TROUT-WEST FUELS REDUCTION PROJECT FINAL ENVIRONMENTAL IMPACT STATEMENT

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SUMMARY

Hazardous fuels need to be treated within the Trout-West project area to reduce the potential for adverse effects from crown wildfire and provide for firefighter and public safety. Much of the Trout-West area contains overly dense forests associated with high crown fire potential. Damaging wildfires similar to those experienced in recent years will continue unless action is taken to reduce forest density and fuel hazard. Hazardous fuels reduction can effectively reduce the potential for damaging crown fire (Omi and Pollet 2002).

The Trout and West Creek watersheds are important to the quality of life of residents and visitors, including people who live in Denver. These watersheds drain into the Upper South Platte River and contribute to Denver's municipal water supply. The soils in the watersheds tend to erode following severe disturbance such as wildfire. The potential for catastrophic flooding and sedimentation is very high.

In 1999, Foster-Wheeler Corporation published the *Landscape Assessment - Upper South Platte Watershed*, which identified the Trout and West Creek watersheds as having high fire hazard. The project area is located within the "red zone" (Colorado State Forest Service 1999). Fuels treatments in red zone lands are prioritized in the National Fire Plan.

In 2000, the National Fire Plan was adopted to address hazardous fuels concerns across the United States. The Fire Plan presented the concept of "Condition Class," a way of rating how today's forests compare with historic forests. Condition Class 1 lands are associated with historic, desirable, and sustainable forest/fuel conditions. Condition Class 2 and 3 forests are denser and have greater fuel loading, uncharacteristic proportions of common species, and/or higher mortality levels than desired. Many of the stands proposed for treatment in the Trout-West project area exhibit characteristics associated with Condition Classes 2 and 3. As a whole, the analysis area is in Condition Class 2. The objective for fuels treatments is to reduce the analysis area to Condition Class 1.

The year 2002 was one of the worst fire seasons on record; the high intensity, stand-replacing Hayman Fire was the largest in Colorado history. Hundreds of structures were destroyed and several thousand acres burned within the Denver municipal watershed. The fire burned approximately 26,800 acres in the Trout and West Creek watersheds and 25 percent of the original project area.

The Trout-West Fuels Reduction Final Environmental Impact Statement (FEIS) was prepared by a Forest Service Enterprise Team. The process complies with the National Environmental Policy Act and Forest Service policy for environmental analysis.

The FEIS contains discussions about why action is needed in the project area; proposes actions to meet the need; considers public issues; identifies alternatives to address public concerns; and discloses the environmental consequences of No Action, the Proposed Action, and five action alternatives. The project would be implemented over a ten-year period. Summary charts comparing the alternatives are at the end of Chapter Two in the FEIS. Costs and acreage displayed in this summary are approximate; savings in wildfire costs and damages are estimated for a 30-year period and reflect the relative ability of each alternative to reduce the probability of future wildfire losses.

The Proposed Action

The Proposed Action includes thinning and prescribed burning within approximately 20,000 acres of National Forest to implement the National Fire Plan and the *Pike and San Isabel National Forests; Comanche and Cimarron National Grasslands Land and Resource Management Plan* (Reference). The Proposed Action includes design features intended to meet all applicable environmental standards. The Proposed Action would use (and maintain or reconstruct) 68 miles of system roads in the project area to facilitate operations. About 14 miles of temporary roads would be built and then reclaimed when no longer needed. An additional 48 miles of existing non-system roads would be upgraded and used, and then reclaimed when no longer needed to implement the project. The Proposed Action treats sufficient acreage to reduce Condition Class across the analysis area.

Acres Treated: 20,170
Cost of Operation: $14.6 million
Savings in Wildfire Costs and Damages: $156 million
Meets Purpose and Need: Yes

No Action

The No Action alternative would not result in any hazardous fuels reduction treatments or associated road work. No Action would not have any direct effects, but is associated with adverse indirect and cumulative effects.

Acres Treated: None
Cost of Operation: None
Savings in Wildfire Costs and Damages: no savings, wildfire costs predicted to exceed $240 million in a 30-year period
Meets Purpose and Need: No

Alternative A

Alternative A would include mechanical treatment as proposed, but would not use prescribed burning to reduce fuels. Fuels would be removed using tractors, cable systems, and helicopters and hauled away as logs, chips, or other products. Alternative A is more expensive to implement than the Proposed Action and eliminates all prescribed burning impacts. Adverse impacts of prescribed burning that are eliminated include accelerated erosion and smoke. Alternative A treats sufficient acreage to reduce Condition Class across the analysis area but does not include beneficial ecological effects of prescribed burning.

Acres Treated: 19,220
Cost of Operation: $16 million
Savings in Wildfire Costs and Damages: $154 million
Meets Purpose and Need: Yes

Alternative B

Alternative B would implement thinning, piling, and burning on the portion of the project area within one mile of private property that contains at least one home per 40 acres. Alternative B is less expensive than the Proposed Action, but not as effective in reducing hazardous fuels across the analysis area. Alternative B would leave a larger portion of the watershed susceptible to damaging wildfire. Alternative B does not treat sufficient acreage to reduce Condition Class across the analysis area. The Hayman Fire demonstrates that fires can spread far more than one mile in a single burning period.

Acres Treated: 13,570
Cost of Operation: $11.4 million
Savings in Wildfire Costs and Damages: $125 million
Meets Purpose and Need: Partly

Alternative C

Alternative C would implement the Proposed Action without building any temporary roads. Alternative C is more expensive to implement than the Proposed Action and has similar effects. The analysis does not show significant benefits from eliminating temporary roads. Helicopter logging has greater safety risks than conventional logging.

Acres Treated: 20,170
Cost of Operation: $15.1 million
Savings in Wildfire Costs and Damages: $155 million
Meets Purpose and Need: Yes

Alternative D

Alternative D would treat vegetation within one-half mile of private property that has at least one home per 40 acres. Alternative D is the least expensive alternative, but does not treat sufficient acreage to reduce Condition Class across the analysis area. The Hayman Fire demonstrates that fires can spread far more than one mile in a single burning period.

Acres Treated: 6,750
Cost of Operation: $5.3 million
Savings in Wildfire Costs and Damages: $3 million (wildfire costs similar to No Action)
Meets Purpose and Need: Partly

Alternative E

Alternative E would treat the area most aggressively by treating approximately 26,320 acres. It would include harvest openings on 30 percent of the project area to mimic historic conditions. It would not meet all current Forest Plan Standards and Guidelines and would require a Forest Plan amendment. It would not reduce fire hazard significantly more than the Proposed Action, but it would restore the landscape to its historic condition more rapidly than the other alternatives. Alternative E would be more expensive to implement than the Proposed Action. Alternative E treats sufficient acreage to reduce Condition Class across the analysis area.

Acres Treated: 26,320
Cost of Operation: $22.2 million
Savings in Wildfire Costs and Damages: $149 million
Meets Purpose and Need: Yes, but would require Forest Plan Amendments to implement

The FEIS addresses effects of the project, considering several public concerns and issues:

1. **Crown Fire Hazard**
2. **Forest Vegetation**
3. **Forest Pathogens**
4. **Soils and Water**
5. **Fish and Wildlife**
6. **Noxious Weeds, Sensitive Plants and Range Resources**
7. **Air Quality**
8. **Visual Quality**
9. **Recreation**
10. **Socio-economics**

CHAPTER 1. PURPOSE OF AND NEED FOR ACTION

Introduction

The Forest Supervisor for the Pike and San Isabel National Forests; Comanche and Cimarron National Grasslands proposes to implement the National Fire Plan with the Trout-West Fuels Reduction Project.

The National Fire Plan discusses two principles related to fire hazard reduction:

Principle #4: "Assign highest priority for hazardous fuels reduction to communities at risk and readily accessible municipal watersheds."

Principle #5: "Restore healthy, diverse, and resilient ecological systems to minimize uncharacteristically intense fires on a priority watershed basis. Methods will include removal of excessive vegetation and dead fuels through thinning, prescribed fire, and other treatment methods."

The Trout-West Project follows these principles. The National Forest lands proposed for treatment are high priority because they are at high risk of catastrophic losses from wildfire. The project area is located within the "red zone" as defined by the Colorado State Forest Service in 1999. The red zone identifies areas of extreme fire hazard to surrounding communities.

The Trout-West area contains a readily accessible municipal watershed for the community of Woodland Park, as well as major tributaries to the South Platte River and the Denver municipal water supply. The Trout-West Project proposes methods such as thinning and prescribed burning to reduce the canopy density and ground fuels throughout six treatment units in the project area.

High fire hazard was also identified as a serious concern for the Trout and West Creek watersheds in the *Upper South Platte Watershed Landscape Assessment* (Foster Wheeler 1999), due to the vegetation conditions, home density, and fire history of the area.

Management direction guiding the proposed project is contained within the *Pike and San Isabel National Forests; Comanche and Cimarron National Grasslands Land and Resource Management Plan* (Forest Plan) (USDA 1984). The Upper South Platte Watershed Protection and Restoration Project Environmental Assessment (USDA 2000c) also provided relevant information.

The project is located within the Trout and West Creek watersheds, tributary to the Upper South Platte River. The analysis area and the Trout-West project area are depicted in Map 1.

Vicinity Map 1

Back of map 1

Purpose and Need

Fuels need to be treated within the Trout-West project area to reduce the potential adverse effects of wildfire and provide for firefighter and public safety. Much of the Trout-West area contains forests that burn hotter than historic forests (Kaufmann et al. 2001; Kaufmann et al. 2000; Kaufmann et al. 1999; Brown et al. 1999). Nearby, recent fires have led to catastrophic losses of life, watershed values, homes, property, and wildlife habitat. Without action, continued catastrophic losses from wildfire are predicted.

The risk of these effects from wildfire is high (and increasing) within the Trout and West Creek watersheds. The watersheds are important to residents, visitors, and the city of Denver as part of their municipal water supply. Many private homes and subdivisions are nestled within overly dense forests. Approximately 20,000 people live in the Trout and West Creek watersheds and many more use the National Forest for recreation and other needs. In the past ten years, population has increased by over a million people within a two-hour drive of the project area. As population increases, so do the chances for a human-caused fire. Lightning also has the potential to cause damaging wildfires. The project area averages six to 20 lightning strikes (cloud to ground) per square mile annually.

The type, density, and structure of the wildland vegetation, as well as the amount of down, dead material determine the type of fire behavior and associated hazard. Generally, the potential for high intensity crown fire increases with the density and continuity of forest canopy.

The National Fire Plan uses the concept of Fire Regime Condition Class to characterize whether vegetation is prone to uncharacteristically damaging wildfires. Fire Regime Condition Class 1 describes a condition within the sustainable, historic range. Wildfires under Fire Regime Condition Class 1 fuels conditions would be expected to behave in a natural or characteristic manner. Wildfires in Fire Regime Condition Classes 2 and 3 areas would behave in an uncharacteristically damaging manner. The differences between Fire Regime Condition Classes are the degree of departure from the historical average; Fire Regime Condition Class 2 has a greater risk of uncharacteristic wildfire behavior than Fire Regime Condition Class 1, and Fire Regime Condition Class 3 has a greater risk than Class 2.

The Trout-West project area contains thousands of acres in Fire Regime Condition Classes 2 and 3. The objective for vegetation management under the National Fire Plan is to reduce areas to Fire Regime Condition Class 1.

Project Goals

- Promote less hazardous fuel conditions by reducing overall biomass and canopy continuity.
- Reduce potential for loss of ecological and monetary values on public and private lands.
- Reduce potential for insect and disease infestation.
- Promote sustainable, diverse forest conditions, more like historic forest conditions.
- Increase acreage in Fire Regime Condition Class 1.
- Promote aspen regeneration to increase species diversity and reduce future fuel hazard.
- Reduce risk of erosion and sediment delivery to area streams; protect short and long term municipal water quality.
- Develop a socially acceptable project regarding safety, aesthetic quality, and smoke.
- Adequately protect cultural heritage sites.
- Adequately protect wildlife, fish, and plant habitats.
- Meet legal requirements and Forest Plan Standards and Guidelines.

