Indirect Effects

Alternative 1 – 2001 Rule (No Action)

This alternative, as well as the other alternatives, would not revoke, suspend, or modify any existing permit or other legal instrument authorizing the occupancy and use of NFS lands. In addition, none of the alternatives differ in the ability to provide roads needed for access to private lands in accordance with ANILCA or roads needed to meet public health and safety purposes, including roads needed for wildfire suppression and law enforcement (refer to chapter 2 for details on road building exceptions that are common to all alternatives).

Under alternative 1, existing utilities and water conveyance systems authorized prior to January 12, 2001 (enactment of the 2001 Roadless Rule) may include new roads. Approximately 0.6 mile of road construction or reconstruction is projected annually for the reconstruction, operation and maintenance of existing utilities or water conveyances in IRAs, including road reconstruction for ditch maintenance activities. Future special use authorizations, including utilities and water conveyance systems in IRAs are allowed but unlikely to occur, as this alternative prohibits new roads in IRAs for uses authorized after January 12, 2001. Any future special use authorizations would be restricted to existing roads if such roads are currently adequate for that use.

Alternative 1 limits the authorization of new special uses. This could cause economic consequences such as increased costs associated with having to locate all needed special land use facilities outside IRAs because of an inability to build roads in IRAs. Public benefits would also be limited as communications (including law enforcement communications sites) and utilities requiring the construction of roads would be prohibited.

Unlike alternative 2 (proposed rule), oil and gas pipelines would continue to be allowed within IRAs. Estimates of oil and gas pipeline miles are not available.

Alternative 2 – Colorado Rule (Proposed Action)

Unlike alternative 1, this alternative allows road building for future utilities and water conveyance systems. However, the definition of utilities in the Colorado Rule does not include other utilities such as telephone lines or communications facilities (microwave, cellphone, radio, or television) and the water conveyance systems do not include reservoirs (see definition in chapter 2). Approximately 1.2 miles of road construction or reconstruction are projected annually in CRAs for this purpose. This alternative provides greater flexibility and would be beneficial to the proponents of new utility and water conveyance facilities. The prohibition on road construction for water supply reservoirs or communication facilities may prohibit the establishment of needed public service.

For current special use authorizations in CRAs other than utilities and water conveyances, estimates are for 0.7 miles of road construction or reconstruction annually in CRAs. Unless authorized before promulgation of a Colorado Rule, no roads may be built for future special use authorizations other than utilities and water conveyances in CRAs. This prohibition would necessitate locating new facilities outside CRAs if they required roaded access and could cause reduced public services and economic consequences such as increased costs for the proponent by limiting siting options.

Unique to this alternative, the construction of oil or gas pipelines through a CRA from a source or sources located outside a CRA would be prohibited. Currently, there are no proposals for an oil and gas pipeline. This prohibition might have an economic consequence for the proponent and for land owners or managers of the leased lands. Prohibitions for this category of pipeline may necessitate longer routes and larger pipelines to increase capacity for future activity.

Alternative 3 – Forest Plans

For currently authorized and future utilities and water conveyance systems, estimates are for about 1.2 miles of road construction or reconstruction annually in IRAs under alternative 3. Estimates for other lands special use authorizations are for about 0.8 miles of construction or reconstruction annually. Thus, projections for road construction or reconstruction in roadless areas for special use authorizations are the same under alternatives 2 and 3. For future oil and gas pipelines, estimates are not available for projected pipeline miles.

Under this alternative, management direction in forest plans for acreage within IRAs in Colorado is generally less restrictive than the 2001 Rule or Colorado Rule in terms of roading for special use authorizations. Most forest plans would continue to allow new roads in IRAs in support of current as well as future special use authorizations. However, the forest plan for the Rio Grande National Forest is more restrictive on land use activities for most IRA acres compared to the 2001 Rule or Colorado Rule. Four forest plans do not restrict roading in IRAs at all. Appendix B, forest plan management area direction, lists the differences among forest plans regarding road building restrictions in IRAs, and the alternative 3 map in the map packet spatially displays those differences. For the acres in IRAs where roading is prohibited or restricted (discouraged), it is less likely that new special use authorizations would be approved, unless those facilities can be constructed and maintained without new roads.

Under this alternative, if there is a sufficiently compelling need, such as a critical public service or a new road in support of a new special use authorization, a project-specific amendment to the applicable forest plan may be considered.

Summary of Direct and Indirect Effects

Alternative 1 (no action) would provide the least flexibility among the alternatives in terms of providing opportunities for obtaining lands special use authorizations in roadless areas, because some of those authorizations would likely require new road access within the IRA. Special use authorizations could be located where there currently are roads, as long as the current roads are adequate. Thus, alternative 1 could result in reduced public services, increased economic consequences, or hardships related to having to locate future utilities and other infrastructure facilities outside IRAs.

Alternative 2 (proposed action) would provide greater flexibility for opportunities to locate utilities (electrical transmission lines and facilities) and water conveyances (excluding water supply reservoirs) in CRAs because it allows roads in support of those facilities. Alternative 2 would provide less flexibility regarding oil or gas pipelines, as it prohibits such pipelines from being located through CRAs from leases outside CRAs.

Alternative 3 (forest plans) would provide the most flexibility for lands special use authorizations that include supporting roads on the majority of the IRA acres.

Environmental Consequences – Cumulative Effects

Continued population growth; addtional need for municipal, agricultural, and domestic water; development and sale of private land inholdings; subdivision of ranch lands; exploration for energy sources; and the need to move products to market via pipelines, transmissions lines, and roads all affect management of NFS lands both within and adjacent to roadless areas in Colorado.

All discussions about future use and occupancy of IRAs and CRAs are somewhat speculative, as proposals for special use authorizations come from outside the agency. The agency recognizes the demand and projections of increases in oil, gas, and coal leasing activity within and outside roadless areas, and anticipates the possibility of additional pipelines through roadless areas for product transportation. Increases in population growth and development around the national forests are expected to trigger new proposals for additional access and facilities on NFS lands. Many communities would likely have a need to expand their municipal water supplies, which may involve proposals to add or expand reservoirs on NFS lands.

Under all alternatives, limitations on roading in roadless areas cumulatively added to other roading prohibitions found in wilderness and certain forest plan standards would cumulatively limit community opportunities to use NFS lands to meet infrastructure needs. Roadless areas and wilderness areas combined cover nearly half of the NFS lands in Colorado. Thus, roading prohibitions under alternative 1 would have the greatest potential to contribute to cumulatively constrain the NFS acreage available for economic development and growth opportunities in Colorado. Alternatives 1 and 2 both constrain the ability to build or expand water supply reservoirs in roadless areas due to road prohibitions. Alternative 2 would provide more opportunities to meet community infrastructure needs than alternative 1, but would limit roads for reservoirs, utilities other than electrical transmission lines, and all other potential lands special use authorizations outside the identified exception.

SOCIAL VALUES

The social implications of roadless area management in Colorado are of interest to local residents surrounding the roadless areas, users of roadless areas, and people throughout the country who value or are interested in roadless area resources. Policy decisions that influence the management of roadless areas attempt to balance the wide variety of uses and values individuals hold for national forest resources. It is unlikely that any alternative selected in this process will answer the needs of all those interested in management of roadless areas in Colorado. Each alternative will be a compromise between the competing uses and values of roadless areas.

This section describes the potential impacts on different interests and values of roadless area resources by alternative. This section includes a description of counties and statewide demographics and trends within Colorado, environmental justice considerations, and potential impacts by alternative on various forest interests and values.

Affected Environment

Demographic information describes the social and economic conditions and trends of populations in specific geographic areas. It allows the decision maker and public to understand how population trends influence or are influenced by public land management.

The population variables considered for this analysis include population and growth trends, age composition, racial diversity, and poverty level. Where possible, explanations of trends that are not typical for Colorado are provided. Otherwise, trends are assumed to reflect some preference or response to natural, physical, or political frameworks, and would be expected to continue in the future.

Population numbers and composition can influence the ability of the area to absorb or adapt to changes as well as change the demands locals have for forest products and opportunities. It is important to consider any potential changes within the context of trends or changes that are occurring outside Forest management activities, for example the movement of retirees into Colorado or changes in preferred recreational activities.

Colorado Populations and Growth Trends

There are 64 counties in Colorado. Table 58 highlights the 41 counties with roadless area acres, including inventoried roadless area (IRAs) and Colorado roadless areas (CRAs), and the percentage of those NFS acres within the county. Counties without roadless area acres are not included in the analysis. Of those 41 counties with roadless area acres, 16 counties have 35 percent or more of the NFS lands within the county in roadless areas. In Moffat, Las Animas, and Mesa counties, over half of the NFS lands in the county are within roadless areas. There are fewer total acres of CRAs based on adjustments of CRA boundaries compared to IRA boundaries. However, in Dolores, Jefferson, Las Animas, Montezuma, Montrose, Ouray, Park, Pueblo and San Miguel Counties there are more total CRA acres compared to IRA acres, due to the unroaded areas outside IRAs that were included in CRAs (refer to appendix A, IRA and CRA acres and names).

Table 58. Colorado counties with IRA and CRA acres

County	National Forest System lands	IRA acres, alternatives 1 and 3	Percent of NFS acres that are w/in IRAs	CRA acres, alternative 2	Percent of NFS acres that are w/in CRAs
Archuleta	430,000	125,500	29%	103,000	24%
Boulder	138,000	22,600	16%	22,600	16%
Chaffee	457,000	180,000	39%	179,300	39%
Clear Creek	175,000	62,800	36%	59,300	34%
Conejos	301,000	65,700	22%	64,000	21%
Costilla	1,000	-	-	500	50%
Custer	162,000	60,900	38%	57,800	36%
Delta	192,000	85,300	44%	75,400	39%
Dolores	335,000	69,700	21%	88,500	26%
Douglas	142,000	57,500	40%	55,700	39%
Eagle	596,000	231,000	39%	229,500	39%
El Paso	101,000	12,000	12%	13,200	13%
Fremont	100,000	43,200	43%	45,500	46%
Garfield	516,000	85,400	17%	85,500	17%
Grand	572,000	182,500	32%	186,400	33%
Gunnison	1,276,000	501,900	39%	370,200	29%
Hinsdale	559,000	133,100	24%	124,100	22%
Huerfano	141,000	47,200	33%	42,000	30%
Jackson	333,000	60,500	18%	58,900	18%
Jefferson	105,000	27,400	26%	28,800	27%
La Plata	404,000	191,700	47%	198,200	49%
Lake	162,000	53,900	33%	45,900	28%
Larimer	648,000	154,800	24%	153,600	24%
Las Animas	22,000	13,300	60%	14,900	68%
Mesa	548,000	288,200	53%	275,700	50%
Mineral	525,000	207,000	39%	202,000	38%
Moffat	42,000	28,200	67%	28,100	67%
Montezuma	257,000	40,900	16%	52,200	20%
Montrose	327,000	21,900	7%	33,500	10%
Ouray	132,000	11,600	9%	21,100	16%
Park	650,000	132,900	20%	142,700	22%
Pitkin	496,000	104,700	21%	104,400	21%
Pueblo	33,000	9,500	29%	11,600	35%
Rio Blanco	359,000	169,700	47%	169,600	47%
Rio Grande	280,000	87,600	31%	86,700	31%
Routt	583,000	222,100	38%	215,000	37%

County	National Forest System lands	IRA acres, alternatives 1 and 3	Percent of NFS acres that are w/in IRAs	CRA acres, alternative 2	Percent of NFS acres that are w/in CRAs
Saguache	932,000	304,900	33%	222,700	24%
San Juan	174,000	62,200	36%	68,800	40%
San Miguel	177,000	18,600	11%	20,200	11%
Summit	313,000	59,100	19%	57,100	18%
Teller	125,000	14,100	11%	15,300	12%
TOTAL	13,885,000	4,249,000	31%	4,031,000	29%

Totals may not add due to rounding

Source – County data is from USDOC Census Bureau, 2000 census. Roadless area data is from the GIS roadless areas database, April 2008

In general, the population within Colorado has been increasing since 1900. Colorado saw rapid growth in the 1980s and early 1990s. More recently, the rate of growth has leveled off, but the population is still increasing as a whole. Figure 10 shows the population trend for Colorado from 1900 to 2000 and then projected through 2030.

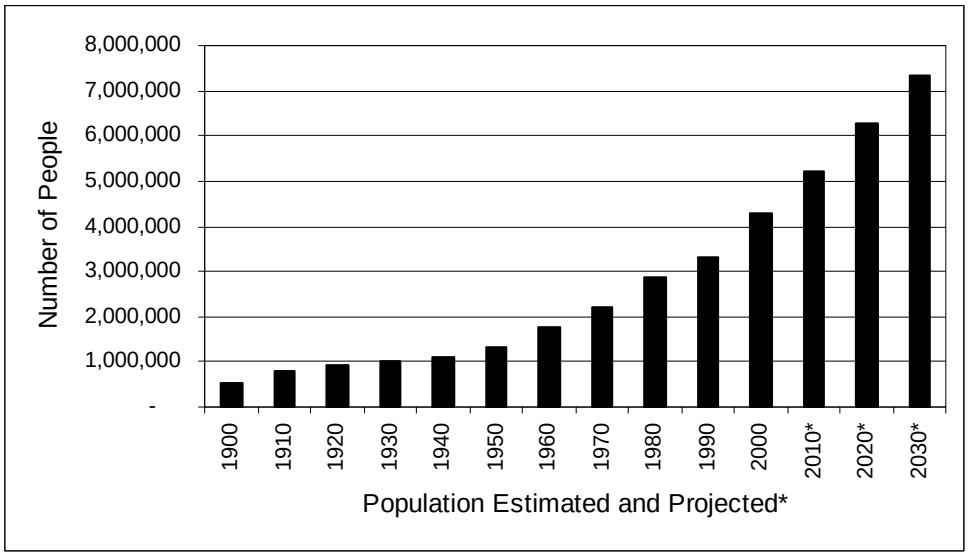

Figure 10. Colorado estimated population from 1900 to 2000 and projected for 2010 to 2030

**Source: State of Colorado, Division of Local Affairs - State Demography Office Website, 4/11/08*

Overall, Colorado's population increased about 2 percent between 2000 and 2005, from about 4,338,800 to 4,718,600, and is expected to continue growing at 2 percent until 2020 when growth slows slightly to 1.6 percent. Within the counties with roadless area acres in them, Archuleta, Chaffee, Custer, Delta, Douglas, Eagle, Garfield, Grand, Lake, Mesa, Montrose, Park, San Miguel, and Summit counties are projected to have higher growth rates than the state average, but the trend is similar in that growth will continue and begin to decline between 2015 and 2020. Reasons for the growth in Colorado include the oil and gas boom on the western slope as well as the continued influx of retirees into the state (DOLA website, April 2008).