Implementation Time-Frames

The Trout-West Project would be available for implementation once the Record of Decision is published in the Pueblo Chieftain and legal appeal periods are completed. The Forest Service expects to begin work on the ground beginning Fiscal Year 2004, at the latest. The project could take up to 10 years to complete.

Proposed Action In Brief

The Proposed Action includes thinning about 20,000 acres of National Forest; yarding trees from about 17,000 of these acres; construction of about 14 miles of *temporary roads*[1] to facilitate log haul; restoration to near natural conditions of about 48 miles of existing unclassified (non-system roads)[2] once they are no longer needed to facilitate operations; and follow-up slash treatments such as piling and burning any remaining unwanted debris.

[1] Temporary roads would be returned to near natural conditions once they are no longer needed for the project.

[2] Non-system or unclassified roads on National Forest lands have not been constructed or authorzied by the Forest Service.

Thinned areas would have an average crown closure of 15 to 25 percent following treatment; any given acre would range from 10 to 40 percent crown closure.[3] Thinning would retain the oldest and largest trees but could include removal of some overstory (co-dominant) trees as part of the canopy reduction prescription. Understory trees would be removed first; larger trees would be removed only as needed to reach crown density reduction goals.

Decision Framework

In the early stages of this project, the Pike and San Isabel Forest Supervisor elected to document the effects of this project with an Environmental Impact Statement (EIS). At that time no conclusion had been made regarding whether an EIS was the required type of document—too little was known about the project and its effects to support such a conclusion. Rather, it was concluded that preparing an EIS would be the most efficient approach in terms of the overall project timeline. Had an Environmental Assessment been prepared and the conclusion subsequently reached that an EIS was required, additional time would have been needed to prepare an EIS. Therefore, in the interest of time and not knowing whether an EIS would be necessary, the Forest Supervisor elected to disclose the effects of the Trout-West Project via an EIS.

A Forest Service "Enterprise Team" was hired to prepare the EIS in cooperation with Pike and San Isabel National Forests personnel. The Pike and San Isabel National Forest Supervisor will consider the relative costs, effectiveness, and environmental risks associated with the alternatives. The Forest Supervisor will decide the following:

- whether or not to implement the Proposed Action or select an alternative; and
- design features, mitigation measures, and monitoring connected with the selected alternative

Assuming an action alternative is selected, treatment areas will be field verified and laid out on the ground. Boundaries shown on maps in this EIS are subject to change based on actual field conditions. Cutting guidelines and operational methods are expected to vary depending on conditions during layout and implementation. The likelihood for change is high, especially where the project areas abut private land. Neighbors would be contacted before implementation and would have input into the type of treatment, design features and access.

Many methods are available to the Forest Service to accomplish the work. The Trout-West Project may be implemented through service contracts, timber sales, small forest products sales, Federal work crews, partnerships with private groups, individuals or other agencies, or a combination of methods.

[3] The canopy reduction goal of 15 – 25% would move the landscape toward the historic condition (see Table 10) and retain protect effectiveness for a 20 year period following treatment. Actual tree retention is likely to be higher given no treat areas, and design features to protect visuals, soils, and wildlife..

Relationship to Other Policies and Plans

This project is directly related to the National Fire Plan and is intended to be implemented using National Fire Plan or other fuels-related funding. The Pike and San Isabel National Forest Plan is also an integral part of the design of this project. The Interdisciplinary Team (IDT) reviewed the Forest Plan guidance for the Trout-West project area and found that the fuel hazard reduction project was consistent with the existing land allocations. The team recommended design features to meet Forest Plan guidance. Levels of treatment under Trout-West and other National Fire Plan projects are unlikely to exceed Forest Plan direction for vegetation management and fuels treatment.

The analysis assumes this project would be implemented over a ten-year period; within that time period, monitoring and other information is likely to lead to changes in the project. The Forest Service will maintain implementation files and document site-specific changes as they occur. Changes that do not deviate from the intent of the Record of Decision and supporting effects analysis would not be subject to further disclosure under the National Environmental Policy Act.

Forest Plan Management Areas

The Trout-West project area is allocated to the Forest Plan Management Areas listed in Table 1.

Table 1. Trout-West Forest Plan Management Areas

Management Area	Trout-West Location
2B – Rural and Roaded Natural Recreation	Western edge of Phantom, Eastern two-thirds of Ryan Quinlan, South half of Long John, Entire Skelton area
4B – Wildlife Management Indicator Species Management	Southwest part of Rampart
7A – Wood Fiber Production (logs)	Western third of Ryan Quinlan, North half of Phantom
7D – Wood Fiber Production (other forest products)	Most of Rampart
9A – Riparian Area Management	Streamsides throughout the project area
10B – Manitou Experimental Forest	Entire Ridgewood area, North part of Rampart, North half of Long John

Each of these land allocations is associated with specific Forest Plan guidance and objectives. Fuels reduction treatments are generally not proposed in Management Areas 9A and 4B due to restrictive Forest Plan guidelines for these areas. The Manitou Experimental Forest (Management Area 10B) is managed as a natural laboratory. Ongoing and future research projects need to be protected in the area. Fuels reduction is excluded in a large portion of this area to maintain the integrity of existing research plots.

Transportation analysis was completed as per Forest Service Manual 7710 and FS-643, *Roads Analysis: Informing Decisions About Managing the National Forest Transportation System*. Recommendations from the Roads Analysis were carried into the Proposed Action where applicable.

Public Involvement and Issues

A description of the Proposed Action and request for participation was circulated in December 2001 to an estimated 600 addressees. The flyer was also posted at public places in the towns of Woodland Park and Divide. A legal notice was published in four area newspapers. Each of these flyers and notices advertised two public meetings held January 22 and 24, 2002. A Notice of Intent to prepare an EIS was published in the federal register on January 2, 2002.

Two public meetings were held: dozens of people attended and had informal discussion with the IDT and others (including managers and Colorado State Forest Service representatives). Some attendees used a comment form provided for their written input. Others mailed or e-mailed letters. In total, 31 comment letters were received during the scoping period. Each letter was examined for substantive comments. These were excerpted, categorized, and assigned to team members for analysis.

On April 15, 2002, the IDT reviewed project design features, mitigation measures, and analysis elements suggested by the public comments. The Proposed Action was refined and several alternatives identified to resolve public issues and explore trade-offs. The IDT met after the Hayman Fire to revise the analysis accordingly.

The following list of issues is based on public input and National Forest planning requirements. The analysis described in Chapter 3 focuses on these issues.

Issue 1 – Crown Fire Hazard

The primary Purpose and Need for this project relates to the existing high crown fire hazard from overly dense forests within the project area. Some members of the public requested that the Forest Service consider treating only that portion of the project area nearest private property. Alternatives to the Proposed Action were developed to respond to that issue. Each alternative is evaluated based on its effectiveness in reducing crown fire hazard and reducing the Fire Regime Condition Class from 2 and 3 to 1 within the analysis area.

Issue 2 – Vegetation Conditions

Part of the Purpose and Need is to promote vegetation more like historic conditions. Currently, many stands in the Trout-West project area are denser than historic stands, have an uncharacteristic species mix (specifically more Douglas-fir relative to pine), and have less old-growth and aspen. The current and post-treatment proportions of vegetation structural stages are compared to historic ranges and the similarities and differences between the alternatives and the historic condition are discussed.

Issue 3 – Forest Pathogens

Another project goal is to reduce the forest's susceptibility to insect and disease. Tussock moth, bark beetle, and dwarf mistletoe occur and are likely to spread within the analysis area. The alternatives are compared against No Action in terms of forest pathogen trends and susceptibility. Some members of the public expressed concern about effects of the Proposed Action on mistletoe and the habitat it may provide for wildlife. These concerns are addressed in the section on wildlife.

Issue 4 – Soil and Water

The decomposed, granitic soils within the Trout and West Creek watersheds can become erodible when disturbed. Storms that follow high intensity wildfire can cause severe erosion. Fuels reduction treatments are intended to reduce the likelihood of watershed damage following a wildfire. Thinning, road work and use, yarding, and prescribed burning can also accelerate erosion. Many design features and mitigation measures are included to reduce the potential for erosion resulting from the project.

Once soils are mobilized through erosion, they have the potential to enter streams and deliver sediment downstream. Water quality protection is a goal for this project. Some streams are already listed as impaired due to sediment; the Clean Water Act requires minimizing sediment delivery to these streams.

Quantities of accelerated erosion and sediment delivery are predicted for each alternative. Sediment predictions for the Hayman Fire within the watershed are also included.

Issue 5 – Fish and Wildlife

Many environmental policies, laws, and Forest Plan Standards and Guidelines that address wildlife needs apply to this project. Wildlife effects analysis includes a Biological Assessment for Threatened and Endangered Species and a Biological Evaluation focusing Sensitive Species (see Appendix B). Additional analysis in the main body of the EIS focuses on Management Indicator Species (MIS).

Issue 6 – Noxious Weeds, Range Resources, and Special Plant Species

Mitigation measures applied to all action alternatives are proposed to protect special plant species and range resources and reduce the risk of spreading noxious weeds. A Biological Evaluation/Biological Assessment (BE/BA) was prepared to disclose potential effects on Threatened, Endangered, and Sensitive Plant Species. The BE/BA is summarized in Chapter 3.

Issue 7 – Air Quality

Many members of the public expressed concern about the potential health effects of smoke from prescribed burning. Many environmental standards and analytical processes accompany prescribed burning plans. Issue measures include particulate emission estimates for prescribed fire and wildfire and number of days of burning each year.

Issue 8 – Visual Quality

Many people expressed concerns about the effects of the project on aesthetic quality. The project is designed to address standards and guidelines for scenery management. Impacts on visuals from the operation would be mitigated to the extent possible.

Issue 9 – Recreation

Several recreation issues are evident in the public comments. Concern that off road vehicle access may be increased by the project is addressed through project design features in all action alternatives. The project may also disrupt recreation during operations; some trails and roads used for recreation may be needed for the operation, and some may be closed following treatment. Impacts from vegetation management, road work and wildfire are considered.

Issue 10 – Socio-Economics

Each alternative is associated with a monetary cost. Estimated costs of treatment (i.e., thinning, yarding, burning, road work) are disclosed for each action alternative.

There are also costs associated with wildfire. Predicted costs of wildfires to private landowners, firefighting agencies, Denver water providers, and the Forest Service are disclosed.

Other socio-economic issues include effects on residents and Environmental Justice considerations.

Other Concerns

Other public concerns addressed in this FEIS include protection of heritage resources, safety considerations (including the potential for prescribed burn to escape control), and opportunities for citizens to participate in the planning, implementation, and monitoring of the project. These concerns are addressed through design features intended to meet applicable planning guidelines and encourage citizen participation.

CHAPTER 2. ALTERNATIVES, INCLUDING THE PROPOSED ACTION

Introduction

The Trout-West EIS was initiated in Spring 2001. A Forest Service "Enterprise Team" spent the summer reviewing existing information and gathering field data. At the same time, the Pike-San Isabel National Forest piloted the *Trout-West Fire Regime Condition Class Analysis* (Hann and Strohm 2001). In Fall 2001, the IDT developed a general proposal for the Trout-West Project. The general proposal was based on the IDT's assessment of the actions necessary to reduce the probability of damaging wildfires. The Condition Class analysis was available for IDT review in Fall 2001. That analysis confirmed that the size of the project was appropriate and necessary to reduce Fire Regime Condition Class across the Trout and West Creek watersheds.

A general proposal was circulated publicly in November 2001, and many comments were received. Excerpts from written input were extracted to represent the range of substantive comments received. Comment letters were circulated among managers and the IDT. The Proposed Action was refined, and alternatives considered that responded to the public comment.

The Proposed Action, No Action, and five alternatives are fully analyzed in this FEIS. Some alternatives were dropped from detailed consideration; these alternatives and the rationale for dismissal are discussed later in this chapter. Maps of the Proposed Action and action alternatives are displayed on pages 35 through 45 in the DEIS. The maps are not reproduced in this FEIS, but are posted on the website: http://www.fs.fed.us/r2/psicc/spl/twest.htm.

Alternatives Considered in Detail

Proposed Action (Preferred Alternative)

The Proposed Action was developed to meet the Purpose and Need for action and project goals and respond to public scoping. Table 2 summarizes the treatments proposed in the Proposed Action.

Table 2. Summary of Proposed Action Treatments

Total Treatment Acres	Acres Heavy Thin			Acres Light Thin	Access Needed (Miles)		
	Tractor	Helicopter	No Yarding		Existing Roads		New Temp
					System	Un-C[4]	
20,170	13,380	3,890	950	1,945	68	48	14
Prescribed Burning							
Pile Burning				Broadcast Burning			
10,660 acres				6,600 acres			

Thinning

The Proposed Action would thin trees within approximately 20,000 acres of the project area. The desired average canopy closure for the treated acres is 15 to 25 percent, with high variation. Variation would depend on many conditions: for example, retention of pockets of snags and down wood, treatment of pockets of dwarf mistletoe, aspect, steepness, etc. The 15 to 25 percent canopy average would maintain a fuel profile that would adequately reduce crown fire hazard and resemble historic conditions for about 20 years following treatment.

The proposed treatment would prioritize the removal of smaller, suppressed, and intermediate trees and would retain the oldest and largest trees in the stand. Some co-dominant trees may need to be removed to effectively reduce canopy density.

The purpose of the Proposed Action, in addition to reducing wildland fire intensity, is to create a spatially diverse and resilient ecosystem across the landscape. To accomplish this, the proposed silvicultural treatment is to thin by removing the suppressed and intermediate trees first, followed by the co-dominant and dominant trees as necessary to meet the desired canopy cover. Thinning is a common silvicultural treatment designed to reduce competition for superior trees, leaving behind a stand of uniformly spaced co-dominants and dominants. However, the purpose here is not to release stands for growth, but to reduce fire intensity by disrupting canopy continuity, removing fuel ladders, and creating landscape diversity. Uniform tree spacing, while disrupting canopy continuity, would fail to provide the desired spatial diversity within the stands and across the landscape.

Trees are to be thinned in such a fashion as to create clumps or cohorts of trees intermingled with small irregular openings or areas of lower tree density up to ¼ acre in size. For example, a clump of 3-10 trees that is 3-20 feet from the nearest neighboring tree could be left adjacent to an opening or area of low tree density, containing 0-3 trees.

[4] Un-C = unclassified roads used in project

Pockets of older, platy-barked trees would be targeted as leave clumps, and areas of younger trees or pockets of dwarf-mistletoe-infected trees would be targeted for removal to create openings. The above is only an example; actual leave groups and openings would be dictated by stand structure and site characteristics. Overall, canopy cover may differ substantially from one point to another, but across a given stand it should average 15 to 25%.

The lowest densities and majority of openings would occur on south- and west-facing slopes. The north and east slopes would have fewer openings and slightly higher densities.

No-treatment areas are included as part of the design of the Proposed Action. No-treatment areas include areas where fuels reduction or maintenance treatments are not needed, within 100 feet of streams (more discussion about riparian areas can be found in Chapter 3), with existing thermal cover patches (more discussion about thermal cover can be found in Chapter 3), and where treatment would disrupt ongoing research within the Manitou Experimental Forest.

About 17,000 acres would be prescribed for *heavy* thinning with potential log removal. Heavy thinning describes areas where approximately 20 to 50 percent of the existing co-dominant tree overstory would be removed to meet canopy reduction goals. Trees would be removed via ground-based logging equipment or helicopters. Most heavy thinning areas are likely to produce logs that could be sold to offset the cost of the operation.

The remaining 3,000 acres are unlikely to produce logs. Of these, about 2,000 acres currently have less than 30 percent canopy closure and would require little removal of co-dominant overstory to meet project goals. *Light* thinning treatments in these stands would help maintain the desired condition. Some logs could potentially be removed from these sites, but more likely, biomass would be treated on-site (few or no logs removed).

About 1,000 acres have denser vegetation than desired, but their location and steepness restricts use of conventional yarding equipment. These areas would be treated with power saws or feller-buncher machines, but biomass would not be yarded off-site (these are called "on-site treatment" on the Proposed Action map and summary tables). On-site treatments include mechanical lopping, scattering, crushing or piling, and/or controlled burning. Since no biomass would be yarded away, the amount of follow-up slash treatments would be more difficult. Full canopy reduction goals may not be met in this entry, so on-site treatments are limited to areas far from private property.[5]

Tractor Yarding

Approximately 13,380 acres would be thinned from below, with wood products removed using conventional yarding equipment.[6] Steeper areas exist throughout the tractor areas; some of these steeper areas would become no-thinning areas. Steeper areas would be favored for no-treatment areas where possible to meet habitat, watershed, or aesthetic design features/mitigation measures.

[5] Recent experience on the South Platte Ranger District may lead to more options for on-site treatment than currently assumed for Trout-West (Fred Patten, personal communication, November 2002). Some of the tractor or helicopter yarding areas could be treated on-site as long as the end result meets canopy retention and fuel load goals.

[6] A small amount of acreage could be skyline cable yarded.

Helicopter Yarding

About 3,890 acres are proposed for helicopter yarding. These areas are too steep for conventional yarding equipment or are inaccessible without increased road construction. Many of these areas are within one mile of private land.

Prescribed Burning and Other Follow-Up Treatments

The IDT responded to public concerns about prescribed burning by developing follow up treatment zones. People expressed concern about prescribed burns escaping control and moving onto adjacent private land. People also expressed concern about the potential health impacts of smoke.

The risk of exceeding expected burn plan thresholds is greater with broadcast burning than with pile burning, and lowest with no burning. Concern increases the closer to one's home that the burn is proposed. Therefore, recommendations were made about the kinds of burning that would occur within various zones.

Three zones were recommended to deal with slash created from the thinning and existing excessive surface fuels. Two of the zones are within the *wildland-urban interface buffer*, defined as one mile around subdivisions and other occupied private lands[7]: "*The Neighboring Private Land zone*," which is within 600 feet of private property, and "*the one-mile buffer zone*," which refers to the remaining urban interface buffer. The third zone applies to the rest of the project area, which is generally between one and two miles from occupied private land.

Burning methods would depend on actual conditions after thinning and yarding. Some areas may not need to be burned to reach fuels objectives. Discussions with neighbors may allow for greater flexibility than assumed in this analysis. On-site fuels treatment may be an alternative to tractor or helicopter yarding given further site-specific analysis and discussions with neighbors.

Analysis for the Proposed Action is based on the prescribed burning zone recommendations. Analysis assumes that 2,910 acres would not be burned at all, 10,660 acres would be piled and burned, and the remaining 6,600 acres would be available for broadcast burning or other prescribed methods. Table 3 displays the recommended follow up treatment zones.

The project would be implemented to reduce potential fire hazard from slash created through thinning. Slash would be treated as much as practical during the thinning operation. Prescribed burning would be scheduled to avoid large continuous areas of untreated slash at any one time.

[7] Occupied means that there is at least one house per 40 acres of private property. Follow-up treatment zones are specific to occupied property.

Table 3. Follow-Up Treatment Zones

The Neighboring Private Land Zone	The Neighboring Private Land Zone applies to National Forest within 600 feet of private land boundaries (about 2,900 acres). Burning would not be assumed in this zone. Adjoining landowners would be consulted regarding treatment methods and intensity.
The One-Mile Buffer Zone	The One-Mile Buffer Zone applies to National Forest between 600 feet and one mile of occupied private land. Assumptions for this area are that landing or hillside piles would be burned, but broadcast burning would not be prescribed except for approximately 300 acres within this zone that are proposed for on-site treatment with broadcast burning.
The Rest of the Project Area	Outside the One-Mile Buffer Zone, the assumption is that hazardous fuels would be burned via broadcast burning or other effective method(s).

Access and Road Work

Existing system roads that are suitable to support log haul (about 68 miles) would be maintained, with minor reconstruction as needed for safety or environmental considerations. About 48 miles of unclassified roads/trails considered suitable for operations would also be maintained or reconstructed, but would be rehabilitated once operations were completed. These unclassified roads are not part of the Forest Service system and are candidates for restoration-based on-roads analysis. An additional 14 miles of temporary new roads would be built and rehabilitated once the project was completed.

Certain types of contracts allow for pairing temporary road construction and restoration following use; temporary roads (both new and existing unclassified) would be rehabilitated to near natural conditions once they are no longer needed for the fuels reduction project. This analysis assumes that only unclassified roads used in the project would be rehabilitated; other unclassified roads may be rehabilitated as funding allows.

Private roads in the project area could increase access for ground-based logging systems or reduce the need for some roadwork. During implementation, these options could be pursued to reduce the cost or impact of the project.

Design Features/Mitigation Measures to Reduce Impacts

The following design features and mitigation measures are recommended to reduce potential impacts from the Proposed Action. These recommendations were developed in response to public scoping and current management direction.

Crown Fire Hazard Reduction

- Reduce conifer canopy cover to an average 15 to 25 percent to reduce probability of damaging crown fire.
- Maintain less than four to six tons fuel loading per acre following treatment (vary as needed to meet Large Woody Material guidance).

Forest Stand Conditions

- Vary stand level prescriptions to mimic natural variability.
- Vary stand density/canopy closure by aspect, with south, east, and west aspects more open and dominated by ponderosa pine and north aspects somewhat more closed with more Douglas-fir component.

Forest Pathogens

- Leave-tree selection will be based partly on that tree's potential longevity. As a general rule, leave-tree selection will favor healthy trees over diseased trees. Some small openings with few or no trees could be created in diseased pockets.

Soil and Water Quality Protection

- No new system road construction.
- Meet or exceed Colorado Forest Stewardship Guidelines to Protect Water Quality. Limit detrimental soil compaction and displacement to 15 percent (or less) of each treatment area by implementing the following recommended methods:
  - Require ground based skidding over frozen ground or dry soils (less than 20 percent soil moisture).
  - Require at least partial suspension of logs for all yarding systems.
  - Monitor unit for detrimental soil conditions following yarding; allow machine piling only if detrimental soil conditions would not exceed 15 percent standard.
  - Limit ground based skidding equipment to slopes less than 20 percent, except steep pitches less than 40 percent for less than 200 feet.
  - Avoid skidding down ephemeral draws. Cross draws at steep angle.
- Avoid temporary road construction on slopes steeper than 20 percent; avoid stream crossings.[8]
- Leave maximum amount of biomass possible for soils (given that the amount is acceptable from a fuels standpoint); use low to moderate intensity burn to retain most of the 3" and greater material and some of the fine material.
- No heavy machinery or tree removal within 100 feet of perennial and intermittent streams. Prescribed fire may be allowed to back into these areas.
- Hazard trees within the riparian buffer felled for safety should be directionally felled across the stream if the top can reach more than halfway across. Trees would otherwise be felled on the contour.
- Where whole-tree yarding occurs, return slash with skidder to the skid trail with each turn to keep landing size down and redistribute slash onto the skid trails to function as organic waterbars to dissipate overland flow energy (up to two tons per acre).
- Fell, lop, and scatter vegetation onto rehabilitated roads for effective ground cover (integrate with down wood requirement).
- Maintain a minimum of 40 percent effective ground cover in slash, coarse wood, grass, forbs, and shrubs for filtered sunlight and cooler soil surface temperatures.
- Allow slash to cure at least one year before underburning so that nutrients will leach into the soil.

[8] See alternative maps for new temporary road locations based on this mitigation measure. These locations are subject to change with further site-specific work; actual road routes would be chosen to minimize impacts. Agreements for access through private land may reduce need for some temporary roads.

- Subsoil temporary roadbed where original slope was less than 10 percent; re-contour as needed to rehabilitate roads to near natural conditions on steeper slopes.
- Integrate no-treatment islands in steeper portions of ground-based logging units. Use of ground-based equipment on steeper areas should be closely monitored.