Age Composition

Figure 11 highlights the age distribution estimates for Colorado for 1990 and 2000 and projections to 2030. As with the national trend of the aging baby boomers, Colorado is expecting a significant increase in the over 65 age category beginning in 2010. The Colorado Demography Office is predicting that between 2000 and 2020, Colorado's population within the 55 to 64 age category will more than double (Colorado DOLA State Demography Office 2007). This growth is greater than would be expected from Colorado's natural growth, indicating that retirees from outside Colorado will be moving to the state. With the projected increase in the 55 to 64 and over 65 age categories, Colorado counties will likely face many changes including personal income sources, different infrastructure needs to accommodate this population, and increasing demands for local services.

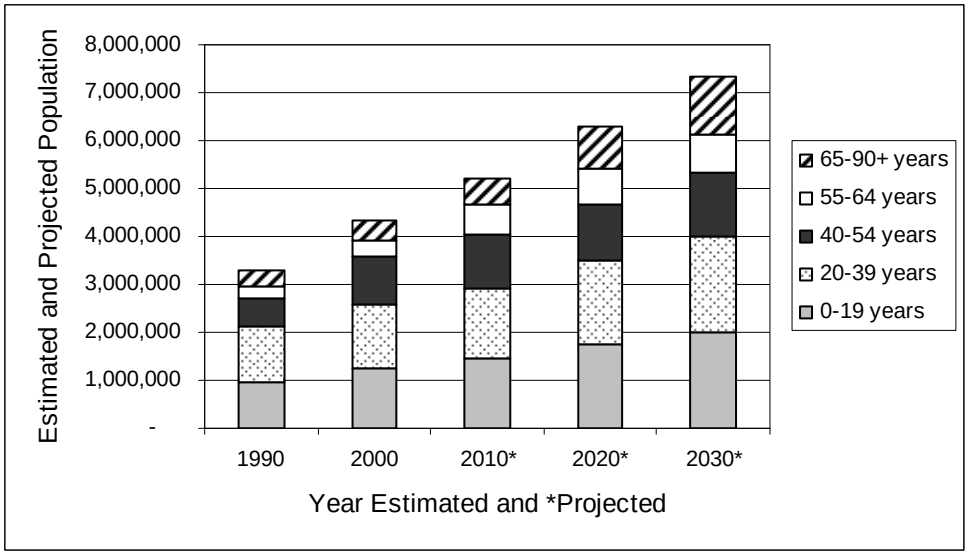

Figure 11. Colorado population by age, estimated for 1990 and 2000, projected for 2010 to 2030
Source: State of Colorado, Department of Local Affairs - State Demography Office Website, 4/11/08

Racial Diversity

Racial diversity is displayed for the current population in Colorado and projected through 2030 in figure 12. Overall, Colorado has limited diversity relative to the entire U.S. However, the trend in Colorado, as with the national trend, is toward more racially diverse populations in the future. The state average is not reflective of many individual counties in Colorado. Counties in the southern San Luis Valley, as well as many counties on the western slope, have significantly higher Hispanic populations than the state average.

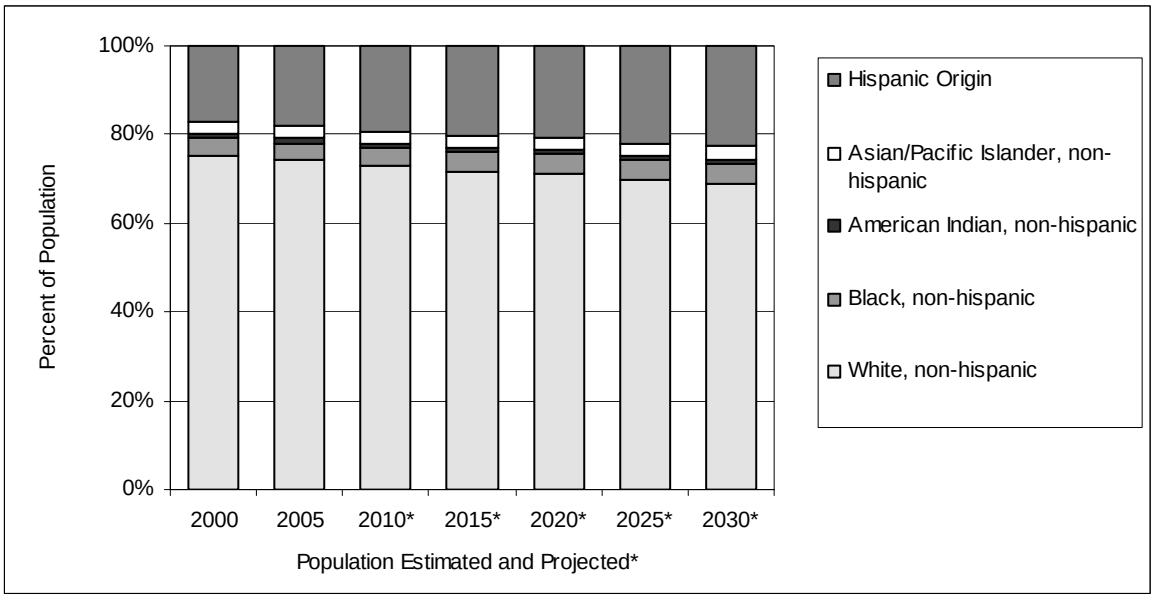

Figure 12. Colorado population by racial group estimated for 2000 to 2005 and projected for 2010 to 2030
**Source: State of Colorado, Department of Local Affairs - State Demography Office Website, 4/11/08*

For more detailed information, appendix I, social and economic data tables, includes maps displaying demographic information for all counties in Colorado.

In some cases, demands for resource opportunities in roadless areas may change over time as the growth of different racial and ethnic groups increase in communities around national forests or within user groups on the forests. Different groups often have different ways of recreating on or using public lands. Current Forest Service management and assumptions about how people use the national forest is likely to change as the population surrounding the forest changes. For example, limits on group sizes and numbers of vehicles allowed within developed sites may not be reflective of larger family gatherings that people desire to hold on public lands (Chavez 2000, Chavez 2005).

The following discussion of environmental justice includes more specific information concerning racial diversity, as well as poverty level associated with each county with roadless area acres (roadless area counties).

Environmental Justice

Executive Order (EO) 12898 directs federal agencies to focus attention on the human health and environmental conditions in minority and low-income communities. The purpose of EO 12898 is to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority and low-income populations.

Table 59 was developed from Census Bureau data from 2000. It highlights the minority group composition of the roadless area counties compared to Colorado state statistics. A minority population exists if 50 percent or more of the total population is considered to be of any minority group (Council on Environmental Quality, 1997). The table shows that Alamosa, Eagle, Huerfano, Lake, Las Animas, Pueblo, Rio Grande, and Saguache Counties have minority populations larger than the state average, and Conejos and Costilla County in the San Luis

Valley have the largest minority populations. Table 59 also displays the percent of individuals living below the poverty level by county and by state, and displays the percentage of households that heat with wood as their primary heat source, which is another low income indicator. In some areas of the state, heating with wood is an important factor to consider when looking at potential impacts of Forest Service actions because many low income families gather and use wood as their primary source of affordable heat.

Table 59. Environmental justice statistics for roadless area counties in Colorado

State/County	2000 population	Percent Black or African American	Percent American Indian, Alaska Native	Percent Asian, Native Hawaiian, other Pacific Islander	Percent some other race	Percent two or more races	Percent Hispanic or Latino, any race	Percent below poverty level	Percent heat with wood
Colorado	4,301,261	3.7%	0.7%	2.3%	0.1%	2.8%	17.1%	9.3%	1.0%
Alamosa	14,966	1.0%	2.3%	1.0%	20.3%	4.2%	41.4%	21.3%	5.3%
Archuleta	9,898	0.4%	1.4%	0.3%	7.0%	2.6%	16.8%	11.7%	9.0%
Boulder	291,288	0.9%	0.6%	3.1%	4.7%	2.2%	10.5%	9.5%	0.5%
Chaffee	16,242	1.6%	1.1%	0.5%	4.2%	1.7%	8.6%	11.7%	6.5%
Clear Creek	9,322	0.3%	0.7%	0.4%	1.0%	1.2%	3.9%	5.4%	4.8%
Conejos	8,400	0.2%	1.7%	0.2%	21.5%	3.6%	58.9%	23.0%	11.1%
Costilla	3,663	0.8%	2.5%	1.1%	29.5%	5.2%	67.6%	26.8%	12.2%
Custer	3,503	0.4%	1.1%	0.3%	0.7%	1.6%	2.5%	13.3%	6.8%
Delta	27,834	0.5%	0.8%	0.3%	4.3%	1.8%	11.4%	12.1%	6.7%
Dolores	1,844	0.1%	2.0%	0.4%	0.6%	1.7%	3.9%	13.1%	8.6%
Douglas	175,766	1.0%	0.4%	2.6%	1.4%	1.9%	5.1%	2.1%	0.3%
Eagle	41,659	0.3%	0.7%	0.9%	10.8%	1.9%	23.2%	7.8%	1.9%
El Paso	516,929	6.5%	0.9%	2.8%	4.7%	3.9%	11.3%	8.0%	0.3%
Fremont	46,145	5.3%	1.5%	0.6%	1.2%	1.8%	10.3%	11.7%	2.2%
Garfield	43,791	0.4%	0.7%	0.5%	6.5%	1.8%	16.7%	7.5%	2.7%
Gilpin	4,757	0.5%	0.8%	0.9%	1.5%	1.9%	4.2%	4.0%	9.6%
Grand	12,442	0.5%	0.4%	0.8%	2.0%	1.1%	4.4%	7.3%	6.6%
Gunnison	13,956	0.5%	0.7%	0.6%	1.4%	1.7%	5.0%	15.0%	7.6%
Hinsdale	790	0.0%	1.5%	0.3%	0.4%	0.5%	1.5%	7.2%	14.8%
Huerfano	7,862	2.7%	2.7%	0.5%	9.4%	3.7%	35.1%	18.0%	4.4%
Jackson	1,577	0.3%	0.8%	0.1%	1.5%	1.3%	6.5%	14.0%	4.8%
Jefferson	527,056	0.9%	0.8%	2.4%	3.2%	2.2%	10.0%	5.2%	0.5%
Lake	7,812	0.2%	1.3%	0.4%	18.0%	2.6%	36.1%	12.9%	4.8%
La Plata	43,941	0.3%	5.8%	0.5%	3.9%	2.3%	10.4%	11.7%	5.9%
Larimer	251,494	0.7%	0.7%	1.6%	3.4%	2.2%	8.3%	9.2%	0.7%
Las Animas	15,207	0.4%	2.5%	0.6%	10.0%	3.8%	41.5%	17.3%	2.9%
Mesa	116,255	0.5%	0.9%	0.6%	3.7%	2.0%	10.0%	10.2%	1.7%
Mineral	831	0.0%	0.8%	0.0%	0.1%	2.2%	2.0%	10.2%	19.4%
Moffat	13,184	0.2%	0.9%	0.4%	3.2%	1.8%	9.5%	8.3%	2.0%
Montezuma	23,830	0.1%	11.2%	0.3%	4.3%	2.4%	9.5%	16.4%	8.9%

State/County	2000 population	Percent Black or African American	Percent American Indian, Alaska Native	Percent Asian, Native Hawaiian, other Pacific Islander	Percent some other race	Percent two or more races	Percent Hispanic or Latino, any race	Percent below poverty level	Percent heat with wood
Montrose	33,432	0.3%	1.0%	0.5%	5.7%	2.5%	14.9%	12.6%	6.7%
Ouray	3,742	0.1%	0.9%	0.4%	0.5%	1.7%	4.1%	7.2%	9.2%
Park	14,523	0.5%	0.9%	0.4%	1.2%	1.8%	4.3%	5.6%	8.8%
Pitkin	14,872	0.5%	0.3%	1.2%	2.4%	1.3%	6.5%	6.2%	2.8%
Pueblo	141,472	1.9%	1.6%	0.7%	12.9%	3.4%	38.0%	14.9%	0.6%
Rio Blanco	5,986	0.2%	0.8%	0.3%	2.0%	1.7%	4.9%	9.6%	3.7%
Rio Grande	12,413	0.3%	1.3%	0.2%	21.4%	2.8%	41.7%	14.5%	6.9%
Routt	19,690	0.1%	0.5%	0.5%	0.7%	1.3%	3.2%	6.1%	4.5%
Saguache	5,917	0.1%	2.1%	0.5%	23.0%	3.1%	45.3%	22.6%	7.6%
San Juan	558	0.0%	0.7%	0.5%	0.7%	0.9%	7.3%	20.9%	11.1%
San Miguel	6,594	0.3%	0.8%	0.8%	3.4%	1.1%	6.7%	10.4%	7.8%
Summit	23,548	0.7%	0.5%	0.9%	4.0%	2.1%	9.8%	9.0%	2.7%
Teller	20,555	0.5%	1.0%	0.7%	0.9%	2.0%	3.5%	5.4%	6.3%

Source: USDOC Census Bureau, 2000 census

For more detailed information, appendix I, social and economic data tables, includes maps displaying demographic information for all counties in Colorado.

The state had about 9 percent of the total population living below the poverty level in 2000. Alamosa, Conejos, Costilla, Saguache, and San Juan counties all had individual poverty rates of 20 percent or higher in 2000. In addition, Conejos, Costilla, and Saguache Counties also had higher levels of households heating with wood. These counties are within the southern San Luis Valley in southern Colorado, and have historically seen lower income levels and higher minority populations than the rest of Colorado.

Within the southern San Luis Valley, many rural Hispanic families continue to live in traditional ways on lands farmed by their ancestors. Many families operate outside the cash economy, relying on access to public lands for resources they need. This includes subsistence hunting and gathering, gathering wood for heating and cooking, grazing small herds of domestic animals under permit, and gathering traditional cultural products (Romero et al. 2001).

Civil Rights

A civil rights impact analysis was completed for this proposed rulemaking process and approved by the WO Civil Rights Department. This document is available in the EIS record.

Social Values and Interests

Social concerns are broad and complex enough that they do not constitute a single issue that can be easily measured and addressed. Generally, the values people hold with respect to forest resources are the measures used to assess if alternatives will have positive or negative impacts on various individuals or groups. There are many definitions of value; for this analysis it is

assumed that we can understand forest values, such as biological diversity, recreation, or subsistence, by understanding what is important to people (USDA Forest Service 2003b).

Forest values represent the importance and worth that people have assigned to Colorado roadless areas. Table 60 lists, in alphabetical order, major categories of forest values that individuals may hold for any forest resource or opportunity. People can hold multiple values for the same resource, or may hold very separate values for specific places or experiences. The same place or roadless area will have different values for different people.

Table 60. Examples of forest values

Forest value	Description of why people hold this value
Aesthetic	Value the forest because of the scenery, sights, sounds, smells, etc.
Biological diversity	Value the forest because it provides a variety of fish, wildlife, plant life, etc.
Cultural	Value the forest because it is a place to practice and pass down wisdom, knowledge, and traditions
Economic	Value the forest because it provides timber, minerals, oil/gas/coal, or tourism opportunities (for outfitters/guides)
Future	Value the forest because it allows future generations to experience the forest as it is now
Historic	Value the forest because it has places and things from natural and human history that are important
Intrinsic	Value the forest in and of itself, just to know it exists, no use is needed to gain value
Learning	Value the forest because one can learn about the environment through scientific observation or experimentation
Life sustaining	Value the forest to produce, preserve, clean, and renew air, soil, and water
Recreation	Value the forest because it provides a place for outdoor recreation activities
Spiritual	Value the forest for sacred, religious, or spiritually special places, and for providing a feeling of reverence and respect for nature
Subsistence	Value the forest because it provides necessary food and supplies to sustain life for individuals
Therapeutic	Value the forest for physical and/or mental health

Source: Brown and Reed 2000, page 243

Conflicts occur when individuals or groups hold different forest values for the same resource or place. It is difficult to measure these forest values, so specific information is limited, yet it is these differences in values that create resource management conflicts. Resolving issues resulting from conflicting forest values is a political problem and would not be corrected by simply counting or measuring the values more rigorously (USDA Forest Service 1995b). The debate about roadless area conservation reflects the broader question of how demands for the many values that national forests and grasslands provide should be met. Much of the public comment during the 2001 Roadless Rule development was rooted in the more fundamental issues of how NFS lands should be managed and how to balance commodity and non-commodity values. These issues are discussed at length in the 2001 Rule FEIS and associated specialist report (http://roadless.fs.fed.us/documents2.shtml).

For this analysis, the values and interests included are based on the many responses to comments the public has provided during the 2001 Roadless Rule comment periods, the 2006 Colorado Task Force public hearings, and the 2007 Colorado Rulemaking Notice of Intent comment period. This is not a random sample; people who chose to respond to a Forest Service comment period are self-selected. By focusing on those who commented, the analysis focuses on those people who hold strong values regarding roadless area resources.

This analysis centers on nine broad categories of roadless values/interests, based on the comments received. These categories, defined in table 61, are used to display the differences between alternatives, and do not define specific individuals or groups.

Several assumptions underlie this analysis:

- People make choices or reflect their preferences based on what is important to them (Kleindorfer et al. 1993).
- Any individual may hold one or more of the values/interests in roadless areas described in this section. Consequently, the impacts of the alternatives on specific individuals may be cumulative, mixed, or singular, depending on how many different values the individual holds. For example, a person may hold values similar to those of the preservation category when considering wildlife habitat, but may hold values similar to the non-motorized recreation category when considering access to recreational opportunities.
- Management actions within roadless areas that are inconsistent with people's forest values are perceived by them as threatening and undermining to their values.
- The ability of forest users to continue to engage in current or future use of roadless area lands and to maintain the quality of their experience is tied to the ecological health of the natural resources found there.
- The majority of uses occurring in roadless areas begin with developed infrastructure outside of the roadless area (road, trailhead, campground, boat ramp, etc.).

Table 61. Forest value/interest categories used for Colorado roadless area analysis

Value/Interest category	Defined for Colorado roadless area analysis
Conservation	Values the balancing of roadless area management between active management of resources for use and areas where natural processes dominate.
Industry access	Values commercial activities such as timber, oil and gas development, mining, coal extraction, utilities, and other uses where appropriate in roadless areas. Values future access as needed to facilitate continued resource development and support for resource jobs and income.
Preservation	Values roadless areas for the natural processes and opportunities provided without additional management or infrastructure development. Much of the value is in knowing roadless areas exist and are protected from future development, rather than associated with actual use or visitation.
Recreational use – motorized	Values focus on maintaining current motorized use of roadless areas for recreational opportunities, as well as, where appropriate, increasing backcountry motorized opportunities in the future, which may be trails/singletrack rather than roads.
Recreational use – non-motorized	Values maintaining or expanding non-motorized opportunities in roadless areas. There is some division in this category between those interested in mechanized use (mountain bikes) and those who would like to limit access to hiking and horses.

Value/Interest category	Defined for Colorado roadless area analysis
	Overall the desire is for quiet/non-motorized experiences in roadless areas.
Roaded access	Values gaining access via roads to the forest, including roadless areas. For some, driven by need or disability, the desire for roaded access is due to the inability to get into the forest without the road system. For others, roaded access is the preferred method of travel, and the travel itself is the recreational experience.
Tourism (including ski resorts)	This category is another commercial interest, but capitalizes on the roadless area as a natural amenity that attracts customers to the area for leisure activities. Scenery is of concern to this category, but the value of roading depends on the types of experiences the operation is providing.
Wilderness	Values roadless areas as land that can be included within the wilderness system in the future. This category focuses on future primitive and protected wilderness experiences and wilderness resources.
Wildland-urban interface	This category is specific to those activities in WUI or CWPP acres that overlap in roadless areas where vegetation treatments are desired to reduce wildfire hazards. This category values reducing wildfire hazards for houses and communities no matter the location. This category does not focus on individuals living within the WUI.

Environmental Consequences – direct/indirect effects

Alternative 1 - 2001 Rule (No Action)

This alternative, like the other two alternatives, would not change the demographic conditions and trends described in the affected environment. The increasing and changing population growth, along with changes in age and racial diversity, would have some impacts on NFS lands in terms of the types of resources and opportunities people demand from their public lands. The effects of increasing demands for the resources in roadless areas are discussed in other sections of this EIS.

In terms of environmental justice indicators, the southern San Luis Valley appears to be an area where access to NFS lands is important for families to maintain their rural lifestyle. The 2001 Roadless Rule does not allow additional road construction, but does not close or limit use of existing roads in roadless areas, so fuel wood gathering from a road system could continue. It is likely the local district would continue to plan vegetation management projects along existing road systems, so future fuel wood would likely be available. If the majority of these projects are for community wildfire protection, families interested in gathering fuel wood would have a short commute to those project areas. The actual availability of fuel wood is dependent on district decisions, but future fuel wood would likely be available.

The social values and interests associated with public comments received revealed strong support from individuals and groups who view the highest value of Colorado roadless areas to be maintained through preservation/non-development, as well as strong support from individuals and groups who view a balanced management approach that allows some development and extractive uses to be the best use of the roadless areas.

This alternative, like the other alternatives, differs in the balance points between those key conflicting values. Effects on those values and interests are described in terms of the nine key categories outlined in table 61. This analysis uses public comments for each category to describe the potential effects and differences between alternatives.

Conservation. In the conservation balance between active management and allowing natural processes to dominate, this alternative offers the least ability to actively manage forest resources now and in the future, focusing more heavily on allowing natural processes to dominate. While the limitation on roads could prevent future resource damage, the majority of active management would also be limited.

Industry Access. The potential economic impacts to industry access into roadless areas are considered specifically in the Economic values section of this analysis. Generally, roaded access and the ability to remove trees are necessary for timber operations to be profitable. Similarly, energy resources and mineral activity requires some level of roaded access and infrastructure development to operate. Because of limited access, alternative 1 limits future extractive operations in IRAs. Some limited timber harvest may occur in the substantially altered acres, and energy leases prior to January 12, 2001 could be allowed roaded access according to the specific lease stipulations. The majority of IRA acres would remain with restricted access thereby limiting future commercial activity. The 309,000 unroaded acres may be developed, depending on suitable conditions, resource availability, and forest plan direction.

Preservation. This category favors the limited roading and tree cutting allowed under alternative 1. Limits on future activity will maintain IRA acres that are not already substantially altered in their current condition, allowing for natural processes to take place. The substantially altered acres will continue to have some tree cutting, and existing roaded access will continue, which will detract from roadless characteristics. Similarly, any future management activities within the 309,000 unroaded acres could decrease the roadless experience in those areas.

Recreational use – motorized. Any additional roading in IRAs under alternative 1 will not change the current level of roaded access for this category. Any new roads will be closed to general public motorized access, so no additional motorized roaded opportunities will be created. Overall, this category may be more concerned with forest travel management decisions as an opportunity to maintain or increase overall motorized access. This category is also interested in keeping motorized trails open and adding additional trails within IRAs, providing users with a more primitive trail experience as well as roaded opportunities.

Recreational use – non-motorized. Any additional roading in IRAs under alternative 1 would be closed to public motorized use, but may be useable by non-motorized users. As the majority of any needed roads would be temporary, additional opportunities are not likely to provide a roadless experience in the short term. Overall, this alternative best maintains the non-motorized status of IRAs. Although motorized trail use would not be limited by this alternative, there would be restrictions on new roading. Similar to the motorized category, the forest travel management plans will be of concern to the non-motorized category, and may have a greater impact on their current and future roadless opportunities depending on future travel management decisions.

Roaded access. This alternative is the most restrictive for this category. Even though the majority of roads likely to be built under any alternative would be closed to public motorized use, alternatives 1 and 2 (proposed action) limit the possibility for future NFS roads within roadless areas. As with the recreational categories, the travel management plans for the road system outside of roadless areas is likely to be of greater concern to the category to maintain their current level of roaded opportunities.

Tourism. Depending on the type of tourism opportunities offered, this category parallels the recreational categories. Those tourism operations that focus on motorized opportunities would continue to operate under alternative 1 on current roads and use existing access points and motorized trails. Neither alternative 1 nor 2 would offer new roaded access for tourism operations; the majority of new roads would be closed to general motorized use. Tourism operations that focus on non-motorized opportunities favor the additional limitations on new roads and tree-cutting to preserve the type of experience they offer. Specific to the ski industry, alternative 1 may limit future expansions into IRA acres surrounding existing permit boundaries.

Tourism operations of all kinds in Colorado use the scenery on NFS lands to advertise. Alternative 1 would continue to limit additional roading and tree cutting in roadless areas which may maintain scenery. However, with recent beetle epidemics, much of the scenic quality of NFS lands will be altered inside and outside roadless under any alternative.

Wilderness. None of the alternatives recommend wilderness or provide for activities that would change current status as recommended wilderness. For future wilderness potential, alternative 1 is viewed as the best alternative. Although some roading and tree cutting is projected within IRAs, the level of activity is less than the other alternatives. Alternative 1 allows use and maintenance of existing roads and some tree- cutting within substantially altered acres; those areas would continue to be inconsistent with wilderness characteristics. Alternative 1 would not address the 309,000 acres of unroaded areas outside the IRAs. None of the alternatives address motorized use within IRAs, so roadless areas will continue to be open to motorized trail use unless otherwise closed by forest travel management plans. Such motorized use detracts from the wilderness experience this category values within IRAs.

Wildland-urban interface. Alternative 1 offers the least flexibility and access to address wildland-urban interface (WUI) concerns. Future fire/fuels/forest health projects would be limited to those areas that can be accessed via existing road systems, or to tree-cutting activities within substantially altered acres. For this category, the actual location of the IRA in relation to specific communities is also important, but is not analyzed in detail in this section. The Economic Values and Fire and Fuels sections of this analysis address the potential community impacts in more detail.

Alternative 2 – Colorado Roadless Rule (Proposed Action)

This alternative does not differ from alternative 1 (no action) relative to how population trends may influence or be influenced by roadless area management.

In terms of environmental justice indicators, alternative 2 would provide additional opportunities for families to collect fuel wood, if additional temporary roads are allowed in CRAs and collection of fuel wood is deemed by the local district as an approved use of those temporary roads.

Using public comments received, the social values and interests are described by the nine categories for alternative 2:

Conservation. In the conservation balance between active management and allowing natural processes to dominate, this alternative offers greater ability to actively manage forest resources now and in the future. It provides less emphasis on allowing natural processes to dominate compared to alternative 1. Although the restrictions on new road building could prevent future

resource damage, there would be more active management (based on the projections of activities described in the Analysis Framework section).

Industry Access. As with alternative 1, the majority of CRA acres would remain closed to future commercial activity. As discussed in the analysis framework, alternative 2 does allow for some additional roading and tree-cutting within WUI and community wildfire protection plans (CWPP). These activities may have a commercial element to them, but not as the primary purpose of the project. Energy activities would also be allowed to continue according to their lease stipulations as of the date of the Colorado Rule, so future activities would have to occur without new roads. One specific exception is the ability to build new roads for coal activities within the North Fork coal mining area, (see the Leasable Minerals and Economic Values sections for details). In addition, future oil and gas pipelines for a source outside a CRA would not be allowed to cross through a CRA, which may limit pipeline access or significantly increase the cost of a pipeline. The 309,000 unroaded acres would be included within the CRAs, so any suitable resources would not be available if a road or tree-cutting was needed.

Preservation. Alternative 2 allowances for additional roading and tree-cutting would preserve fewer of CRA acres in a primitive state than alternative 1. Removing the substantially altered acres from CRAs reduces the total acres included under a roadless rule, although adding the 309,000 unroaded acres into CRAs would increase the restrictions of future roading and tree cutting on those acres. The restriction on additional oil and gas pipelines from sources outside of CRAs through a CRA would also prevent some pipeline activity in a CRA that would be allowed under alternative 1.