Fish and Wildlife Protection

- Meet Forest Plan standards for snags by maintaining a minimum of 20-30 snags per 10 acres, well-distributed; retain all soft snags, and in ponderosa pine, Douglas-fir, and aspen stands provide hard snags where biologically feasible: 12" diameter or larger with at least five per 10 acres; 10" diameter or larger with at least nine per 10 acres; and 6" diameter or larger with at least six per 10 acres. Trees and snags with existing cavities and lightning-struck trees should be favored for cavity nester habitat.
- Assure that adequate down wood is retained following mechanical treatment and burning to retain an average of 50 linear feet of 12" diameter wood per acre.
- No active goshawk nests are known in the project area. Pre-treatment goshawk surveys would be conducted to identify any active nests within the treatment areas. If an active nest was identified, the Forest Service biologist would be notified immediately. Work would stop until the biologist made a determination of potential impact and mitigation needed. A 30-acre, no-activity buffer would be applied around the nest from March 15 to September 15. This buffer would allow vegetation management operations outside of the March 15 to September 15 period. Structural and vegetation recommendations developed by Reynolds do not apply to this project.
- Pre-treatment surveys would be conducted for flammulated owls. If an active nest was discovered, the Forest Service biologist would be contacted immediately. Work would stop until a Forest Service biologist made a determination of impacts.
- Linkhart's long-term flammulated owl study area would not be treated.
- Protect Abert's squirrel tree clumps (incorporating nesting and feeding trees and interlocking trees) where they are found.
- Protect two turkey roost tree clumps per section in ponderosa pine sale areas, if available. Minimum size of a clump is 1/10 acre.
- Avoid disturbing elk calving and mule deer fawning concentration areas between May 15 and June 30.
- Apply necessary mitigation for any threatened, endangered or sensitive species found in pre-treatment or other surveys. One unit (stand 14 of Ridgewood) may be within 300 feet of the 100-year floodplain of Trout Creek; the boundary would be modified to avoid potential for Preble's meadow jumping mouse habitat.
- After Manitou Lake is re-filled, monitor for two winters from December through February for concentrated use by bald eagles for nocturnal roosting. If roosts are found, a 1/8-mile radius "no forest management" protection zone would be applied, as well as a restriction of work activities within a one-mile radius from November 1 to March 30.
- All mature forest stands exceeding 70 percent canopy, based on the Resource Inventory System (RIS) database, would be left untreated to meet thermal cover standards.
- Leave higher densities of trees around rock outcrops (except specific areas that may be opened to enhance scenic quality), resembling natural fire patterns.
- Consult a fisheries biologist if barriers to fish passage are identified during roadwork. Barriers would be evaluated and redesigned if they are suspected to have unacceptable impacts on fish.

Sensitive Plants, Range Resources, and Noxious Weeds

- Require contractor/purchaser to use designated skid trails and travel routes that would avoid spreading weeds from infested areas.
- Require contractor/purchaser to clean all heavy equipment that operates on Forest Service projects before entering treatment areas.
- Require contractor/purchaser to reseed disturbed roadbeds with a certified noxious weed-free native seed mix.
- All hay, straw, and mulch used for revegetation or watershed protection measures on National Forest lands will be certified as noxious weed-free.
- Conduct pre- and post-project field surveys as needed to identify and treat noxious weeds in proposed treatment areas until controlled or eradicated.
- Conduct field surveys to locate specific special plant species as indicated in the BE/BA.

Air Quality

- Require a Smoke Management Plan.
- Use whole-tree yarding and other methods to reduce logging residue without burning.
- Burn when conditions are good for rapid dispersion and when transport winds would carry smoke away from populated areas, highways, Class 1 airsheds, and other sensitive areas.
- Machine piles would be clean of dirt.
- Consultation with appropriate agencies and weather specialists would occur prior to burning.
- Monitoring as required would occur per permitting process, depending on category of burn.

Visual Quality Management

- The following recommendations apply to areas in the immediate foreground (within 300 feet or sight distance, whichever is less) of State Highway 67, County Roads 78, 79, 511, 51, 25, and 5, and developed campgrounds in order to meet Forest Plan Visual Quality Objective of Retention. A landscape architect or recreation specialist would help determine site-specific methods to meet retention guidelines.
    - Mark trees on the side away from roads and trails for 300 feet or sight distance. Mark cut trees instead of leave-trees where reasonable. The objective is to reduce marking paint visibility to the casual observer.
    - Vary spacing and blend thinned areas with untreated areas.
    - Leave stumps no higher than eight inches.
    - Bury or scatter stumps that are pulled up as a part of roadwork.
    - Leave trees in natural patterns around rock outcrops.
    - Retain elements of a park-like setting (larger ponderosa pines, random tree spacing, understory grasses and shrubs) for visual variety.
    - Return skid trails to as near natural condition as possible.
    - Slash depth would be retained at less than 18 inches and scattered to mimic natural surroundings.

- The following recommendations apply to areas in the immediate foreground (within 300 feet or sight distance, whichever is less) of areas adjacent to residential developments on private land. The objective of these measures is to reduce negative visual effects of logging slash and other harvest-related disturbances.
  - Use whole-tree harvesting to minimize slash.
  - Minimize and screen slash piles, skid trails, and landing areas.
  - Attempts should be made to reduce the potential strong contrast between private and Forest Service boundaries. Treatments should mimic natural landscape patterns and avoid straight lines in the boundary layout.

Recreation Management

- Review travel corridors in the selected alternative to assure that adequate screening is retained to reduce risk of increased off-road/trail use.
- Maintain a visual screen within 200 feet of natural openings to deter off-road/trail use. Add physical barriers along roads to thinned areas if needed to discourage off-road vehicle traffic.
- Close treatment units to recreation use during implementation.
- Use boulder and earthen barriers, fencing, slash, etc. to deter access if monitoring shows that unwanted use is occuring.
- Favor winter logging to reduce resource impacts.

Other Concerns

- Burn planning would be done using post-thinning conditions and up-to-the-minute weather information.
- Reduce risk of out-of-control prescribed burn by favoring pile burning closer to the urban interface and by reducing biomass on-site through yarding. Public education and engagement could lead to favoring broadcast burning in areas currently considered for pile burning only.
- Survey and monument all forest boundaries in activity areas prior to contracting.
- Special use permittees and those with Rights-of-Way would be contacted before implementation to avoid conflicts with the selected alternative.
- Provide wood products, including firewood, consistent with demand and treatment prescription.
- Pursue standard contracts/agreements relative to County Road maintenance and damage.
- Perform heritage resource surveys and protect known sites. Meet Memorandum of Understanding for National Fire Plan projects.
- Use appropriate signing, traffic control, and area closures, and provide advance information to user groups about closures to adequately protect public safety. Increase public education about road closures and appropriate uses.
- Meet all applicable laws regarding safety; follow Occupational Safety and Health Administration (OSHA) and State safe work practice guidelines.
- Restrict operations on weekends and holidays as needed to reduce user conflicts.
- A spill plan would be part of contracts used to implement this project.

- Respond to neighbors' concerns identified as part of implementation planning. Encourage and provide opportunities for citizen involvement in planning, implementation, monitoring, and adaptive management (the public may contact Pikes Peak District Fire Management Officer, Mike Kerrigan, at 719-477-4218 for further information).
- The following design features apply to treatments within the Manitou Experimental Forest:
  - Ongoing and future research compatible with the project may occur within the experimental forest.
  - A variety of techniques, methods and prescriptions for fuels reduction may be implemented and evaluated with the experimental forest.
  - Density guidelines and techniques within the experimental forest may vary more than the general forest as needed for approved research.
  - All activities proposed within the experimental forest would be coordinated with experimental forest staff.

Detailed Stand Information

Physical and vegetative site condition information for each of the six treatment units was collected and assembled as part of this analysis. The values (acres, mile) reported in Chapter Two are based on this detailed information but have been summarized and rounded. Specialist reports may include more precise or differently-totaled values; simple rounding differences account for most discrepancies.

Monitoring and Adaptive Management

The following section summarizes recommended monitoring. Two types of monitoring activities are identified: implementation and effectiveness.
The intent of monitoring and adaptation is to allow land managers to respond to changed conditions and new information during the ten-year project implementation period. Options for how to best implement this project exist and would continue to evolve. For instance, current work on the South Platte Ranger District may prove on-site treatment more effective and feasible than assumed in this analysis (Fred Patten, personal communication, November 2002). This information would be integrated into the implementation plan for the Trout-West Project to allow for adaptation as more is known.

Involvement of private landowners adjacent to treatment areas would be likely to affect the way the project would be implemented. This analysis assumes only current right-of-way across private land and roads. Alternative access may be available that would be less environmentally adverse. These would be pursued during implementation. In addition, private landowners may agree to prescribed burning closer to private land boundaries than assumed in this analysis. This option should be available to fuel managers given local consensus. The prescribed burning plan offered for the Proposed Action responds to public concerns and provides a basis for analysis but should not be considered an end in itself. The intent of the mitigation measures and design features associated with the Proposed Action is to adequately reduce crown fire hazard while meeting environmental standards and reducing risk of adverse impacts. Forest Service managers would be prudent to adapt to changed conditions and new information to allow for maximum achievement of benefits with minimum adverse impact.

The monitoring recommended here would provide information to help determine site-specific implementation methods during the life of the project.

Implementation Monitoring

Implementation monitoring is based on the Forest Plan standards and guidelines, as well as existing laws and regulations that must be followed. The IDT recommends that the project be implemented in stages so that monitoring and adaptation can occur as needed.

Monitoring for Damaging Crown Fire Hazard and Range of Vegetation Conditions

Question: What specific crown closure should be applied to each project area?
What: Use Higley's vegetation stratification to design data collection strategy. Collect stand exam information for sample stands to determine crown closure needed to maintain less than 30 percent canopy for 20 years. Adapt to site-specific conditions.
Who: Qualified Forester.

Question: Was the prescription implemented as intended; specifically, are crown closure and fuel tonnage objectives met in each unit once the project is complete?
What: Mark and thin 10–100 acres using basal area correlation to crown closure (at least one for each forest type and structure group), then check with densiometer to see if canopy closure goals are met. Continue this strategy over the life of the project and adapt as needed. Use photo series to make ocular estimate of residual fuel tonnage. Make sure densiometer readings are calibrated with air photos to avoid leaving too few trees (canopy cover should be measured straight down, the densiometer may provide too much side shade and lead to too-heavy marking.
Who: Qualified forester.

Question: Was marking consistent with marking guidelines and silvicultural prescription? Were sufficient numbers of large trees retained?
What: Post-marking field review.
Who: Qualified forester (i.e. Silviculturist).

Adaptation: Marking guidelines should be adapted based on vegetation monitoring results.

Monitoring for Soil and Water Quality

Question: Were design features, mitigation measures, watershed conservation practices, and any other guidelines followed adequately; specifically, did the project adversely affect soils on 15 percent or less of any treated area?
What: Run transects with sample scheme designed by hydrologist or soils scientist. Determine percentage of area adversely impacted. Steeper areas should be sampled at higher frequencies. Monitoring should occur on some completed areas before new areas are treated.
Who: Hydrologist or soil scientist.

Adaptation: Designate skid trails prior to treatment as needed. Reduce tractor yarding (or machine piling/broadcast burning) as needed, or restrict yarding/piling to times when ground is frozen. Use on-site treatment as an alternative to helicopter yarding if results indicate that such work would result in the desired condition without violating the 15 percent standard.

Monitoring for Wildlife

Question: Were wildlife mitigation measures incorporated into marking guidelines and implemented as planned? Specific concerns include the following: snags, down woody material retention, Abert's squirrel clumps, thermal cover retention, and riparian area buffer.
What: Check marking guides to assure they included the design features/mitigation measures. Check areas before treating to make sure guides are followed. Review sample cut areas (10-100 acres) before larger project is implemented to make sure marking guides are adequate.
Who: Wildlife biologist and forester.
Adaptation: Adjust marking guidelines or marking as needed.

Monitoring for Air Quality

Question: What is the trajectory and vertical dispersion of smoke plumes?
What: Observe smoke plume from ground level and from the air – determine whether dispersion avoids sensitive areas as planned.
Who: Fire Management Officer/Air Quality Specialist.
Adaptation: Suspend further burning until conditions are acceptable.