Recreational use – motorized. There would be little change for this category between alternatives 1 and 2. Any additional roads would generally be temporary roads and closed to public motorized use, so there would be no increase in roaded opportunities.

Recreational use – non-motorized. The actual miles of roads open for public motorized use would not change between alternatives 1 and 2, but this alternative allows additional circumstances for road building that would detract from the overall non-motorized experience. The majority of these additional roads would be temporary, so the potential impact would be in the short term. Non-motorized opportunities would be maintained over the longer term.

Roaded access. Alternative 2 is not significantly different from alternative 1 in providing additional roaded opportunities.

Tourism. As with the recreational categories, there is not much difference between alternatives 1 and 2 in terms of additional roaded access. Specific to the ski industry, this alternative would allow limited expansions of ski areas not allowed in alternative 1 (see Developed Ski Areas section for details). Alternative 2 may create some short term declines in scenery within WUI and CWPP areas. Over time, the temporary roads and tree-cutting allowed within the CRA acres may provide for improved scenery compared to the rest of the CRA acres depending on the outcome of the beetle epidemics.

Wilderness. The additional circumstances for roads and tree cutting in alternative 2 may not offer the same protection of the potential future wilderness as alternative 1. In addition, CRAs do not include the substantially altered acres which under alternative 1 (no action) are not required to be returned to a roadless state. Wilderness interests are concerned that management of these acres under forest plan direction would open those acres for additional activities.

Alternative 2 would add the 309,000 unroaded acres as CRAs; these acres would not be included under alternative 1 or 3 (forest plans).

Wildland-urban interface. Alternative 2 offers the additional flexibility and some local direction to address WUI concerns. Future fire/fuels/forest health projects in CRAs would be limited to those areas that have an approved CWPP, or within the WUI area. This alternative provides communities with additional opportunities to reduce wildfire hazards with temporary roads and tree-cutting.

Alternative 3 – Forest Plan

This alternative does not differ from alternative 1 (no action) relative to how population trends may influence or be influenced by roadless area management.

Under this alternative, all IRAs would be managed under the existing forest plan direction. Most of the forest plans would continue to allow families to have adequate opportunities to collect fuel wood in the roadless areas. Roading restrictions for each forest plan are described in appendix B, forest plan management area direction.

Using public comments received, the social values and interests are described by the nine categories for alternative 3:

Conservation. In the conservation balance between active management and allowing natural processes to dominate, this alternative offers the most flexibility to actively manage forest resources now and in the future. It provides less emphasis on allowing natural processes to dominate compared to alternatives 1 or 2 (proposed action). While some forest plans have restrictions on new road building in roadless areas that could prevent future resource impacts, there would be more active management (based on the projections of activities described in the Analysis Framework section). (See appendix B, forest plan management area direction, for specific forest plan information).

Industry Access. Alternative 3 offers industry the most flexibility to gain access to timber and energy/mineral resources within IRAs, according to forest plan direction.

Preservation. Depending on individual forest plan direction, alternative 3 would likely have the potential for the greatest impact to roadless characteristics.

Recreational use – motorized. While the majority of projected new roads would be likely be closed to public motorized use, alternative 3 would allow for new NFS roads in IRAs as directed by forest plan direction, travel management plans, and budgets. Outside of the possibility of new roads, alternative 3 is similar to alternatives 1 and 2 in terms of providing for motorized trail opportunities in IRAs.

Recreational use – non-motorized. Alternative 3 would detract the most from the values of this category. As stated in the motorized category, new roads could occur in IRAs under alternative 3. Any new roads in IRAs would negatively impact non-motorized opportunities.

Roaded access. Alternative 3 is not projected to allow additional NFS roads open for public use, but of the alternatives, this is the only one that has the potential to build new roads in IRAs that could be open for public use.

Tourism. Alternative 3 projects the most additional roading and tree cutting which may impact scenery in the short term. As with the other alternatives, some roads would be closed to public

motorized use. Depending on the tourism operation, there would be little change between alternatives. In terms of providing a roadless experience, alternative 3 has the most potential to impact such experiences in specific locations. Specific to the ski industry, existing and future ski resorts that wanted to expand or build in IRAs would need to be consistent with the forest plan, but would not be limited by specific roadless rule direction.

Wilderness. Those areas identified in forest plans as recommended wilderness will continue to be protected as wilderness under alternative 3. This alternative may impact future areas from being recommended for wilderness due to projected roading, tree- cutting, and other management activities. Areas identified in forest plans as recommended wilderness would continue to be managed as such.

Wildland-urban interface. Alternative 3 offers the most flexibility to address WUI concerns. Future fire/fuels/forest health projects would be scheduled as needed and as budgets allowed. Roading would take place as allowed under the forest plans and as needed to access specific WUI locations.

Summary of Effects

It is unlikely that any of the alternatives would have a disproportionately negative impact on minority or low-income groups in the roadless area counties identified. In addition, information concerning this rulemaking effort and the potential changes in roadless area management would be made available within local communities of concern.

Table 62 compares the effects of each alternative relative to how they respond to each social value/interest category, based on the public comments as previously described. Some interests are more adaptable to differences between alternatives, and so more than one of the alternatives may be acceptable. Other interests are specific in their needs and values for roadless area resources; even small variations in potential impacts can result in undesired outcomes. The actual response of any group or individual to activities related to roadless area management will depend on location, substitute sites, timing, mitigation measure, and other trends and events occurring outside Forest Service control. The table highlights where each value/interest category may hold a specific preference for an alternative.

Table 62. Summary of social value and interest preference for alternatives by interest category

Value/Interest category	Alternative 1	Alternative 2	Alternative 3
Conservation	Not preferred	No strong preference	Preferred
Industry access	Not preferred	Not preferred	Preferred
Preservation	Preferred	Not preferred	Not preferred
Recreational use – motorized	Not preferred	Preferred	Preferred
Recreational use – non-motorized	Preferred	No strong preference	Not preferred
Roaded access	Not preferred	Not preferred	Preferred
Tourism	Nature/eco based, preferred	No strong preference	Motorized-adventure based and ski industry, preferred
Wilderness	Preferred	Not preferred	Not preferred
Wildland-urban interface	Not preferred	Not strong preference	Preferred

Cumulative Effects

Population growth, influx of retirees, changes in diversity, and other demographic trends are outside of Forest Service control, but could greatly impact the demands placed on national forest resources, both inside and outside of roadless areas.

Population growth is resulting in the conversion of existing open spaces and ranches into subdivisions and ranchettes. This may limit the opportunity for private lands to supply recreation areas or other demands for open space and push additional needs onto public lands, possibly increasing demands for open space recreation resources in adjacent roadless areas. Future development of private lands adjacent to roadless areas is expected to increase the WUI acreage in roadless areas, requiring more vegetation treatment to address concerns of wildfire hazard.

Future changes expected in recreation activities and equipment would change the way people use roadless areas. The current user conflicts on NFS lands between motorized, mechanized, and non-motorized opportunities will likely increase in the future, both inside and outside roadless areas. Additional management tools will be required to address these conflicts.

Public demands and market values for energy resources such as oil, gas and coal are expected to increase, which can increase the demand for industry access to public lands as discussed in the Leasable Minerals (Energy Resources) and Economic Values sections.

As these trends play out in Colorado, more types of people with different values will be affected and the values people hold for roadless areas will likely change. It is unlikely that there will be agreement in the future for how roadless areas should be managed.

Under any alternative, the debate is likely to continue. The issues of debate will be different depending on which alternative is selected.

ECONOMIC VALUES

This section addresses the economic consequences of each alternative, including both impact effects and efficiency effects. Impact effects include effects of alternatives on production outputs, employment, and labor income, in addition to federal payments to state and local governments. Efficiency effects include the economic benefits and costs, considering market and non-market goods and services such as roadless characteristics, options for future use of roadless areas, and ecosystem function. This section is a summary of the more detailed specialist report in the EIS record.

Affected Environment

The Colorado economy is diverse, ranging from urban centers along the Front Range (the urban development from the Denver metro area north to Fort Collins and south to Pueblo) to rural communities in the mountains and plains. Known world-wide for skiing and beautiful scenery, Colorado enjoys a strong tourism industry. It also benefits from sizable cable and satellite, defense, technology, and mining industries (including energy). Roadless area management, as described in chapter 2, directly affects the energy resources sector of the economy (oil, gas, and coal) and indirectly affects other sectors. Table 63 displays the distribution of industries in Colorado's economy based on production output, employment (jobs), and labor income.

Table 63. Output, employment, and income in the Colorado economy

Industry*	Output ($ millions)	Employment (jobs)	Labor income ($ millions)
Agriculture	5,554	47,044	824
Mining	12,361	24,191	3,091
Utilities	5,173	8,421	1,155
Construction	30,908	229,465	12,373
Manufacturing	61,010	157,037	11,216
Transportation & warehousing	12,920	79,545	4,942
Trade	39,816	398,601	15,745
Finance, insurance, & real estate	48,183	239,346	11,770
Professional services	37,524	270,801	19,521
Administrative & waste services	11,602	168,875	5,350
Educational, health, & social services	23,237	289,192	12,123
Arts, entertainment, & recreation	4,285	67,908	1,719
Accommodation & food services	13,005	229,075	4,450
Other services	53,745	245,328	15,509
Government	46,566	416,486	27,266
Totals	405,890	2,871,314	147,053

Source: Minnesota IMPLAN Group Inc. & Colorado DOLA State Demography Office, 2008

***Agriculture:** primarily engaged in growing crops, raising animals, harvesting timber, and harvesting fish and other animals*

***Mining:** primarily engaged in extracting mineral solids, liquids, or gases such as coal, petroleum, and natural gas*

***Utilities:** primarily engaged in providing electric power, natural gas, steam supply, water supply, and sewage removal*

***Construction:** primarily engaged in the construction of buildings or engineering projects (e.g. highways and utility systems)*

***Manufacturing**: primarily engaged in transformation of materials, substances, or components into new products*

***Transportation and warehousing:** primarily engaged in providing transportation of passengers and cargo, or storage of goods*

***Trade:** primarily engaged in wholesaling merchandise, generally without transformation*

***Finance, insurance and real estate:** primarily engaged in financial transactions involving financial assets*

***Professional services:** primarily engaged in performing professional, scientific, and technical activities for others*

***Administrative, waste management and remediation**: primarily engaged in performing routine support for other organizations*

***Educational, health and social assistance:** primarily engaged in providing instruction and training in a wide variety of subjects*

***Arts, entertainment, and recreation:** primarily engaged in providing services to meet entertainment and recreational interests of patrons*

***Accommodation and food services:** primarily engaged in providing lodging and/or preparing meals, snacks, and beverages*

***Other services:** primarily engaged in providing services not specifically provided for elsewhere in the classification system*

***Government:** primarily engaged in administration or management of public programs and agencies*

Economic Impact Areas

To provide a statewide context for the analysis, all Colorado counties were organized into four model areas. Table 64 summarizes the counties in each of these model areas. Figure 13 is a map displaying the county composition of each model area.

Table 64. Colorado counties by economic impact model area

Economic impact model area	Colorado counties
Energy Roadless[1]	Delta, Garfield, Mesa, Montrose, Rio Blanco
Rural Roadless[2]	Alamosa, Archuleta, Chaffee, Conejos, Costilla, Custer, Dolores, Eagle, Fremont, Grand, Gunnison, Hinsdale, Huerfano, Jackson, La Plata, Lake, Las Animas, Mineral, Moffat, Montezuma, Ouray, Park, Pitkin, Rio Grande, Routt, Saguache, San Juan, San Miguel, Summit, Teller
Front Range-metro[3]	Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Denver, Douglas, El Paso, Gilpin, Jefferson, Larimer, Pueblo, Weld
Eastern plains	Baca, Bent, Cheyenne, Crowley, Elbert, Kiowa, Kit Carson, Lincoln, Logan, Morgan, Otero, Phillips, Prowers, Sedgwick, Washington, Yuma

Source: The economic models were developed using IMPLAN (Minnesota IMPLAN Group 2008). The data set used in this analysis was developed specifically for Colorado using 2006 employment data from the Colorado Department of Local Affairs (Colorado DOLA State Demography Office 2008). The model was further customized to account for economic conditions and interactions in the oil, natural gas, and coal mining industries (McDonald et al. 2007). The most recent data available is from 2006.

[1] Economic impacts for oil, gas and coal are modeled using only Delta, Garfield, Mesa, Montrose, and Rio Blanco Counties. The model has been adjusted to fully account for all coal mining operations in Gunnison County.

[2] Oil, gas, and coal production for Gunnison and Pitkin Counties have been moved into the energy roadless model counties to better account for economic interactions.

[3] Some counties contain roadless acres. Appendix I, social and economic data tables, contains a list of those counties with roadless acres within their boundaries.