Monitoring for Visual Quality

Question: Were visual quality objectives incorporated into marking guidelines and implemented as planned? Specific concerns include views from Sensitivity Level 1 travelways and use areas and from private lands. These areas are described in Chapter Three.
What: Check marking guides to assure they include the design features/mitigation measures. Check areas before treating to make sure guides are followed. Review sample cut areas (10-100 acres) before larger project is implemented to make sure marking guides are adequate.
Who: Landscape Architect and Forester.
Adaptation: Adjust marking guides or marking as needed.

Monitoring for Recreation

Question: Are barriers needed to prevent illegal, off-road motorized use within thinned areas?
What: Review impacts to thinned areas from off-road motorized use.
Who: Any trained observer.
Adaptation: Place barriers as needed. Maintain adequate Forest Service presence, including law enforcement, to prevent illegal off-road use.

Monitoring for Heritage Resources

Question: Are the measures taken to avoid disturbance of heritage resources effective?
What: Review of selected sites before, during, and following implementation.
Who: Heritage Resource Specialist.
Adaptation: Increase or decrease buffers, amend project boundaries.

Effectiveness Monitoring

Effectiveness monitoring would lead to more precise predictions and adaptations in future projects and would contribute to design and analysis for other projects in the region.

Monitoring for Damaging Crown Fire Hazard and Range of Vegetation Conditions

Question: How were fuel models changed within treated areas?
What: Determine fuel models pre- and post-treatment on a sampled area for each of the six treatment units within the project area. Use fuel modeling techniques to determine change in predicted fire behavior.
Who: Fuels Specialist.

Monitoring for Soils and Water Quality

Question: Did the sediment model accurately predict amount of erosion for selected alternative?
What: Stratify project by treatment type and slope class. Install silt fences and measure amount of sediment at sample points. Determine tons per acre of loss and compare to prediction.
Who: Hydrologist or Soil Scientist.

Monitoring for Fish and Wildlife

Question: Are nest buffers effective in maintaining goshawk occupancy?
What: Visit nest sites during fledgling period during treatment to determine whether nest is still occupied.
Who: Wildlife Biologist.

Question: Is thinning, with mitigation for retention of feeding and nesting trees, affecting Abert's squirrel density?
What: Pre- and post-treatment Abert's squirrel inventories using Forest survey protocols (track plates or feeding indices).
Who: Wildlife Biologist.

Monitoring for Air Quality

Air quality monitors are located around the state. The state burn permitting process is adapted to the results of this monitoring.

Monitoring for Recreation
Question: Were mitigation measures/design features to reduce potential illegal off-road motorized use effective?
What: Visit treatment areas and observe use.
Who: Everyone – involve motorized user groups, Forest Service workers, public, and landowners.

No Action Alternative

The No Action alternative would not reduce fuels in the Trout-West project area. Analysis for this alternative assumes that in any given year, 3 percent of the watershed is likely to experience a crown fire. For the project area, that equates to at least one 10,500-acre fire within a decade. For the rest of the analysis area, that equates to three 10,500-acre wildfires. The Hayman Fire burned about 26,800 acres within the analysis area.

Alternative A (Proposed Action, but extend no burn zone to entire project area)

Table 4 summarizes the treatments proposed in Alternative 1.

Table 4. Summary of Alternative A Treatments

Total Treatment Acres	Acres Heavy Thin			Acres Light Thin	Access Needed (Miles)		
	Tractor	Helicopter	No Yarding		Existing Roads		New Temp
					System	Un-C	
19,220	13,380	3,890	0	1,945	68	48	14
Prescribed Burning							
Pile Burning				Broadcast Burning			
0 acres				0 acres			

This alternative thins about 19,000 acres, similarly to the Proposed Action, but does not include any burning. All mitigation measures (except those that apply specifically to burning) listed under the Proposed Action would apply to Alternative A. Thinning, log removal, and access would occur as described under the Proposed Action, except that fuels reduction would be entirely mechanical. Thinned trees would be whole-tree yarded to a landing and processed. Merchantable material would be hauled away as logs. Unmerchantable material would be chipped and hauled away.

Stands that could not be safely or effectively treated without burning would not be treated at all (about 950 acres of on-site treatment included in the Proposed Action would NOT be treated under this alternative). Some light thinning stands might also be left untreated. All applicable mitigation measures and design features listed for the Proposed Action are included for Alternative A.

Alternative B *(Proposed Action, but only treat within the one-mile buffer zone)*

Alternative B responds to public concerns about fuels treatment extending beyond the one mile urban interface buffer. Table 5 summarizes the treatments proposed in Alternative B.

Table 5. Summary of Alternative B Treatments

Total Treatment Acres	Acres Heavy Thin			Acre Light Thin	Access Needed (Miles)		
					Existing Roads		New Temp
	Tractor	Helicopter	NoYarding		System	Un-C	
13,570	9,270	2,900	300	1,100	50	31	12
Prescribed Burning							
Pile Burning				Broadcast Burning			
10,660 acres				0 acres			

Alternative B would not treat any stands further than one mile from populated areas. Stands within the one-mile buffer zone would be treated as described under the Proposed Action. This alternative responds to the following public comments: the project scale is too large, and National Fire Plan funding should be concentrated in close proximity to private property. All applicable mitigation measures and design features listed for the Proposed Action are included for Alternative B.

Alternative C –*(Proposed Action, but stands that would require new temporary roads to facilitate tractor yarding would be yarded with helicopters instead)*

Table 6 summarizes the treatments proposed in Alternative C.

Table 6. Summary of Alternative C Treatments

Total Treatment Acres	Acres Heavy Thin			Acres Light Thin	Access Needed (Miles)		
	Tractor/ Cable	Helicopter	No Yarding		Existing Roads		New Temp
					System	Un-C	
20,170	11,280	6,090	950	1,945	68	48	0
Prescribed Burning							
Pile Burning				**Broadcast Burning**			
10,660 acres				6,600 acres			

Alternative C treats the project area similarly to the Proposed Action but does so without temporary road construction. This alternative responds to public concerns about new temporary road construction. All applicable mitigation measures and design features listed for the Proposed Action are included for Alternative C.

Alternative D –*(Modified treatment, limited to stands within ½ mile of private land)*

Table 7 summarizes the treatments proposed in Alternative D.

Table 7. Summary of Alternative D Treatments

Total Treatment Acres	Acres Heavy Thin			Acres Light Thin	Access Needed (Miles)		
	Tractor	Helicopter	No Yarding		Existing Roads		New Temp
					System	Un-C	
6,750	3,130	3,020	0	600	36	13	0
Prescribed Burning							
Pile Burning				**Broadcast Burning**			
0 acres				3,840 acres			

This alternative is based on recommendations from some organized environmental groups and responds to concerns about the prescription and extent of the project. Many design features and mitigation measures recommended for the Proposed Action would be applied but would be modified as discussed below:

Project Boundaries

National Forest in the six treatment units within ½ mile of occupied private land would be considered for treatment. Treatment would be deferred for lands beyond ½ mile.

Thinning

The thinning prescription would remove fewer co-dominant trees. Canopies would not necessarily be opened to 15 to 25 percent. Intermediate and suppressed trees would be removed, and some canopy gaps would be created in areas of smaller trees. Strict upper diameter limits would be set for each thinning area. These upper diameter limits would be designed to retain all trees over a certain size and age. Dwarf mistletoe would not be a factor in leave-tree selection.

Prescribed Burning and Other Follow-Up Treatments

Broadcast burning would be the preferred follow up treatment method. Consultation with neighbors would determine actual methods. For effects analysis, the Neighboring Private Land Zone is assumed to have no burning; the remaining area would have broadcast burning.

Access

No new temporary roads would be built.

Alternative E –(Historic Condition)

Table 8 summarizes the treatments proposed in Alternative E.

Table 8. Summary of Alternative E Treatments

Total Treatment Acres	Acres Heavy Thin/Harvest Openings			Acres Harvest Openings	Access Needed (Miles)		
	Tractor/ Cable	Helicopter	No Yarding		Existing Roads		New Temp
					System	Un-C	
26,320	19,380	5,690	1,250	7,900	68	48	14
Prescribed Burning							
Pile Burning				Broadcast Burning			
13,500 acres				9,410 acres			

Alternative E responds to concerns that the Proposed Action does not go far enough toward meeting the project goal of sustainable, diverse forest conditions, more like historical forest conditions. Researchers such as Dr. Merrill Kaufmann determined that historically, approximately 30 percent of pine stands (and 15 percent of Douglas-fir stands) had less than 10 percent canopy cover (Kaufmann 2001). Alternative E modifies the Proposed Action by creating harvest openings on approximately 7,900 acres. Some of the harvest openings would be recommended for maintenance over time to retain a grass/forb component across the landscape. Some would be cultured for forest regeneration. Harvest openings would range between two and 40 acres and average about 20 acres. The edges of created openings would be feathered and designed to blend with the existing landscape to avoid any sharp contrasts of form, line or texture. Color contrasts would be designed to vary and appear like a natural meadow. Specific mitigation measures would apply to meet visual quality objectives. These openings would be distributed according to historic variation across the landscape (more on south and west slopes, fewer on north and east slopes).

Thinning, with similar specifications to the Proposed Action, would occur on 18,420 acres. Prescribed burning would occur within the three treatment zones as per the Proposed Action. Alternative E extends treatment into existing thermal cover stands and riparian areas. Thermal cover stands would be treated with thinning or openings. Riparian areas would also be thinned. Alternative E includes helicopter yarding within Management Area 4B, an area excluded from treatment in the other alternatives. Other design features discussed for the Proposed Action are integrated into this alternative. If selected, this alternative would likely require Forest Plan Amendments, because it would not fully meet existing Forest Plan standards and guidelines related to wildlife and forest management.

Alternative Maps

Maps depicting the Proposed Action and Alternatives A through E are included as pages 35 through 45 of the DEIS **and are not reproduced for the FEIS**. The maps have not changed since their publication in the DEIS. The maps are available electronically at the following web address: http://www.fs.fed.us/r2/psicc/spl/twest.htm.

Alternatives Dismissed from Detailed Consideration

Several alternatives were identified to respond to scoping. Some were dismissed from further analysis and are briefly summarized in the following paragraphs.

An Alternative that Only Treats the Neighboring Private Land Zone

Some people commented that only the areas directly adjacent to private land should be treated. The proposed treatment zone recommendations varied from 30 feet to ½ mile. The IDT identified an alternative that only treated the neighboring private land zone (600 feet around private property).

The Responsible Official decided to dismiss this alternative from further analysis because other alternatives satisfy an appropriate range: from over two miles from private land (Proposed Action, Alternatives A and C), to one mile (Alternative B), to ½ mile (Alternative D), and No Action.

An Alternative that Would Not Yard Biomass Away from the Site

The IDT identified an alternative that would treat biomass on site, rather than yarding some of it away. Biomass treatment on site would consist of mechanical lopping, scattering, crushing or piling, and/or controlled burning. Road improvements would not be necessary to support log haul.

This alternative would require extensive burning to treat biomass. The inherent risks of prescribed burning to air quality, soils, standing forests, and surrounding lands would have to be mitigated through limiting the amount of created slash. Without yarding, the canopy may not be effectively opened. Preliminary analysis indicated that yarding material away would more effectively reduce fuels, without the risks inherent to treating the material on-site. Therefore, an alternative that does not yard any biomass was not considered. Approximately 1,000 acres are proposed for on-site treatment in the Proposed Action and Alternatives C and E.

Fewer Limitations on Roads

Relaxing the restrictions on the design of new temporary roads would increase acreage accessible to ground-based logging systems. The mitigation measures for soil and water quality eliminate some road options that would reduce helicopter yarding acreage and the overall cost of the operation. Preliminary analysis indicated that the risks from increased road construction and relaxed soils protections outweighed the potential cost savings. Therefore, the Responsible Official decided not to fully develop this alternative.

An Alternative that Treats Land Outside the Six Treatment Units

Some people suggested that areas outside the six treatment units are also in need of treatment or are a higher priority for treatment. The six treatment units were prioritized based on proximity to private land, stand health, access, and project feasibility. Acres not treated under this analysis could be considered for treatment sometime in the future, but are not currently proposed for treatment in any known project. Other projects that have occurred in the analysis area, but outside the Trout-West project area, include the Trout Creek Timber Sale and Polhemus Burn.

Alternatives Compared

Narrative Comparison – Issues

1. **Crown Fire Hazard**
   The project area and surrounding watersheds (analysis area) are associated with a high risk of damaging crown fire. This condition is overly dense as compared to a sustainable and fire-safe condition. The Proposed Action and Alternatives A and C reduce the risk of damaging crown fire by decreasing canopy density and fuel loading across about 20,000 acres. Alternative E decreases canopy density on over 26,000 acres. Sufficient acreage is treated across the analysis area under the Proposed Action and Alternatives A, C, and E to reduce Condition Class and increase the ability to contain future fires. No Action and Alternatives B and D treat insufficient acreage to reduce the Condition Class across the analysis area.

2. **Forest Stand Conditions**
   Approximately 80 percent of the landscape consists of stands denser than 40 percent canopy closure. The Proposed Action and Alternatives A, C, and E would reduce canopy cover on nearly 70 percent of the project area. Alternative E further restores the project area to a more historic condition by reducing canopy cover across about 90 percent of the project area, and creating openings across 30 percent of the area. Alternative B would reduce canopy cover on 47 percent of the project area. Alternative D reduces canopy cover on 23 percent of the project area. No Action does not reduce canopy closure and thus perpetuates this overly dense condition. All action alternatives increase aspen in treated stands and increase the proportion of large trees across the project area. No adverse effects on development of old-growth characteristics are anticipated to result from proposed thinnings associated with the action alternatives.

3. **Forest Pathogens**
   The existing overly dense condition contributes to higher than endemic levels of insects and disease. No Action continues this condition. All action alternatives would increase the longevity and vigor of treated forests.

4. **Soils and Water Quality**
   The decomposed granitic soils within the analysis area can become erosive when disturbed. The Hayman Fire is likely to deliver millions of tons of sediments downstream. Future wildfires are also likely to result in accelerated erosion and subsequent sediment delivery to area streams. The Proposed Action, Alternative C, and Alternative E all provide equal protection from future wildfires, but are associated with some increased erosion. Alternative A would result in the least amount of sedimentation of all alternatives because it does not incur any risks to soils and water from prescribed burning. No Action and Alternatives D and B do not provide adequate protection from future wildfire and are likely to result in damage to the soil and water resource in the event of a large wildfire.

5. Fish and Wildlife

All action alternatives may affect, but are not likely to adversely affect bald eagle. No other threatened, endangered, or sensitive wildlife species would be adversely affected by this project. The USFWS has concurred with these findings. The action alternatives were designed considering Management Indicator Species needs and trends. All action alternatives, except Alternative E, incorporate specific design features to meet wildlife planning guidelines, including retention of stands mapped as deer and elk thermal cover and retention of riparian buffers. Alternative E would have to be modified to meet these guidelines, or would require a Forest Plan amendment to implement.

6. Sensitive Plants, Range Resources, and Noxious Weeds

No known populations of sensitive plants would be adversely affected by any alternative. All action alternatives have the potential to spread noxious weeds through ground disturbance. Many mitigation measures must be applied to the project to reduce the risk of spreading noxious weeds. Continued botanical surveys are recommended so that site-specific mitigation measures may be followed. No range resources would be adversely affected by any of the alternatives.

7. Air Quality

Alternative A reduces the risk of degraded air quality from wildfire smoke, and does not include any burning. All other action alternatives reduce the risk of wildfire smoke and create some smoke through prescribed burning. The FEIS includes estimates of annual days of burning for each alternative. These range from one to three days per year for ten years (Alternative D) to 10 to 13 days per year for ten years (Alternative E). No Action has the greatest potential to degrade air quality through predicted wildfire smoke.

8. Visual Quality

All alternatives, except Alternative E, meet the current Visual Quality Objectives. Alternative E, as currently designed, does not fully meet Retention or Partial Retention objectives. Mitigation measures could be applied to reduce the impact of Alternative E. All other alternatives meet visual quality objectives as currently designed.

9. Recreation

All action alternatives affect recreation, particularly through closing and rehabilitating non-system roads. Current off-road use does not meet Forest Plan standards and is potentially illegal. Increased off-road use may result from opening forests through thinning. All action alternatives include mitigation measures to address off-road use.

10. Socio-Economics

The economic consequences of wildfires in the watershed are high. Many values are at risk, including private property, National Forest improvements, and the Denver municipal water supply. No Action continues the current high costs of wildfire, predicted to exceed $240 million. Action alternatives that reduce Condition Class are predicted to significantly reduce the cost and damages incurred due to future wildfires. The Proposed Action results in the greatest Present Net Value of all the alternatives.

Action Alternative Components Compared

Table 9. Action Alternative Components Compared

	No Action (NA)	Proposed Action (PA)	Alternative A – No Burning	Alternative B – No Treat Beyond One Mile of Private Land	Alternative C – No New Temporary Roads	Alternative D – No Treat Beyond ½ Mile of Private Land	Alternative E – Historic Condition
Total Acres Treated	0	20,170	19,220	13,570	20,170	6,750	26,320
Acres Tractor/ Other	0	13,380	13,380	9,270	11,280	3,130	19,380
Acres Helicopter	0	3,890	3,890	2,900	6,090	3,020	5,690
Acres On-Site Treatment	0	950	0	300	950	0	1,250
Acres Light Thin	0	1,945	1,945	1,100	1,945	600	0
Miles System Road	0	68	68	50	68	36	68
Miles Existing Unclassified Road	0	48	48	31	48	13	48
Miles New Temporary Spur	0	14	14	12	0	0	14
Acres Proposed for Pile Burning (not broadcast)	0	10,660	0	10,660	10,660	0	13,500
Acres Proposed for Broadcast Burning	0	6,600	0	0	6,600	3,840	9,410
Acres Proposed for Mechanical Slash Treat Only	0	2,910	19,220	2,910	2,910	2,910	3,410

	No Action (NA)	Proposed Action (PA)	Alternative A – No Burning	Alternative B – No Treat Beyond One Mile of Private Land	Alternative C – No New Temporary Roads	Alternative D – No Treat Beyond ½ Mile of Private Land	Alternative E – Historic Condition
Acres Treated Outside One Mile Urban Interface Buffer	0	6,600	5,650	0	6,600	0	9,410

Detailed Issue Comparison

Table 10. Alternative Response to Issues

	No Action (NA)	Proposed Action (PA)	Alternative A – No Burning	Alternative B – No Treat Beyond one mile of private land	Alternative C – No new temporary roads	Alternative D – No Treat Beyond ½ mile of private land	Alternative E – Historic Condition
Treats Sufficient Acres to Reduce Condition Class to I in Veg Types 1, 2, and 4?	No	Yes	Yes	No	Yes	No	Yes
Project Area Percent Wildfire Risk (once project is complete)	100	20	20	40	20	80	20
Analysis Area Percent Wildfire Risk (once project is complete)	100	30	30	60	30	100	30
Project Area Density Reduced (Percent)	0	70	70	47	70	23	90

	No Action (NA)	Proposed Action (PA)	Alternative A – No Burning	Alternative B – No Treat Beyond one mile of private land	Alternative C – No new temporary roads	Alternative D – No Treat Beyond ½ mile of private land	Alternative E – Historic Condition
Large Trees Retained	No direct effect.	Yes, all treatments retain sufficient large trees to meet old-growth definitions.	Yes, all treatments retain sufficient large trees to meet old-growth definitions.	Yes, all treatments retain sufficient large trees to meet old-growth definitions.	Yes, all treatments retain sufficient large trees to meet old-growth definitions.	Yes, all treatments retain sufficient large trees to meet old-growth definitions, with strict diameter limits.	Large trees would be removed over 30 percent of the project area to create openings.
Forest Pathogens	Increasing density and mortality.	Density Treatments improve forest health.	Density Treatments improve forest health.	Density Treatments improve forest health, but less acreage treated than the Proposed Action. Risks in untreated areas similar to No Action.	Density Treatments improve forest health.	Density Treatments improve forest health, but less acreage treated than the Proposed Action. Risks in untreated areas similar to No Action.	Density Treatments improve forest health.
Soil and Water Quality	No direct impacts. Current Wildfire Risk likely to accelerate erosion.	Prescribed burning and other treatments likely to accelerate erosion, but not as much as a wildfire.	Limited accelerated erosion from project, and reduced risk from wildfire.	Prescribed burning and other treatments likely to accelerate erosion, along with remaining wildfire risk.	Prescribed burning and other treatments likely to accelerate erosion, but not as much as a wildfire.	Remaining Wildfire Risk likely to accelerate erosion.	Prescribed burning and other treatments likely to accelerate erosion, but not as much as a wildfire.

	No Action (NA)	Proposed Action (PA)	Alternative A – No Burning	Alternative B – No Treat Beyond one mile of private land	Alternative C – No new temporary roads	Alternative D – No Treat Beyond ½ mile of private land	Alternative E – Historic Condition
Fish and Wildlife	No direct impacts. Current Wildfire Risk likely to affect fish and wildlife habitat.	No significant impacts on any species.	No significant impacts on any species.	No significant impacts on any species, remaining wildfire risk likely to affect fish and wildlife habitat.	No significant impacts on any species.	No significant impacts on any species, remaining wildfire risk likely to affect fish and wildlife habitat.	Would not meet thermal cover or riparian guidelines in the Forest Plan. Greater impacts on fish and wildlife.
Sensitive Plants, Range Resources, and Noxious Weeds	No direct impacts.	Mitigation measures applied to reduce spread of noxious weeds, protect sensitive plants.	Mitigation measures applied to reduce spread of noxious weeds, protect sensitive plants.	Mitigation measures applied to reduce spread of noxious weeds, protect sensitive plants.	Mitigation measures applied to reduce spread of noxious weeds, protect sensitive plants.	Mitigation measures applied to reduce spread of noxious weeds, protect sensitive plants.	Mitigation measures applied to reduce spread of noxious weeds, protect sensitive plants.
Air Quality	No direct effects. Current High Risk of degraded air quality from wildfire smoke.	Approves 6 - 10 days per year of prescribed burning with mitigation measures. Reduces risk of wildfire smoke.	Reduces risk of wildfire smoke without prescribed burning.	Approves 3-5 days per year of prescribed burning with mitigation measures. Reduces risk of wildfire smoke but not as much as the PA.	Approves 6-10 days per year of prescribed burning with mitigation measures. Reduces risk of wildfire smoke.	Approves 1-3 days per year of prescribed burning with mitigation measures. Limited reduction in risk of wildfire smoke.	Approves 10-13 days per year of prescribed burning with mitigation measures. Reduces risk of wildfire smoke.

	No Action (NA)	Proposed Action (PA)	Alternative A – No Burning	Alternative B – No Treat Beyond one mile of private land	Alternative C – No new temporary roads	Alternative D – No Treat Beyond ½ mile of private land	Alternative E – Historic Condition
Visual Quality	No direct impact.	Mitigation measures included to meet VQO's.	Mitigation measures included to meet VQO's.	Mitigation measures included to meet VQO's.	Mitigation measures included to meet VQO's.	Mitigation measures included to meet VQO's.	May not meet current VQO's, would require additional mitigation or Forest Plan Amendment.
Recreation	No direct impact. Wildfire risk threatens facilities and use.	Limited effect on users during operations. Potential for increased off road use from thinned areas, but decreased use on rehabilitated non-system roads. Reduced wildfire risk.	Limited effect on users during operations. Potential for increased off road use from thinned areas, but decreased use on rehabilitated non-system roads. Reduced wildfire risk.	Limited effect on users during operations. Potential for increased off road use from thinned areas, but decreased use on rehabilitated non-system roads. Reduced wildfire risk.	Limited effect on users during operations. Potential for increased off road use from thinned areas, but decreased use on rehabilitated non-system roads. Reduced wildfire risk.	Limited effect on users during operations. Potential for increased off road use from thinned areas, but decreased use on rehabilitated non-system roads.	Limited effect on users during operations. Potential for increased off road use from thinned areas and created openings, but decreased use on rehabilitated non-system roads. Reduced wildfire risk.
Net Operations Cost Over 9-Year Period	$0	$14.6 million	$16 million	$11.4 million	$15.1 million	$5.3 million	$22.2 million
Total Cost Over 30 Years (Operations + Predicted Wildfire Damage)	$240 million	$84 million	$86 million	$115 million	$85 million	$237 million	$91 million

CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Introduction

Chapter 3 provides the analytical basis for the alternative comparison in Chapter Two. The specialist reports (see list of Appendices) include more detailed analysis than is included in Chapter 3 and are hereby incorporated by reference.