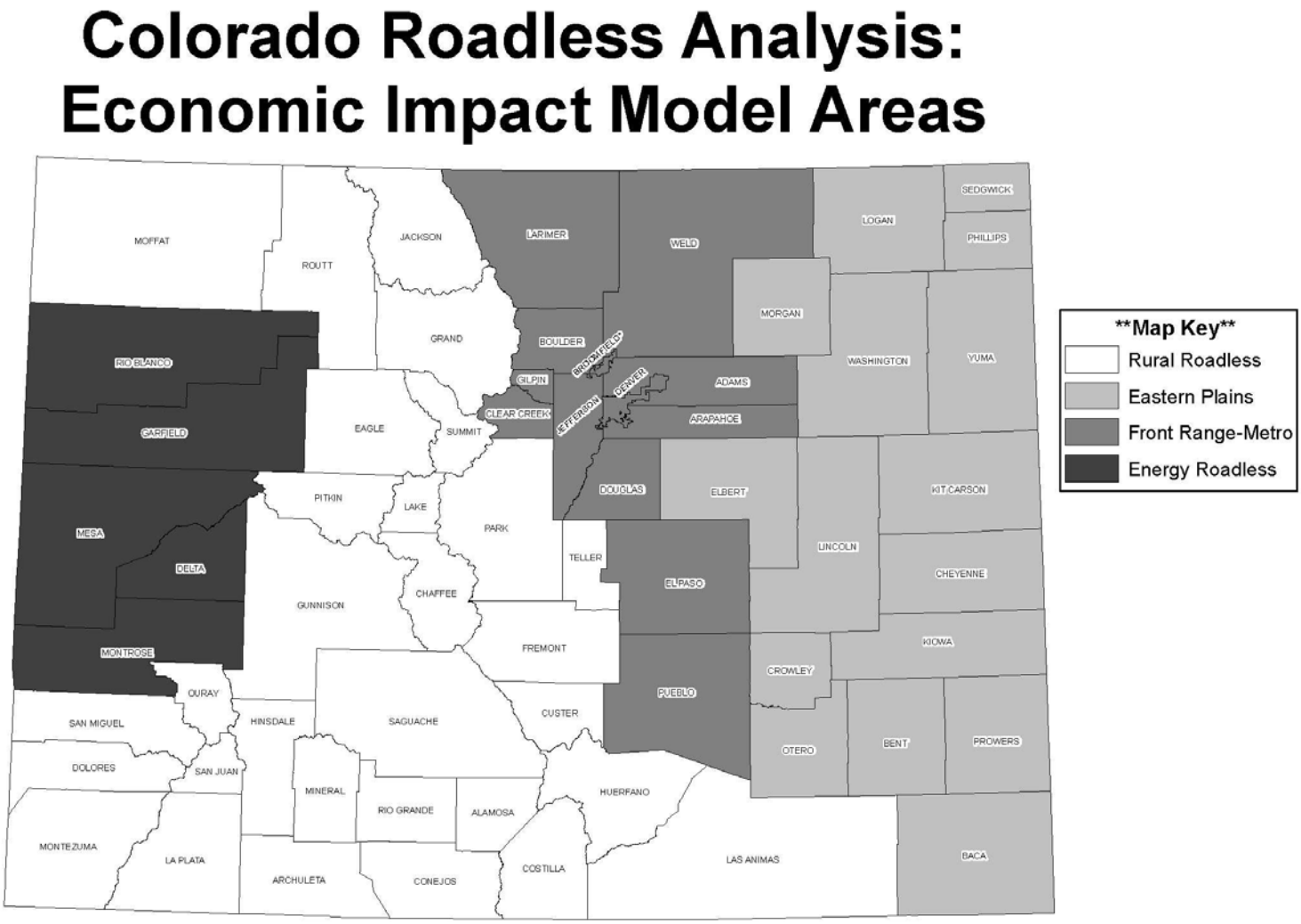

Figure 13. Economic impact model areas and associated counties

The energy roadless model area (hereafter called energy model area) includes a variety of communities, ranging from small towns – such as Somerset – to the economic center of western Colorado – Grand Junction. In prior years, this area was primarily defined by retirees, tourism, and agriculture. With the recent energy boom, the area has developed into the center for energy development in western Colorado. Table 65 shows the production outputs, jobs, and labor income for each economic sector in energy model area, comprising five counties in Colorado. The totals are strongly influenced by Grand Junction, a regional provider of energy-related goods and services.

Table 65. Output, employment, and income in the energy model area

Industry	Output ($ million)	Employment (jobs)	Labor income ($ millions)
Agriculture	472.6	5,472	87.4
Mining	5,101.9	7,027	662.1
Utilities	294.2	780	65.8
Construction	2,393.5	18,153	942.6
Manufacturing	1,822.3	6,561	294.6
Transportation & warehousing	647.5	4,897	238.8
Trade	1,772.7	21,824	713.5
Finance, insurance, & real estate	1,723.5	9,799	378.7
Professional services	791.3	7,540	358.4
Administrative & waste services	415.2	6,370	189.1
Educational, health, & social services	1,141.4	15,642	603.4
Arts, entertainment, & recreation	119.3	2,559	42.3
Accommodation & food services	586.4	11,322	192.1
Other services	856.6	10,674	292.5
Government	1,903.3	19,836	1,039.2
Totals	20,041.8	148,457	6,100.5

Source: Minnesota IMPLAN Group, Inc. & Colorado State Demography Office, 2006

Table 66 displays the same economic variables in comparison form for all four economic model areas in Colorado. The Front Range-metro model area dominates the Colorado economy in all respects with over 80 percent of production, jobs, and labor income, and includes some roadless areas. The rural roadless model area (rural model area) follows in economic importance and contains roadless areas in 30 of the 31 counties in this model area. The energy model area, with only five counties, trails only slightly in the size of its economy and includes roadless areas in all of its counties. The eastern plains model area provides for only about 2 percent of the state's economic production, jobs, and income, and contains no roadless areas.

Table 66. Output, employment, and income for each economic model area

Model Area	Output		Employment		Labor income	
	($ millions)	Percent	(jobs)	Percent	($ millions)	Percent
Energy	20,041.8	5%	148,457	5%	6,100.5	4%
Rural	32,551.7	8%	279,280	10%	10,657.4	7%
Front Range-metro	343,794.5	85%	2,366,618	82%	127,871.0	87%
Eastern plains	9,502.1	2%	76,959	3%	2,423.7	2%
Total for Colorado	405,890.1	100%	2,871,314	100%	147,052.8	100%

Source: Minnesota IMPLAN Group, Inc. & Colorado State Demography Office, 2006

Energy Resources

Table 67 compares the economic outputs associated with the mineral energy resource industry within each economic model area of Colorado. The energy model area has greater production than any other part of the state. This is notable given the large oil and gas fields north of Denver

that have been producing for many years. Employment in the energy model area ranks second to the Front Range-metro model area, primarily because of Denver-based corporate headquarters for mining companies doing business in Colorado and other parts of the US. For the same reason, income in the energy model area trails the Front Range-metro area.

Table 67. Energy mineral industry output, employment and income in each model area

Model Area	Output		Employment		Labor income	
	($ millions)	Percent	(jobs)	Percent	($ millions)	Percent
Energy	5,101.9	35%	7,027	29%	662.1	21%
Rural	4,383.4	30%	3,371	14%	331.7	11%
Front Range-metro	4,466.1	31%	12,694	52%	2,005.4	65%
Eastern plains	690.6	5%	1,110	5%	106.0	3%
Total for Colorado	14,641.9	100%	24,202	100%	3,105.2	100%

Source: Minnesota IMPLAN Group, Inc. & Colorado State Demography Office, 2006

The energy minerals sector of Colorado's economy provides over 2 percent of statewide employment and 3 percent of earnings (McDonald et al. 2007). As energy development continues in the state, especially on the western slope, these differences can be expected to narrow.

Social and economic conditions and trends in counties that make up the energy model area include the following (BBC Research and Consulting Inc. 2008):

- Operating wells in the region can be expected to increase six-fold in the next 30 years
- Wages are increasing dramatically as employment opportunities in the energy industry expand
- Housing prices often match or exceed those found in the Denver metro area today; affordable housing has become and will continue to be a serious issue
- Public infrastructure and local governmental services will need expansion before revenues are available
- Existing communities may not be able to accommodate the growth, spawning entirely new communities
- Land uses will likely shift from their agricultural heritage to other purposes.

Although the analysis area used for those research findings are not identical to the energy model area used in this EIS, there is substantial overlap. These observations help to portray the current and future importance of the oil and gas industry in western Colorado.

In the Rocky Mountains of Colorado, natural gas is the most common energy resource produced. Although the presence of these natural gas reserves has been known for decades, new gas recovery technologies combined with high gas prices have greatly increased the economic viability of gas production operations in Colorado. Natural gas prices are now more than double their 2000 levels. Colorado natural gas prices at the wellhead peaked in 2006 at an average of $6.31 per mcf (Colorado DNR Oil and Gas Conservation Commission 2008).

In addition to oil and gas resources known to occur in the roadless areas, there are three large coal mines on NFS lands, including portions of roadless areas. They are located in the North Fork Valley of the Gunnison River near the towns of Paonia and Somerset. In 2006, coal from North Fork Valley mines accounted for 43 percent of all coal production in Colorado and 1.4 percent in the US (Cappa et al. 2007). These mines employed about 930 miners and produced about 15.5 million tons of coal in 2006 (Colorado Mining Association 2007).

Colorado ranks seventh nationally among coal-producing states (National Mining Association 2007). Coal mining in Colorado is most prevalent in four counties: Routt, Moffat, Delta and Gunnison. Of these four counties, only Gunnison County has coal reserves in roadless areas. In the last decade, statewide coal production has doubled, growing from 20 to 40 million tons. About 65 percent of statewide coal is shipped out of state, most to mid-western and southern parts of the US (Cappa et al. 2007). The balance of state production stays in Colorado, supplying several coal-fired electric generation plants (Colorado DNR Geological Survey 2007). The value of Colorado coal production in 2006 was over $883 million. Of this amount, nearly $84 million was paid to federal, state, and local governments in the form of taxes, fees, and royalties (Colorado Mining Association 2007).

Mineral stocks limit the duration of mining operations, and it is no different for coal mines in the North Fork Valley. Additional federal coal is believed to exist under 45,350 acres of NFS land in the North Fork Valley area. It is reasonable to expect that portions of these additional federal coal reserves would be leased over the next 15 years (refer to coal activity projections described in the Analysis Framework section). Total coal production in the North Fork Valley would be limited by the availability of federal coal reserves.

Extraction of energy resources from federal lands provides sizeable revenues to state and local governments. These revenues are important contributions to the fiscal health of small and large governmental entities alike. Royalties of 12.5 percent are paid on production value from federal mineral leases. Half of these revenues are paid to the states where production originated. In Colorado, these revenues are allocated to a variety of state funds, including the State Public School Fund, and to local jurisdictions where employees of mining companies reside. Federal mineral lease payments to Colorado totaled over $128 million in 2007.

The State of Colorado imposes a severance tax that applies to energy minerals, as well as other mineral production. These revenues are distributed among state funds and local jurisdictions in a way similar to federal mineral lease payments. Oil, gas, and coal accounted for $135 million or 99 percent of all severance tax collections in 2007 (Colorado DOLA Division of Local Governments 2008).

Overall, the oil, natural gas, and coal reserves in roadless areas in Colorado have important economic implications at national, state, and local levels. National markets establish the demand for these commodities, but local conditions are affected. The subsequent environmental consequences section describes the economic effects related to energy resource development in roadless areas for each alternative.

Values at Risk of Wildfire

Mountain communities in Colorado near NFS lands are rich in natural amenities that continue to attract new residents. In recent decades these mountain communities have experienced substantial increases in the number of full-time residents as well as seasonal residents with second homes. In particular, people changing careers or retiring are moving in proportionately

significant numbers to these rural mountain communities. Whether they come to stay seasonally or year-round, the economy of these towns has become highly dependent upon their presence and activities (Lloyd Levy Consulting 2004). Most of these mountain communities located near roadless areas are within the rural model area, although they occur in other counties as well.

Table 68 offers a picture of the economy for the counties in the rural model area. The strongest two economic sectors in these rural mountain counties are the accommodation and food services sector and the arts, entertainment, and recreation sector, which are common in tourism-based economies. Another strong sector is the finance, insurance, and real estate sector – another hallmark of economies focused on tourism and second homes.

Table 68. Output, employment, and labor income in the rural model area

Industry	Output ($ millions)	Employment (jobs)	Labor income ($ millions)
Agriculture	1,068.0	11,426	185.1
Mining	4,383.4	3,371	331.7
Utilities	549.7	1,369	125.0
Construction	4,316.1	32,926	1692.1
Manufacturing	1,269.3	4,858	215.9
Transportation & warehousing	754.6	4,890	224.4
Trade	2,575.6	33,355	1017.9
Finance, insurance, & real estate	4,259.5	22,903	895.9
Professional services	1,786.8	15,790	817.5
Administrative & waste services	808.6	10,907	361.5
Educational, health, & social services	1,602.4	21,095	807.1
Arts, entertainment, & recreation	1,384.6	16,231	505.7
Accommodation & food services	2,578.0	38,531	902.1
Other services	1,644.3	20,125	571.6
Government	3,570.9	41,503	2003.9
Totals	32,551.7	279,280	10657.4

Source: Minnesota IMPLAN Group, Inc. & Colorado State Demography Office, 2006

Population growth in the area where mountain communities abut public lands, also referred to in this EIS as the wildland-urban interface, comes with inherent risks. Many mountain communities are particularly susceptible to natural disturbances such as mountain pine beetle infestations, droughts, and wildfires.

Losses from wildfire can impact a community for months or years. The values at risk include public health and safety, reliable water and power supplies, infrastructure (public and private structures), business activity, and general quality of life. Community infrastructure is the most visible and quantifiable value at risk. Homes, schools, retail shops, office buildings, libraries, hospitals, and police stations are just a few examples of infrastructure at risk of wildfire loss. The Colorado State Forest Service provided a list of 1,712 at-risk communities throughout the state (described further in the Fire and Fuels section of this EIS).

The best source of community infrastructure values is found in assessor records for each county. Table 69 shows selected assessor variables by county where the state-identified at-risk communities are located within a 3 mile radius of an inventoried roadless area (IRA) or Colorado roadless area (CRA). Communities within a 3 mile radius from a roadless area would be likely to be affected by differences among the roadless area management alternatives (refer to the Fire and Fuels section). From 1994 through 2007, the state's valuation assessment rate for residential properties has been about 8 percent, while most non-residential properties are assessed at 29 percent. Valuation for entire at-risk communities or for actual properties located within the 3 mile radius was not available. Table 69 does not imply that all county assessed valuation is at risk, but rather provides a context for understanding potential vulnerabilities.