The Trout-West analysis area consists of the Trout and West Creek Watersheds. The analysis area contains about 130,000 acres. Vegetation treatment is proposed for six treatment units (a total of approximately 30,000 acres) located within the larger analysis area (see Map 1). Throughout this FEIS, the two watersheds together are termed the "analysis area," while the six units where treatment is proposed are collectively referred to as the "project area."

The analysis provided in Chapter 3 characterizes short and long term effects of the proposed project. Short-term effects are those that last during the immediate implementation period and up to five years afterward. Long-term effects are those that last beyond five years from the time the project is completed.

Cumulative effects consideration includes the 2002 Hayman Fire, the 2001 Polhemus Burn, and the Trout Creek Timber Sale (2002-2003). Map 8 displays the Cumulative Effects Analysis Area. Other ongoing ongoing actions within the anlaysis areas include grazing, recreation, and rural agricultural and residential development.

A salvage proposal is being considered for the Hayman Fire area. The salvage proposal would likely be implemented ahead of the Trout-West Fuels Reduction Project. No decisions have been made about the Hayman Salvage, but an Environmental Assessment (EA) has been circulated (USDA 2003a). Cumulative effects analysis considers the preferred alternative in the Hayman Salvage EA, Alternative 3,, which would remove burned trees on 5,437 acres in West Creek, and 632 acres in Trout Creek.

A list of the scientific and common names of plants, animals, and pathogens discussed in this chapter is included in Table 75.

Crown Fire Hazard

The primary purpose of the Trout-West Fuels Reduction Project is to reduce the probability of damaging wildfires in the project area. Over 80 percent of mature forest stands in the Trout-West project area exceed 40 percent canopy closure and are prone to extreme fire behavior. Appendix C includes the full Fire and Fuels Management Specialist Report submitted by Foster Wheeler Corporation for this project.

Map 8

Back of map 8

A study of the Hayman Fire (USDA 2003b) concluded that the horizontal and vertical continuity of surface and crown fuel structure affected fire severity. Dense ponderosa pine/Douglas-fir stands were susceptible to torching, crown fire, and ignition by embers, even under moderate weather conditions. Continuous fuels within the Upper South Platte drainage were found to hamper fire suppression efforts. The few large areas on the Hayman landscape that recently experienced wildfires or fuels management activities (i.e., Schoonover wildfire 2002, Polhemus prescribed burn 2001, Big Turkey wildfire 1998) produced significant but isolated effects on fire growth.

Affected Environment

The concept of Fire Regime Condition Classes was developed by the Forest Service to describe how different the current landscape is from the historic landscape, specifically in terms of potential fire behavior. Table 11 describes characteristics associated with each Condition Class.

Table 11. Fire Regime Condition Class Descriptions

Condition Class	Description
Class 1	Vegetation composition, structure, and fuels are similar to those of the historic regime and do not pre-dispose the system to risk of loss of key ecosystem components. Wildland fires are characteristic of the historic fire regime behavior, severity, and patterns. Disturbance agents, native species habitats, and hydrologic functions are within the historic range of variability. Smoke production potential is low in volume.
Class 2	Vegetation composition, structure, and fuels have moderate departure from the historic regime and predispose the system to risk of loss of key ecosystem components. Wildland fires are moderately uncharacteristic compared to the historic fire regime behaviors, severity, and patterns. Disturbance agents, native species habitats, and hydrologic functions are outside the historic range of variability. Smoke production potential has increased moderately in volume and duration.
Class 3	Vegetation composition, structure, and fuels have high departure from the historic regime and predispose the system to high risk of loss of key ecosystem components. Wildland fires are highly uncharacteristic compared to the historic fire regime behaviors, severity, and patterns. Disturbance agents, native species habitats, and hydrologic functions are substantially outside the historic range of variability. Smoke production potential has increased with risks of high volume production of long duration.

A Fire Regime Condition Class Analysis for the Trout-West area was conducted using the *Fire Regime Condition Class and Associated Data for Fire and Fuels Planning: Methods and Applications* (Hann and Strohm 2001).[9] This analysis determined that the Trout and West Creek watersheds as a whole are in Fire Regime Condition Class 2.

[9] Hann and Strohm (2001) includes pre-Hayman Fire Analysis. Diane Strohm, Pike National Forest, completed a Changed Conditions Analysis following the Hayman Fire. The acreages in the tables in this section reflect post-Hayman Fire conditions.

Four vegetation types found in Trout and West Creek Watersheds were evaluated for Fire Regime Condition Class. The vegetation types include the following:

- Vegetation Type 1: Undulating Ponderosa Pine Type
- Vegetation Type 2: Lower Elevation South Aspect, Ponderosa Pine
- Vegetation Type 3: Lower Elevation, North Aspect, Ponderosa Pine/Douglas-fir
- Vegetation Type 4: Higher Elevation, Ponderosa Pine/Aspen/Douglas-fir/Spruce/Lodgepole

Within each vegetation type, the acreage that would need to be treated or maintained to bring the Fire Regime Condition Class to 1 was estimated (ibid, see Table 12). Analysis file documents further detail the Fire Regime Condition Class analysis process, including maps, tables, and methodology.

The Trout-West project area does not contain sufficient acreage of Vegetation Type 3 to address Condition Class in this type.

Table 12. Acres to Treat/Maintain to Reduce Watershed Condition Class

Vegetation Type	Description	Acres	Condition Class	HRV Dep.	Acres to Treat	Acres to Maintain	Total Acres to Treat
1	Undulating Ponderosa Pine	41,173	2	45	4,941	1,770	6,711
2	Low Elevation S-aspect Ponderosa Pine	11,832	1	32	0	663	663
3	Low Elev. N-aspect Ponderosa Pine/ Douglas-fir	7,251	2	65	2,320	218	2,538
4	High Elevation Ponderosa Pine/ Aspen/Douglas-fir/Spruce/ Lodgepole Pine	63,302	2	53	12,660	1,836	14,496
Total		**123,558**[10]	**2**	**49**	**19,921**	**4,487**	**24,408**

[10] This acreage includes National Forest within the Trout and West Creek watersheds and the Horse Creek subwatershed.

Existing Fuel Loading

Current fuel load data shows an average of 18 tons per acre (with a low of 11 tons per acre and a high of 34 tons per acre) based on sample plots taken in 2001.

Environmental Consequences

Post-Treatment Fuel Loading

Slash created from thinning would average about 13 tons per acre. Fuel loading would be reduced to four to six tons per acre in treated areas in all alternatives.[11] Operations in themselves may create increased fuel hazard on particular sites until follow up surface fuels treatment is completed. Created slash loadings would be dispersed through the project areas and limited to short periods of time (slash would be fully treated within one to two years). Mechanical treatments and yarding would distribute and treat slash coincident with thinning operations to avoid increased hazard where possible.

Project Effectiveness in Reducing Hazard

The *Economic Analysis for Roadless Area Vegetation Treatments, Upper South Platte Protection and Restoration Project* (Culver 2002) included a fire risk assessment that was used to provide values for the existing risk of damaging wildfire in the Trout-West analysis area. The Upper South Platte project estimated that the average size of a damaging wildfire was 10,500 acres, and such a wildfire is predicted to recur within a 10-year period.

The Trout-West IDT applied the Upper South Platte predictions to the watershed analysis area. Four such fires are predicted for the Trout and West Creeks watershed, given the size of the watershed, Condition Class analysis, and observed fire behavior during the Hayman Fire.

Under No Action, the entire watershed is predicted to burn within a 30-year period. Treatment within the project area has the potential to reduce risk of damaging wildfire in treated and untreated areas in the watershed, as is explained in the fire risk assessment for the Upper South Platte Project (ibid).

The project would become increasingly effective each year as more and more of the project was implemented. Expected completion of treatments is by the tenth year. The project is expected to retain its full effectiveness for 20 years. All action alternatives would require future treatment to maintain reduced fuel hazard. Alternative D would need more frequent maintenance since it would tend to retain more tree canopy than the other alternatives.

[11] Fuel loading may be increased if needed to meet site-specific large woody material requirements. Methodology for fuel loading and slash weight estimates are in the project file.

Post-Hayman Fire Acres to Treat/Maintain was displayed in Table 12. These values were compared with treatment acreages for the alternatives to determine whether each alternative fully reduces Fire Regime Condition Class. Table 13 shows the acreage treated in the Proposed Action and Alternative E. These alternatives treat an adequate number of acres to fully reduce Condition Class, particularly in Vegetation Types 1, 2 and 4. Note that the predominant type needing treatment is Vegetation Type 4 and this type is the predominant type proposed for treatment under the Proposed Action and Alternative E. Stands within this vegetation type are overly dense and prone to crown wildfire.

Table 13. Acres Needing Treatment Compared to Proposed Action and Alternative E

Vegetation Type	Acres to Treat/Maintain	Alternative E Treat/Maintain	Proposed Action Treat/Maintain
1	6,711	5,860	4,489
2	663	1000	766
3	2,538	750	575
4	14,496	18,710	14,340
Total	**23,814**	**26,320**	**20,170**

Alternatives A and C treat an acreage that is similar to the Proposed Action, while Alternatives B and D treat significantly less acreage.

Tables 14 and 15 summarize the effectiveness rankings and percentage of risk for a large damaging wildfire and acres of predicted wildfire each year once each alternative has been fully implemented. These rankings and predicted wildfire estimates are based on comparisons between the treatment acres in each alternative and the Fire Regime Condition Class recommendations, as well as professional judgment. These rankings assume that the Hayman Fire is representative of one fire within the watershed this decade.

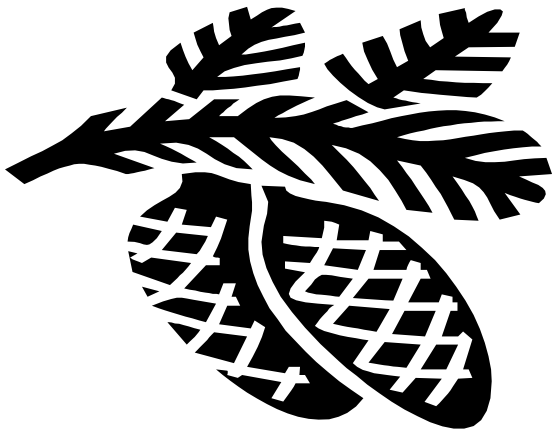


Table 14. Effectiveness Rankings and Risk of Large Wildfire by Alternative

Alternative	Effectiveness Ranking		Percent Of Risk by Year					
			1		5		10	
	Project Area	Balance of Watershed	Project Area	Balance of Watershed	Project Area	Balance of Watershed	Project Area	Balance of Watershed
No Action	0	0	10	10	50	50	100	100
Proposed Actio	9	5	2	3	10	15	20	30
Alternative A	8	4	2	3	10	15	20	30
Alternative B	6	3	4	6	20	30	40	60
Alternative C	9	5	2	3	10	15	20	30
Alternative D	2	1	8	10	40	50	80	100
Alternative E	10	5	2	3	10	15	20	30

Table 15. Acres of Wildfire Predicted by Alternative

Alternative	Acres by Year		
	1	5	10
No Action	4,200	21,000	42,000
Proposed Action	1,150	5,750	11,500
Alternative A	1,150	5,750	11,500
Alternative B	2,310	11,550	23,100
Alternative C	1,150	5,750	11,500
Alternative D	3,990	19,950	39,900
Alternative E	1,150	5,750	11,500

No Action

No Action would defer vegetation management within the project area. The direct effect of No Action is that live and dead fuel loading and continuity would continue to increase. The indirect effect is that the probability of a damaging wildfire would increase over time. Wildfires would continue to be difficult or impossible to control/maintain. Flame lengths would exceed levels (eight feet and greater) that provide for suppression success. Firefighter and public safety would be at risk. Current threats to the one-mile buffer zone (including homes, other buildings, and human improvements on private lands) resulting from severe wildfire conditions would continue.