Table 69. Assessed valuation in counties with roadless areas

	Total assessed valuation	Incorporated municipalities		Unincorporated areas	At-risk communities within 3 miles of a roadless area	County-wide average single family residence
County	($ millions)	Number	Total valuation ($ millions)	Total valuation ($ millions)	Number	Total valuation
Archuleta	345.4	1	61.2	284.2	9	$20,168
Boulder	5,431.3	10	4,458.3	972.9	28	$32,033
Chaffee	314.8	3	127.5	187.3	42	$14,003
Clear Creek	340.7	5	42.7	298.0	17	$21,550
Conejos	44.4	5	9.6	34.8	7	$6,661
Costilla	110.8	2	3.4	107.4	1	$4,489
Custer	84.3	2	16.5	67.8	7	$12,526
Delta	277.4	6	132.5	144.9	1	$13,268
Dolores	40.8	2	13.0	27.7	1	$10,840
Douglas	4,414.5	6	1,568.2	2,846.3	19	$28,026
Eagle	3,116.5	7	1,610.3	1,506.2	8	$88,058
El Paso	6,219.6	8	4,949.6	1,270.0	8	$17,796
Fremont	406.3	6	149.8	256.5	8	$10,959
Garfield	2,801.3	6	529.7	2,271.6	5	$29,095
Gilpin	340.9	2	262.6	78.3	3	$17,244
Grand	777.1	6	267.3	509.9	4	$32,353
Gunnison	759.5	5	343.6	415.9	103	$36,296
Hinsdale	51.4	1	13.1	38.2	53	$19,010
Huerfano	96.6	2	31.4	65.2	4	$7,682
Jefferson	7,049.3	12	4,218.3	2,831.0	8	$22,512
La Plata	2,806.8	3	525.7	2,281.1	22	$30,858
Lake	85.2	1	23.1	62.0	10	$12,763
Larimer	3,894.2	8	2,923.4	970.7	80	$18,799
Las Animas	564.7	6	-	564.7	1	$5,417
Mesa	1,684.7	5	1,012.9	671.7	2	$16,910
Mineral	28.7	1	4.3	24.4	10	$11,419
Moffat	277.2	2	65.4	211.9	2	$11,153

County	Total assessed valuation	Incorporated municipalities		Unincorporated areas	At-risk communities within 3 miles of a roadless area	County-wide average single family residence
	($ millions)	Number	Total valuation ($ millions)	Total valuation ($ millions)	Number	Total valuation
Montezuma	416.5	3	93.9	322.6	1	$12,607
Montrose	498.0	4	305.4	192.7	2	$17,696
Ouray	188.9	2	70.0	118.9	7	$31,140
Park	398.6	2	19.0	379.6	76	$18,620
Pitkin	2,703.9	3	1,779.6	924.2	5	$263,056
Pueblo	1,092.0	3	624.5	467.4	4	$10,720
Rio Blanco	661.2	2	30.0	631.2	4	$11,389
Rio Grande	161.6	4	56.8	104.8	5	$11,074
Routt	1,013.2	4	683.0	330.2	2	$44,972
Saguache	52.0	5	9.0	43.0	13	$0
San Juan	52.9	1	30.2	22.7	2	$20,209
San Miguel	888.2	5	549.1	339.1	15	$109,589
Summit	1,537.8	6	849.4	688.4	7	$46,543
Teller	434.7	4	174.3	260.4	13	$17,911
TOTAL	52,152.3	170	28,378.8	23,773.4	619	--

Source: Colorado DOLA, Division of Property 2008a, 2008b

When using a 3 mile radius to represent the wildland-urban interface, the residents and properties of 41 counties with roadless acres could be affected by roadless area management. There are 619 at-risk communities within a 3 mile radius of a roadless area. Over half of the 619 communities near roadless areas are located in four counties: Hinsdale, Larimer, Park, and Huerfano. Twenty-seven counties have less than 10 communities each.

Benefits and Costs

This section considers benefits and costs realized by citizens in Colorado and across the nation. Benefits and costs are divided into two parts: 1) those which are financial and captured in the fiscal records of the Forest Service and 2) those which are realized by any organization or individual. Financial considerations include revenues and costs from the perspective of the Forest Service or other government agencies. Other benefits and costs can be realized by users of roadless areas in national forests, including backpackers, hunters, viewers of wildlife, permitted outfitters and guides, ski areas, ranchers, timber processors, and water users. Other benefits and costs can also be realized by those who never set foot in Colorado roadless areas who desire the retention of wildland characteristics for their children.

The word "value" can have a variety of meanings. In one sense, value can mean that which is desirable or worthy for its own sake. In another, value can mean a fair or equivalent in terms of money or commodities (Freeman 2003). Economics considers value in the latter sense, using tradeoffs to determine the "equivalence." Often these values and tradeoffs are expressed in monetary terms. At other times where monetary expressions are not available, value and

tradeoffs are considered in qualitative terms. In this section, tradeoffs are discussed qualitatively.

In considering the financial benefits and costs of roadless area management alternatives in Colorado, revenues to the government can range from none to very high. Few revenues are typically obtained when road access is not permitted. At times, revenues in roadless areas might be limited to permit fees from outfitters and guides and livestock grazing. Conversely, road access can provide opportunities for larger revenues, such as when leaseable minerals are present and recoverable. Financial costs can also vary widely. Without road access or vegetative treatment, emergency needs, such as wildfire management, can be expensive. Non-emergency needs, such as treatment for forest health, can also be expensive without road access. At other times, the absence of roads eliminates maintenance costs and reduces law enforcement requirements.

In considering non-financial benefits and costs of roadless area management, both market and non-market goods and services can vary widely. Market goods or services are those for which one can observe transactions in the marketplace. Water rights, ski lift tickets, and the sale of cattle which graze on public lands are some examples of market values that are not captured in the Forest Service financial records. When road building and vegetative treatments are not allowed, these values may be minimal or non-existent. With opportunities to build roads and manage forest vegetation in roadless areas, there is a greater opportunity for generating economic benefits.

Non-market goods and services are those for which there are no observable transactions. The value of these benefits are often estimated by economists using "willingness to pay" concepts (Peterson et al. 1988). Examples of non-market benefits include dispersed recreation, viewing scenery and wildlife, solitude, health benefits, biological diversity, and ecosystem functions. Potential non-market benefits include retaining future options in roadless areas for use or for future wilderness consideration. These values are also discussed in the Social Values section.

Environmental Consequences – Direct/Indirect Effects

Economic impacts are associated with the variables just described such as production outputs, employment, labor income, and revenues to state and local government. Some land uses in roadless areas would not have economic impacts that would vary by alternative because management of those land uses in roadless areas would not differ by alternative. For example, the alternatives are not expected to result in changes in recreation use, livestock grazing, or mining for locatable minerals, nor would there be expected changes in water yield, based on effects analyzed in other sections of this EIS.

Although the proportion of timber products coming from roadless areas relative to other NFS lands in Colorado would vary by alternative, timber products from all national forests in Colorado would remain relatively constant. Budget levels for vegetation management are assumed to remain stable across all alternatives. Thus, the effects of producing more or less timber from roadless areas relative to outputs from surrounding NFS lands would not have a substantial economic impact on the counties or state. The differences in economic impacts between alternatives are related to differences in energy mineral extraction and wildfire hazard abatement treatments.

Energy Minerals

Alternative 1 – 2001 Rule (No Action)

Economic impacts described for each alternative are based on projections for foreseeable future activities in roadless areas that vary by alterantive, which are described in the Analysis Framework and Leasable Minerals (Energy Resources) sections. Those sections list the data sources and assumptions underlying the projected outputs for oil, gas, and coal resources likely to be developed in roadless areas. One key assumption is that roads would be needed to access potential energy mineral resources in leased areas. Thus, variations in road access opportunities in roadless areas would influence economic impacts.

Table 70 shows the direct, indirect, and induced effects for output (production value), employment, and labor income for alternative 1 as well as for the other alternatives. Direct effects are realized by the extraction and drilling companies from the sale of oil, natural gas, coal, and well drilling services. Indirect effects are realized by local companies that provide goods and services to the extraction and drilling industries. Induced effects result from local spending of employee income paid by the companies directly and indirectly affected by extraction and well drilling activities. The data in the table are based on total 15-year projections (2009 to 2023) converted to average annual impacts in 2006 dollars. They show economic impacts for the counties in the energy model area, which are those that would be affected by energy development in the roadless areas.

Table 70. Average annual economic impacts from energy mineral activity in the energy model area, by alternative

Effects	Output ($ millions)			Employment (# of jobs)			Labor income ($ millions)		
	Alt 1	Alt 2	Alt 3	Alt 1	Alt 2	Alt 3	Alt 1	Alt 2	Alt 3
Oil & gas drilling									
Direct	35.8	101.6	115.0	53	150	170	4.4	12.5	14.1
Indirect	13.5	38.4	43.5	68	193	218	2.8	8.0	9.1
Induced	5.1	14.6	16.5	49	139	157	1.6	4.4	5.0
Totals	54.4	154.5	174.9	169	481	545	8.8	24.9	28.2
Oil & gas production									
Direct	59.1	160.8	182.9	18	49	55	3.2	8.7	9.9
Indirect	30.9	83.9	95.5	61	165	188	4.0	10.8	12.3
Induced	5.1	14.0	15.9	49	132	151	1.5	4.2	4.8
Totals	95.1	258.7	294.3	127	346	393	8.7	23.6	26.9
Coal production									
Direct	0.0	97.6	97.6	0	264	264	0.0	32.2	32.2
Indirect	0.0	26.5	26.5	0	117	117	0.0	6.8	6.8
Induced	0.0	28.4	28.4	0	273	273	0.0	8.6	8.6
Totals	0.0	152.5	152.5	0	654	654	0.0	47.6	47.6
Total energy minerals									
Direct	94.9	360.0	395.5	71	462	489	7.6	53.4	56.2
Indirect	44.4	148.8	165.4	128	475	523	6.8	25.6	28.1
Induced	10.3	57.0	60.8	97	544	581	3.1	17.2	18.4
Totals	149.5	565.7	621.7	297	1,481	1,592	17.5	96.2	102.7

Alternative 2 does not include projected activity in the IRA acres that are not included in CRAs under alternative 2

Alternative 1, with the most IRA acres restricted from new road building, would result in the lowest outputs, jobs, and income of the alternatives. Total number of jobs under alternative 1 is almost 300 jobs, while for alternative 2 is almost 1,500 jobs, and for alternative 3 is nearly 1,600 jobs.

Table 71 displays the estimated average annual state and local government revenues (payments and taxes) from energy mineral activity in roadless areas by alternative. It shows that alternative 1 would have the lowest levels of payments and taxes related to mineral production. For property taxes, only revenue based on production is estimated. Personal and other real property may vary by alternative, but estimates for these could not be made. Estimates in table 71 are annual averages based on total 15-year projections, shown in 2006 dollars (thousands of dollars).

Table 71. Average annual energy mineral lease production, payments, and related tax revenues from roadless areas by alternative (thousands of dollars)

County	Oil & gas production value	Coal production value	Total of other payments and taxes[1]	Oil & gas production value	Coal production value	Total of other payments and taxes[1]	Oil & gas production value	Coal production value	Total of other payments and taxes[1]
	Alternative 1			Alternative 2			Alternative 3		
Energy counties									
Delta	$584	$0	$49	$3,540	$0	$340	$7,453	$0	$485
Garfield	$12,193	$0	$434	$40,485	$0	$1,525	$41,420	$0	$1,593
Gunnison	$9,421	$0	$284	$17,216	$97,640	$1,209	$17,351	$97,640	$1,214
Mesa	$30,015	$0	$1,404	$50,691	$0	$2,892	$64,886	$0	$3,534
Montrose	$0	$0	$5	$945	$0	$59	$0	$0	$28
Pitkin	$2,863	$0	$64	$36,867	$0	$822	$39,248	$0	$875
All others	$0	$0	$193	$0	$0	$904	$0	$0	$976
State total	$55,077	$0	$6,146	$149,744	$97,640	$24,481	$170,358	$97,640	$26,825

Alternative 2 does not include projected activity in the IRA acres that are not included in CRAs under alternative 2

[1] Includes property tax receipts (production only), severance tax receipts, federal mineral payments, state distribution of severance tax, and federal royalties

The distribution of severance tax and federal energy mineral lease payments to counties rises from alternative 1 to alternative 3, but the share each county receives remains constant. The largest share of payments goes to Mesa County. Because of state distribution formulas for severance taxes and federal mineral lease payments, Colorado counties outside of the energy model area would share nearly $1.0 million under alternative 3, $0.9 million under alternative 2, and $0.2 million under alternative 1.

Alternative 2 – Colorado Roadless Rule (Proposed Action)

Alternative 2, as displayed in tables 70 and 71, would result in higher production values than alternative 1 due to additional opportunities for road access, especially within the North Fork coal mining area. Employment and income estimated for alternative 2 is about five times that estimated for alternative 1. Similar increases are estimated for the payments and taxes paid to the state and counties based on energy mineral production.

Alternative 3 – Forest Plans

Alternative 3 would have the largest total effects on output, employment, and labor income (table 70). Compared with alternative 1, output would increase from $149.5 to $621.7 million per year. Employment and income for alternative 3 would also be significantly higher than estimates for alternative 1.

Property tax revenues vary depending upon the level of oil and gas development, where oil and gas development is likely to occur, and whether coal reserves can be mined. Nearly all counties have higher property tax revenues under alternative 3. Mesa County shows the largest increase over alternative 1 ($1.4 million); Delta shows the smallest ($0.1 million). The large increase for Gunnison County ($0.9 million) is associated with coal production, but all other increases are associated with oil and gas production.

Historically, decisions on the management of NFS lands have affected revenues and the subsequent "25 percent" payments to states and counties. In 2000, the Secure Rural Schools and

Community Self-Determination Act (SRSCSA) gave counties the opportunity to elect payments that would not vary and be independent of NFS receipts. All counties in Colorado except Douglas, Gilpin, Jefferson, and San Miguel elected to receive their payments under SRSCSA provisions. Only San Miguel County could experience a change in payments resulting from energy mineral development in roadless areas. Only fees associated with Forest Service permits for oil, gas, and coal exploration and development would affect the 25 percent payments to San Miguel County. Federal mineral lease royalties are collected by the Department of Interior and not subject to "25 percent fund" payments. Changes in the payment to the county are not expected to be sizeable under any alternative.

Counties with federal lands also receive payments in lieu of taxes to help offset the loss of property tax revenues caused by federal ownership. Using a system of formulas, those payments are based on county population and acreage in federal ownership, less federal payments from land use in the prior year. Federal mineral lease payments estimated for alternatives 2 and 3 could reduce those payments in lieu of taxes by equal amounts. However, those payments are subject to congressional appropriation, and have not been fully funded in recent years. Consequently, any reduction in payments in lieu of taxes for Colorado counties is likely to be smaller than the increase in federal mineral lease payments estimated for alternatives 2 and 3. For those counties already receiving the minimum payment, no change would occur. There would be no change under alternative 1.

Values at Risk of Wildfire

Some roadless areas pose a higher wildfire hazard to communities than others. Each national forest rated the likelihood of completing hazardous fuels treatment projects over the next 15 years for all IRA and CRAs (see Analysis Framework section). This analysis estimates which counties and how many at-risk communities in each county could benefit from a greater likelihood of roaded entry into roadless areas for treatments to reduce fuels.

Alternative 1 – 2001 Roadless Rule (No Action)

Under alternative 1, no additional roads could be built in roadless areas for fuels treatments, although treatments could occur along existing roads. Projections described in the Analysis Framework and Fire and Fuels sections indicate that after 15 years, less than 1 percent of the IRAs would be treated to reduce fuels or improve forest health. Under this alternative, no significant change would be expected in potential wildfire hazard to at-risk communities in the wildland-urban interface area outside the roadless areas (see Fire and Fuels section). Approximately 619 at-risk communities lie within 3 miles of an IRA. The economic values in those communities would remain at risk from wildfire-related damage or loss of value.

Alternative 2 – Colorado Roadless Rule (Proposed Action)

Under this alternative, roads would likely be built in roadless areas for fuel reduction treatments in wildland-urban interface areas or areas covered by community wildfire protection plans. Table 72 shows those counties which could benefit from additional opportunities for fuel reduction treatment in alternative 2 as compared with alternative 1. Twenty counties (118 at-risk communities) could benefit from additional fuel reduction treatments in CRAs, as they lie within a 3 mile radius of roadless areas with projected treatments, compared to alternative 1. Two incorporated communities – Rico in Dolores County and Rye in Pueblo County – plus 116

other unincorporated areas, could be better protected from wildfire-related losses due to the additional treatments. The assessed valuation for the incorporated communities includes the entire area within incorporated boundaries. Distinctions of reduced threat for only a portion of the community could not be determined. Average single family residence values in these counties range from about $11,000 to $47,000. Values are expressed in 2007 dollars.

Table 72. Alternative 2 - at-risk communities and assessed values where additional fuel treatments are projected, compared with alternative 1

	At-risk communities	Incorporated municipalities at risk		Unincorporated at-risk communities	County-wide avg single family residence
County	Number	Number	Total assessed valuation	Number	Total assessed valuation
Archuleta	5			5	$20,168
Chaffee	4			4	$14,003
Clear Creek	1			1	$21,550
Custer	4			4	$12,526
Dolores	1	1	$10,288,571	0	$10,840
Douglas	16			16	$28,026
El Paso	3			3	$17,796
Fremont	3			3	$10,959
Hinsdale	3			3	$19,010
Jefferson	5			5	$22,512
La Plata	21			21	$30,858
Lake	5			5	$12,763
Mineral	2			2	$11,419
Montezuma	1			1	$12,607
Park	33			33	$18,620
Pueblo	4	1	$876,030	3	$10,720
Routt	1			1	$44.972
Saguache	3			3	$0
San Juan	2			2	$20,209
Teller	1			1	$46,543
TOTAL	118	2	$11,164,601	116	--

Source: Colorado Department of Local Affairs, Division of Property Taxation; Colorado Department of Natural Resources, 2007

Alternative 3 – Forest Plans

This alternative allows for the most roads to be built in roadless areas for fuel reduction treatments. Table 73 shows those counties that could benefit from road access and fuel reduction treatment, as allowed under forest plan direction, compared with alternative 1. Twenty-three counties (196 at-risk communities) could benefit from additional fuel reduction treatments in IRAs, as they lie within a 3 mile radius of roadless areas with projected treatments, compared to alternative 1. Six incorporated communities – Salida in Chaffee County; Rico in Dolores County; Green Mountain Falls, Manitou Springs, and Palmer Lake in El Paso County; and Rye in Pueblo County – plus 260 other unincorporated areas, could be better protected from wildfire-related losses due to the additional treatments. Average single family residence values in these counties range from about $8,000 to $47,000. Assumptions associated with table 73 are the same as those described for table 72.

Table 73. Alternative 3 - at-risk communities and assessed values where additional fuel treatments are projected, compared with alternative 1

	At-risk communities	Incorporated municipalities at risk		Unincorporated at-risk communities	Countywide avg single family residence
County	Number	Number	Total assessed valuation	Number	Total assessed valuation
Archuleta	5			5	$20,168
Chaffee	34	1	$75,014,320	33	$14,003
Clear Creek	1			1	$21,550
Custer	5			5	$12,526
Dolores	1	1	$10,288,571	0	$10,840
Douglas	16			16	$28,026
El Paso	8	3	$96,460,710	5	$17,796
Fremont	3			3	$10,959
Gunnison	1			1	$36,296
Hinsdale	3			3	$19,010
Huerfano	1			1	$7,682
Jefferson	7			7	$22,512
La Plata	21			21	$30,858
Lake	6			6	$12,763
Larimer	11			11	$18,799
Mineral	2			2	$11,419
Montezuma	1			1	$12,607
Park	57			57	$18,620
Pueblo	4	1	$876,030	3	$10,720
Routt	1			1	$44.972
Saguache	3			3	$0
San Juan	2			2	$20,209
Teller	3			3	$46,543
TOTAL	196	6	$182,639,631	190	--

Source: Colorado DOLA, Division of Property 2007

Benefits and Costs

Alternative 1 – 2001 Rule (No Action)

Roads and tree cutting in IRAs are most restricted in this alternative. With such limited road access, entry into IRAs for fuels reduction, forest health, energy mineral extraction, and other purposes would be more expensive compared to expenses under other alternatives. Due to higher costs, potential revenues would be limited.

On the other hand, because this alternative restricts roads and tree cutting more than other alternatives, it would result in the highest value related to protection of non-market roadless characteristics. These non-market values or benefits include natural processes, retention of future options, and recreation uses of IRAs.

Alternative 2 – Colorado Rule (Proposed Action)

Roads and tree cutting in CRAs are somewhat less restrictive in this alternative. While entry to most CRAs remains the same as in alternative 1, CRA acreage within the North Fork coal mining area, wildland-urban interface, or community wildfire protection plan areas could be accessed with new roads. With increased opportunities for road access into some CRAs, entry into CRAs for fuels reduction, forest health, energy mineral extraction, and other allowable purposes would be less expensive compared to alternative 1.

Because this alternative generally restricts roads and tree cutting other than under certain circumstances, it would provide a measure of protection for non-market values such as roadless characteristics. However, it would result in lower non-market values compared to alternative 1, because of the additional roading and tree cutting that would be likely to occur. Where opportunities for fuel reduction, forest health treatments, and energy minerals development do not exist, roadless characteristics and non-market benefits would not be adversely affected.

Alternative 3 – Forest Plans

Roads and tree cutting in IRAs are the least restrictive in this alternative. The majority of the IRA acres within the North Fork coal mining area, wildland-urban interface, and community wildfire protection plan areas could be accessed with new roads. Costs for management activities in IRAs would be substantially reduced under this alternative compared to the other two alternatives due to the increased opportunities for road access into IRAs.

In many portions of IRAs, roadless characteristics would continue to be maintained and remain unchanged. Roadless characteristics could be significantly altered in other areas, depending on forest plan direction. Where opportunities for fuel reduction, forest health treatments, and energy minerals development do not exist, roadless characteristics and non-market benefits would not be adversely affected.

Summary of Economic Effects

The provisions for roads that allow for higher levels of energy mineral development in alternatives 2 and 3 are likely to result in sizeable increases in production, employment, and labor income over the next 15 years in the five counties comprising the energy model area (Delta, Garfield, Gunnison, Mesa, Montrose, and Pitkin). Differences among the three alternatives for total jobs are approximately: 300 jobs (alternative 1), 1,500 jobs (alternative 2), and 1,600 jobs (alternative 3). Compared with alternative 1, alternative 3 would provide about three times more production output, and five times more jobs and labor income. Effects of alternative 2 are slightly less than alternative 3.

Similar economic effects differences among alternatives emerge for state and local government revenues. Compared with $6.1 million in alternative 1, federal mineral lease payments and tax revenues are estimated to be approximately four times larger for alternatives 2 and 3. Other federal payments to state and local governments would either not change or be more than offset by revenues from federal mineral lease payments.

When compared with alternative 1, alternative 3 offers the greatest likelihood for protecting residential values from wildfire-related losses. Up to 263 additional at-risk communities in 19 counties could benefit from roadless management under alternative 3 compared to alternative 1. Alternative 3 also offers the greatest range of single family residence values that could benefit from these potentials. Similarly, alternative 2 offers an increased likelihood for protecting

residential values from wildfire-related losses compared with alternative 1, but not as much as alternative 3. Up to 132 additional at-risk communities in 12 counties could benefit from management under the alternative 2 as compared with alternative 1.

In terms of non-market benefits, alternative 1 would offer the highest values associated with protecting roadless area characteristics. Alternative 2 would offer slightly reduced non-market benefits related to protecting roadless area characteristics, and those benefits would be even lower under alternative 3. However, management costs would be substantially higher under alternative 1, compared to alternative 2, and management costs under alternative 2 would be higher than alternative 3.

Environmental Consequences – Cumulative Effects

Economic changes are anticipated to occur in Colorado as individuals, businesses, governments, and other organizations initiate actions that can affect such things as employment, income, housing, and property values. Some of these actions are specifically identified in other parts of this document, and contributed to the current economic conditions and trends described in the Affected Environment section. Potential other actions that may affect roadless areas or their management were also considered, as described in appendix D, the cumulative effects framework.

For economic impact purposes, it is impossible to account for all such actions separately. Therefore, projections of employment and labor income to 2025 are used to account for all of these changes. They provide a comprehensive context for considering the effects of roadless area management. Projections used here are based upon estimates in the state's economic and population forecasts (Colorado DOLA State Demography Office 2008).

Energy Minerals

Table 74 shows the cumulative employment and income effects using those displayed earlier in this section together with those projected to occur in the energy model area. Employment in the area is expected to grow by 41 percent from 2006 (the model base year) to 2025. However, labor income is expected to grow a very substantial 2 .5 times during the same time period. Reasons for this growth include in-migration of retirees who would not likely be seeking employment, and growth in high income energy-related industries. These projections are assumed to include economic effects under alternative 1.

Table 74. Cumulative economic effects for energy mineral activity in the energy model area

Economic indicator	2006	Projected totals by alternative in 2025		
	Area total	Area total alternative 1	Area total alternative 2	Area total alternative 3
Employment				
Employment (jobs)	148,457	209,700	211,200	211,300
Percent change from 2006	--	41%	--	--
Percent change from alt 1	--	--	0.7%	0.8%
Labor income				
Labor income ($ millions)	$6,100.5	$15,600	$15,703	$15,709
Percent change from 2006	--	156%	--	--
Percent change from alt 1	--	--	0.7%	0.7%

Source: Colorado Department of Local Affairs, State Demography Office 2007

For cumulative effects purposes, average annual oil and gas development activity is assumed to continue as discussed for direct and indirect effects. Coal production in 2025, however, would differ from the annual average used above. Coal production is assumed to be about 6 million tons per year, down from about 16 million tons per year in 2006. Under alternative 1, all existing coal mines would exhaust reserves by 2016 at current production levels. Under alternatives 2 and 3, the Elk Creek mine would exhaust its reserves by 2018. Only the West Elk mine would still be in production by 2025 given the estimated reserves in roadless areas and current production levels. The West Elk mine is estimated to exhaust reserves shortly thereafter.

When comparing projected employment and labor income under alternative 1 within the energy model area, alternatives 2 and 3 would be about 0.7 percent larger (in 2025). Should coal reserves be exhausted before 2025, the effects for alternatives 2 and 3 would be about 0.5 percent larger than alternative 1.

The State of Colorado does not project property tax growth, but BBC (2008) notes that federal royalties, severance tax revenues, and property tax revenues from gas and oil production in Garfield, Mesa, and Rio Blanco Counties would be very strong. Using the BBC study as a good indicator for similar growth in neighboring counties, it appears that the addition of federal payments and tax revenues from oil, gas, and coal extraction under alternatives 2 and 3 could be dwarfed in comparison. However, even a small percent of additional growth in fiscal resources could be important to local governments that may be faced with enormous demands for local services in years to come.

Values at Risk of Wildfire

Growth of mountain communities, including those near public lands and roadless areas, may be the single most important factor in gauging cumulative effects for values at risk of wildfire. National demographics and income trends are primary drivers in Colorado population forecasts. By 2025, the Colorado population is expected to grow by 44 percent. The western slope and central mountain areas of the state, where most roadless areas are located, are expected to grow by 68 percent and 57 percent, respectively (Colorado DOLA State Demography Office 2008). This high growth will likely add to local infrastructure, both public and private, making current at-risk communities even more vulnerable to wildfire hazards. The

ability to treat fuels in roadless areas located in the wildland-urban interface could prove to be increasingly important to maintaining the quality of life in at-risk communities. Even with responsible, proactive actions on the part local homeowners, the ability to manage wildland fuels could be critical. Alternatives 2 and 3 offer more options for reducing the threat of wildfire in roadless areas near these communities now and in the future.

Benefits and Costs

With population growth and private land development, the value of non-market roadless characteristics can be expected to increase. This increase places a higher premium on the retention of roadless characteristics, such as natural processes, retention of future options, and recreation uses. The same growth, however, also increases the value of protection for at-risk communities and energy mineral benefits to the nation. The tradeoffs inherent in each of the alternatives could easily shift in the future, but it is very difficult to assess the direction and magnitude for any shift.

Even with uncertain shifts in national values, alternative 1 places the highest priority on protection of non-market roadless characteristics, followed by alternative 2. The relative value of these opportunities could be greater or less than they are currently, when combined with other activities occurring in and around the roadless areas. The quality of roadless characteristics where entry and treatment occur would likely be altered by a variety of land use activities in addition to those that differ by alternative. Restrictions placed on roaded access under alternative 1 would continue to provide a measure of protection for roadless characteristics. The value of roadless characteristics in areas without these tradeoffs would be unaffected. In alternative 3, roadless characteristics would remain unchanged in some areas but could be significantly altered in others, even when combined with other activities that may occur in the roadless areas. Where opportunities to protect roadless characteristics and non-market benefits currently exist, they would continue to grow in value. Alternative 3 retains the greatest flexibility for roadless area management, allowing management decisions to be in concert with any contemporary shift in national values.

PUBLIC HEALTH AND SAFETY

This section addresses the effects of the alternatives on public health and safety in the roadless areas of Colorado. This public health and safety topic is intended to include worker safety as well.

Under any alternative, roads may be constructed or reconstructed in roadless areas when necessary to protect public health and safety. Thus, this topic warrants only a brief description in this EIS. However, the differences among alternatives in the amount of road construction or reconstruction (roading) that may occur in the roadless areas can influence agency responses to public health and safety situations in the roadless areas.

Affected Environment

Common to all alternatives, roads may be constructed or reconstructed in the roadless areas: (a) where needed to protect public health and safety in cases of threat of flood, fire, or other catastrophic event that, without intervention, would cause the loss of life or property; (b) where needed to conduct a response action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), or to conduct a natural resource restoration action under CERCLA, Section 311 of the Clean Water Act, or the Oil Pollution Act; and (c) where needed to improve road safety of a forest road determined to be hazardous on the basis of accident experience or accident potential on that road. Refer to chapter 2 for details.

Large, high-intensity wildfires often pose threats to loss of life or property, depending on their rate of spread and proximity to places where people live, work, or recreate. Wildfires have occurred in some of the roadless areas and are likely to continue to occur in roadless areas in the future (refer to the Fire and Fuels section). Many people either live close to a roadless area or work or recreate within a roadless area. The limited road density in most of the roadless areas currently limits the management strategies that may be taken as well as the timeliness in response to potentially catastrophic wildfire events in those areas.

There are currently no active CERCLA superfund sites in any of the roadless areas in Colorado (IRAs or CRAs). However, based on the Forest Service abandoned mine lands inventory database, there are 2,901 abandoned mine features existing in 138 IRAs, which is about 13 percent of the 21,880 abandoned mine features on all NFS lands in Colorado (Colorado DNR Division of Reclamation, Mining and Safety 2008). Within the IRAs, this can be further broken down to 1,378 holes, ranging from small prospect pits to open shafts and adits; 760 waste and tailings dumps of varying sizes; and 763 structural features such as head frames and ore bins. A similar number of abandoned mine features would be expected to occur in the CRAs. More than one of these features may exist at any one site; therefore, the number of mine features greatly exceeds the number of abandoned mine sites. The Forest Service inventory of abandoned mines on NFS lands is an ongoing process. Trends indicate that there will always be more sites identified than can feasibly be reclaimed, and the number of abandoned mine sites found within the IRAs is likely to continue to increase. Abandoned mines, quarries, and other mineral sites have often been found to pose human health, environmental, or safety risks until those risks are mitigated. If these sites are releasing or have the potential to release a hazardous substance, they require a response action under CERCLA (USDA Office of Inspector General

1996). The CERCLA requirements address emergency response, site remediation, and spill prevention. The Forest Service has authority for CERCLA enforcement on NFS lands under Executive Order 12580 section 2(j). An engineering evaluation and cost analysis or remedial investigation and feasibility study are completed for CERCLA actions, and include provisions for proposed road construction if needed, consistent with the National Contingency Plan (regulations at 40 CFR Part 300). Additionally, IRAs may have hazardous materials sites that require some type of reclamation to resolve Clean Water Act violations (USDA Office of Inspector General 1996).

It is common for abandoned mines to have an existing road in place from when the mine was developed. Some road reconstruction may be needed to improve access to the mine in order to accomplish reclamation goals. However, these road improvements would only be temporary because closing road access to these mine sites is integral to achieving public health and safety objectives of the abandoned mine land program.

Road reconstruction to mitigate existing forest road hazards based on accident experience or potential may occur in roadless areas. However, the amount of motor vehicle traffic in roadless areas is quite low. Additionally, the maintenance level of most forest roads within roadless areas is low, typically designed for high-clearance vehicles traveling at relatively slow speeds. Therefore, the need for road reconstruction activities for this purpose in the roadless areas over the next 15 years is unlikely.

Tree-cutting may occur in the roadless areas to reduce public safety risks associated with wildfire hazard or other safety risks "where it is incidental to management activities not otherwise prohibited." Refer to chapter 2 for details. These circumstances include the ability to cut dead trees or branches to reduce potential public safety hazards. In managing for semi-primitive to primitive recreational environments and opportunities in roadless areas consistent with desired roadless area characteristics and values (see chapter 1 and the Dispersed Recreation section of chapter 3), there is generally a lower priority or need to conduct hazardous tree inventories and removal projects in roadless areas for public safety purposes compared to the priority on NFS lands managed for developed recreation environments and opportunities. However, the current prevalence of insect-related tree mortality in lodgepole pine and other forest types throughout Colorado indicates there may be an increased need to cut dead and dying trees for either public or worker safety purposes within the roadless areas.

Contractors and permit or lease holders working in roadless areas must take action where necessary to protect worker and public health and safety, based on requirements in the Occupational Safety and Health Act (OSHA 1970; P.L. 91-596) and OSHA regulations at 29 CFR Part 1910. These actions may include cutting hazard trees, disposing of hazardous waste, minimizing chemical spills and fire risks, and other actions as needed, consistent with OSHA regulations.

Environmental Consequences – Direct and Indirect Effects

All Alternatives

As previously described, none of the alternatives restrict management activities in roadless areas that are necessary to protect public health and safety. Under all alternatives, the Forest Service will continue to respond to all potential public health and safety situations in roadless areas as described in the Affected Environment discussion, including response to wildfires,

chemical or oil spills, abandoned mine hazards, road-design hazards, hazard trees, and others. Roads may be constructed or reconstructed in roadless areas for required health and safety responses. These roads will be temporary only in alternative 2. Under alternatives 1 and 3, the roads built for these purposes would generally but not always be temporary.

The key difference among alternatives with respect to effects on public health and safety is related to how differences in the amount of roads in roadless areas influences agency response to public health and safety emergencies in those areas. Under alternative 1, the lower number of road miles projected to occur in roadless areas would continue to limit the responsiveness and timeliness to emergency health and safety situations that may arise in those areas. Under alternative 2, and even more so under alternative 3, the greater increases in road miles projected to occur in roadless areas would better facilitate rapid responses to emergency health and safety situations that may arise in those areas. For example, areas with higher road densities have been found to improve management flexibility and firefighter safety in response to wildfires (as described in the Fire and Fuels section).

In addition, as the projected road miles increase under alternatives 2 and 3 respectively, there would be associated increases in the amount of management activities and vehicle traffic in those roadless areas. As the amount of management activity and traffic increases, so does the potential for increases in safety hazards and accidental injuries.

For mitigating risks associated with safety hazards at abandoned mines and some other non-CERCLA safety issues, it is expected that most of these can be handled by means that do not require additional road construction or reconstruction.

Environmental Consequences – Cumulative Effects

As previously described in Affected Environment, there are existing hazards in roadless areas associated with abandoned mines, quarries, or minerals sites. Other safety hazards in roadless areas are beyond agency control, such as those related to close encounters with wild animals or poisonous plants, or various outdoor recreation-related accidents.

The differences among alternatives in roading and tree-cutting activities and associated management activities could result in differences in both positive and negative impacts on public health and safety, as described under Direct and Indirect Effects. Increased roads can facilitate emergency responses to health and safety situations, but increased roads and associated activities also can increase accidental injury. Other actions within agency control are not expected to measurably add to those effects. Therefore, no significant cumulative effects on health and safety would be anticipated, under any alternative.

OTHER EFFECTS DISCLOSURES

Short-Term Uses and Long-Term Productivity

The NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR §1502.16). As declared by Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101). The alternatives all integrate those considerations, and ascribe to the principles described in the Forest and Rangeland Renewable Resources Planning Act as amended by the National Forest Management Act, as well as the Multiple-Use Sustained-Yield Act. The Multiple-Use Sustained Yield Act defines productivity as part of multiple-use management. None of the alternatives would deviate from those requirements. Consistent with the Multiple-Use Sustained Yield Act, some land will be used for less than all of the resources, and the management of various resources will be done without impairing the long-term productivity of the land. In addition, consideration is given to the relative values of the various resources, and not necessarily the uses that will give the greatest dollar return or output. Adopting any of the alternatives would not involve implementing any on-the-ground action; therefore, the alternatives do not compel any short-term uses.

However, there are differences among alternatives in prohibitions and permissions related to road-building or tree-cutting activities in roadless areas. Road construction would be the only short-term use that varies by alternative and has the potential to cause a reduction in long-term productivity in the roadless areas. Such roads can cause a loss of long-term soil and vegetative productivity and other watershed and wildlife habitat values that last for several decades or longer. Tree-cutting activities would not be likely to result in a long-term or permanent loss of productivity in the roadless areas.

Alternative 1 would cause the lowest risk of a short-term use impairing long-term productivity because the 2001 Rule is the most restrictive of the alternatives in terms of constructing roads in IRAs. Alternative 2 would cause a relatively low risk of losing long-term productivity in CRAs as well, because most roads allowed would be temporary and would eventually be decommissioned. However, projections indicate that alternative 2 would result in more miles of longer-term roads being built in CRAs in support of energy resource operations, so alternative 2 would result in a slightly higher loss of long-term productivity on those road miles (see projections in Analysis Framework section). For either alternative 1 or 2, the loss of long term productivity would be limited to a relatively limited acreage, especially compared with NFS and other lands where roading is not restricted.

Alternative 3 would cause a moderate risk of losing long-term productivity in IRAs where several forest plans do not restrict construction of long term or permanent roads. See appendix B and the alternative 3 map, which show where the forest plan is more restrictive on roads in roadless areas. Projections of long-term roads in support of energy resource operations is slightly higher under alternative 3 compared to alternatives 1 or 2. Under all alternatives, the

use of short-term temporary roads would be more typical in the IRAs or CRAs, and those roads would be rehabilitated to restore long-term productivity after their use has ended.

Unavoidable Adverse Effects

The projected amount of road building, tree-cutting, and energy resource development activities in roadless areas that differ by alternative would result in some potentially unavoidable adverse effects in localized portions of some roadless areas. These effects are described in more detail in each section of chapter 3 as well as in the Comparison of Alternatives section in chapter 2. Site-specific mitigation measures would be expected to be identified during project planning and applied during implementation to avoid or minimize adverse environmental effects.

Alternative 1. Unavoidable adverse effects associated with alternative 1 include less IRA acreage within which to reduce wildfire hazard, improve forest health, provide for utilities or water conveyances, or explore for and develop energy resources (oil, gas, or coal).

Alternative 2. Compared to alternative 1, unavoidable adverse effects associated with alternative 2 include a slight reduction in semi-primitive recreation settings and existing scenic quality; increases in invasive plant populations that can indirectly adversely affect threatened, endangered or sensitive plants and other resources; and an increased risk to aquatic and terrestrial animal species and habitat in some CRAs.

Alternative 3. Compared to alternatives 1 or 2, unavoidable adverse effects associated with alternative 3 include greater reductions in IRA acreage providing semi-primitive recreation settings and high scenic integrity; greater increases in roadless areas with invasive plant populations that can indirectly adversely affect threatened, endangered or sensitive plants and other resources; and an increased risk to aquatic and terrestrial animal species and habitat in some areas.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time, such as the temporary loss of vegetative or soil productivity in forested areas that are cleared for use of those lands for roads, powerline rights-of-way, or other constructed facilities.

The roadless area management alternatives that are subject to this analysis do not include any site-specific actions to be implemented. Therefore, there can be no actual irreversible or irretrievable commitments of resources associated with any of these alternatives. Commitments of resources would take place when projects or activities are proposed and after the preparation and consideration of appropriate NEPA analysis and documentation.

However, based on projections of potential activities that differ by alternative, differences in the potential for irreversible and irretrievable commitments of resources could be estimated. Building new roads and other constructed facilities would result in commitments of resources, as would extraction of non-renewable energy mineral resources such as oil, gas and coal. No irreversible or irretrievable commitments of resources would be likely to result from permissible tree-cutting activities under any alternative.

Alternative 1. The amount of irreversible or irretrievable commitments of resources expected under this alternative would be negligible, due to the general prohibition on road building and tree cutting except under very limited exceptional circumstances.

Alternative 2. There would be a minimal amount of irreversible or irretrievable commitments of resources expected under this alternative due to the general prohibition on road building and tree cutting except under certain exceptional circumstances. However, there would be approximately 21 miles of road construction or reconstruction per year in roadless areas. Of those roads, a relatively high proportion would entail long term road use for energy resource operations. Wells, well pads, and other ground disturbing activities projected to occur in roadless areas under this alternative would be considered an irretrievable commitment of resources in those localized sites (approximately 11 new well pads per year). That commitment would be reversed and vegetative productivity reclaimed on those constructed roads and facilities sites after the use of those roads or facilities has ended. Additionally, the amount of oil, natural gas, and coal that could be extracted from roadless areas would be an irreversible commitment of resources (see the Leasable Minerals section for details and quantities).

Alternative 3. The commitments of resources would be similar to alternative 2, but there would be more roadless area acres where there is an irretrievable commitment of resources anticipated, based on projections displayed in the Analysis Framework section. Approximately 30 miles of roads would be built in roadless areas each year, with the majority of those roads being for long term energy resource operations. Wells, well pads, and other ground-disturbing activities projected to occur would add to the total irretrievable commitment of resources in those localized sites (approximately 11 new well pads per year). Additionally, the amount of oil, natural gas, and coal that could be extracted from roadless areas would be an irreversible commitment of resources (see the Leasable Minerals section for details and quantities).

Other Required Disclosures

The NEPA implementing regulations direct agencies to prepare draft environmental impact statements concurrently with and integrated with other environmental review laws and executive orders (40 CFR 1502.25a). Consultation and coordination with the US Fish and Wildlife Service is ongoing on this rulemaking proposal, in addition to the preparation of a biological assessment, in accordance with the Endangered Species Act requirements (more information is in the Terrestrial Species and Habitat section and EIS record). None of the alternatives would require consultation under the Fish and Wildlife Coordination Act because they do not require water to be impounded or diverted, or with the National Historic Preservation Act because there would be no ground-disturbing actions.

The US Department of Agriculture rulemaking procedural requirements are being followed for this proposed rulemaking action, including associated requirements of the Unfunded Mandates Reform Act, Executive Order 12988, and the Civil Justice Reform Act, as is discussed in the preamble for the proposed rule (published in the Federal Register). There are no anticipated effects on any state or county laws because of the permissions for existing rights. Effects of each alternative in relation to the Clean Air Act, Clean Water Act, Migratory Bird Treaty Act, Wilderness Act, and other federal environmental laws, regulations, and executive orders are disclosed in each section of chapter 3 where an effect is anticipated.