Cumulative Effects of No Action

Two projects that affect the analysis area but that are not directly tied to the project area are the Polhemus Prescribed Fire and the Trout Creek Timber Sale. The Polhemus Prescribed Fire (a broadcast burn) was conducted during the fall of 2001 and covered approximately 8,000 acres as a low intensity burn through all four vegetation types. The Trout Creek Timber Sale was conducted in Vegetation Type 1. The Hayman Fire consumed about 950 acres of the timber sale area. While the two areas provide a reduction of risk and fuel hazard to their immediate areas of treatment, sufficient acreages have not been treated to effectively reduce the Fire Regime Condition Class without implementing other treatments throughout the project area.

The Hayman Fire is thought to have reduced overall fuel hazard in West Creek, and the treatment acreage within this watershed was reduced following the fire. The proposed Hayman Fire Salvage is expected to further reduce fire hazard, especially in West Creek. The Hayman Salvage EA concluded that its Proposed Action would augment the Trout-West Fuels Reduction Project by reducing long-term dead fuel loading and increasing forest heterogeneity (USDA 2003a).

Proposed Action and Alternative C

Vegetation treatment under both the Proposed Action and Alternative C would move about 20,000 acres from Fire Regime Condition Classes 2 and 3 toward Condition Class 1 and significantly reduce the probability of a damaging wildfire. The indirect effect would be that wildfires would burn with lower fire intensities and would be easier to suppress. Resistance to control (suppression) would be lower and ground fires, as they occur, would be expected to burn at flame lengths of four feet in height or less. Fuel ladders would not be common and the potential for a fire to spread through tree crowns would be significantly reduced. Fires within untreated areas would be easier to suppress once they moved into treated areas.

Within the 30,000-acre project area, the probability of a damaging wildfire occurring within 10 years would be reduced from the current 100 percent to 20 percent. Outside the watershed, probability would be reduced to 30 percent.

Current threats to the one-mile buffer zone (including homes, other buildings, and human improvements on private lands) resulting from severe wildfire conditions would be greatly minimized. The conditions for potential wide-scale, high to extreme stand-replacing fires would be greatly lessened. Conditions resulting from implementation of this alternative would significantly improve public and fire fighter safety.

Cumulative Effects of Proposed Action and Alternative C

Two projects that could have an effect within the analysis area but are not directly tied to the project area are the Polhemus Prescribed Fire and the Trout Creek Timber Sale. The Polhemus Prescribed Fire (a broadcast burn) was conducted during the fall of 2001 and covered approximately 8,000 acres as a low intensity burn through all four Vegetation Types. The Trout Creek Timber Sale was conducted in Vegetation Type 1 (the Hayman Fire consumed about 950 acres of the timber sale area).

The Proposed Action, in combination with the treatments of these two areas, would provide effective reductions in the Fire Regime Condition Classes. The consequence of these actions would move the entire Trout Creek and West Creek Watersheds (analysis area) toward the more favorable environmental conditions experienced prior to the European settlement period. Fire, when occurring across the landscape, would not have the far-reaching negative consequences that are currently being experienced. Wildfire may resume a more natural role under this alternative. The Proposed Hayman Fire Salvage would reduce future fuels hazard in West Creek.

Alternative A

The effectiveness of Alternative A will be similar to the Proposed Action, even though no burning will occur. Yarding would effectively remove hazardous fuels, with the same benefits as the Proposed Action. About 2,000 acres would not be treated, but effectiveness would not be significantly reduced. The cumulative effects of Alternative A are similar to those described under the Proposed Action.

Alternative B

Alternative B treats fewer acres than the Proposed Action, leaving more of the project area at high risk of a damaging wildfire. Treated acres would have the beneficial effects described for the Proposed Action, but the potential for a damaging wildfire within the project area would not be as reduced.

Within the 30,000-acre project area, the probability of a damaging wildfire within 10 years would be reduced from the current 100 percent to 50 percent under Alternative B. Outside the watershed, probability would be reduced to 60 percent.

Reducing fuel hazard closest to private land would adequately protect some private property values, but some would remain at risk. In general, the Trout Creek watershed would be affected similarly to the Proposed Action, but the West Creek watershed would be affected similarly to the No Action alternative. As a whole, the municipal watershed would still be at considerable risk.

Cumulative Effects of Alternative B

Projects that have been completed, such as the Polhemus Prescribed Fire and the Trout Creek Timber Sale, do contribute to an increase in the effectiveness of this alternative when combined with the proposed Alternative B treatments. However these projects by themselves are not sufficient in size to reduce the Fire Regime Condition Classes. The combination of these projects with the proposed Alternative B treatments would move the entire Trout Creek and West Creek Watersheds toward the more favorable environmental conditions experienced prior to the European settlement period. Fire, when occurring across the landscape, would not have the far-reaching negative consequences that are currently being experienced, but to a lesser extent than would be realized under the Proposed Action. There is less opportunity for wildfire fire to resume its more natural role under this alternative.

Alternative D

Alternative D treats about 7,000 acres within one-half mile of private land. The effectiveness of this alternative is very low because of the low number of acres treated. The probability of damaging wildfire would be reduced in the area directly adjacent to private land, but the analysis area as a whole would not be significantly affected.

Suppression resource actions would have greater success in the one-half mile treated area because of the lighter fuels that would exist following treatment. Resistance to control (suppression) would be lowered and ground fires, as they occur, would be expected to burn at flame lengths of four feet in height or less. Fuel ladders would not be common in the treated zone. However, in the untreated areas, suppression success would remain similar to current conditions, with greater resistance to control, flame lengths greater then four feet, more common fuel ladders, and high canopy closures. These factors would perpetuate the risk for large, damaging, high-intensity wildfires.

Alternative D maintains an 80 percent risk for a large, damaging, high-intensity wildfire to occur within the project area during next 10 years. For the balance of the watershed, the risk is similar to No Action. Cumulative effects are similar to No Action.

Alternative E

Alternative E would be incrementally more effective than the Proposed Action because it treats more acres; however, the probability of a damaging wildfire occurring in the 30,000-acre project area is the same as the Proposed Action because some risk will remain, despite the increase in effectiveness. Both the Proposed Action and Alternative E effectively reduce fuel hazard within the project area. Cumulative effects are similar to the Proposed Action.

Vegetation Conditions

Affected Environment

Vegetation within the Trout-West analysis area differs dramatically from the historic condition. Studies from researchers such as Dr. Merrill Kaufmann and others (Kaufmann et al. 2001; Kaufmann et al. 2000; Kaufmann et al. 1999; and Brown et al. 1999) indicate that the historic forest was older, more open, and more diverse than today's conditions.

The historic forest was subject to mixed-severity wildfires that burned intensely through patches of dense forest and less intensely in more open areas. Aspen regenerated and was cultured through these fires. Old trees were much more common across the landscape. Openings with few or no conifers were persistent across a greater percentage of the area. Kaufmann's 2001 research indicates that over 90 percent of the landscape had crown closures of 30 percent or less.

Today's forest is the result of logging and fire suppression. Logging in the late 19th and early 20th centuries removed virtually the entire overstory, so older trees and old-growth habitats are rare or non-existent. Fire suppression resulted in the survival and growth of virtually all conifer regeneration, so the formerly persistent openings have regenerated and no new ones have been created. At higher elevations, aspen would have dominated some of these openings, but fire suppression has allowed conifers to overtop and shade out the aspen.

The resulting landscape is now much denser than the historic condition. Douglas-fir has encroached on non-northerly aspects and openings have filled in. Stands have become multi-storied. Individual tree growth has stagnated, limiting the forest's ability to produce larger diameter trees. The forest structure across the landscape is now simplified and homogenous compared to the historic complex and heterogeneous forest structure.

Following a major disturbance such as a stand replacement fire, a forest will develop from grass/forb through shrub/seedling and sapling/pole to the mature structural stage. The decadent stage occurs when stands start breaking apart due to old trees dying. Table 16 shows the historic average and range of structural stages and stand densities in the Trout-West area. The current range of structural classes as compared with historic conditions is displayed in Table 17.

Table 16. Historic Vegetation Condition

Structure Stage	Percent of Landscape			
	Ponderosa Pine (warm)		Douglas-fir (cooler)	
	Average	Range	Average	Range
Grass/Forb	20	15 - 30	10	5 - 20
Tall Shrub/Seedlings	10	5 - 20	5	0 - 10
Open to Medium (10 - 40 percent canopy closure) Sapling/Pole	15	10 - 25	25	15 - 35
Medium to Dense (40 - 70 percent canopy closure) Sapling/Pole	4	0 - 8	4	0 - 8
Very Dense (> 70 percent canopy closure) Sapling/Pole	1	0 - 1	1	0 - 2
Total Sapling Pole	20		30	
Open Mature	30	20 - 40	35	25 - 45
Medium-Dense Mature	4	0 - 8	4	0 - 8
Very Dense Mature	1	0 - 1	1	0 - 2
Decadent	15	10 - 20	15	0 - 20

Table 17. Current and Historic Vegetation Conditions

Structure Stage	Historic Condition	Current Condition	Historic Condition	Current Condition
	Ponderosa Pine Stands		Douglas-fir Stands	
Grass/Forb	20	<1	10	0
Tall Shrub/Seedling	10	0	5	0
Sapling/Pole	20	3	30	0
Mature Open	30	39	35	0
Mature Medium to Dense	4	47	4	84
Mature Very Dense	1	11	1	16
Decadent	15	0	15	0

Old-Growth

As previously shown in Table 17, no decadent stands were identified in the Trout-West project area during field reconnaissance. Tables 18 and 19 describe old-growth components for ponderosa pine and Douglas-fir, and compare historic and current conditions relative to these components. The components described in the following tables are based on the work of Mehl (1992).

Table 18. Old-Growth Components - Pine

Old-Growth Component	Historic Condition	Trout-West Condition
Live Trees/Upper Canopy		
Minimum Diameter	16 inches	10 – 14 inches
Minimum Trees Per Acre > 18 inches	10	0 - 10
Age	200 years minimum	Avg. 100 – 125 years
Variation in Tree Diameter?	Yes	Yes
Decadence (dead, broken or deformed tops and/or bole or root rot)?.	Yes	Some
Multiple Tree Canopy Layers?	No	Yes
Dead Trees		
Average DBH - Standing	10	8 - 12
Minimum Trees per Acre - Standing	2	0 - 2
Down pieces per acre	None	Some

Table 19. Old-Growth Components, Douglas-fir

Old-Growth Component	Historic Condition	Current Condition
Live Trees/Upper Canopy		
Minimum Diameter	18 inches	10 – 12 inches
Minimum Trees Per Acre > 18 inches	10	0 - 5
Age	200 years minimum	100 – 125 years average
Variation in Tree Diameter?	Yes	Yes
Decadence –(dead, broken or deformed tops and/or bole or root rot)?	Yes	Some
Multiple Tree Canopy Layers?	No	Yes

Old-Growth Component	Historic Condition	Current Condition
Dead Trees		
Average DBH - Standing	10	6 - 10
Minimum Trees per Acre - Standing	2	0 – 2
Down Pieces Per Acre	Some	Some

Mapped Old-Growth

The Wildland Resource Inventory System (WRIS) identified several stands within the Trout-West project area as potential old-growth. No old-growth trees or habitat was found during field reconnaissance conducted in 2001. The type of thinning proposed is intended to maintain older trees in mature stands and retain old-growth components such as snags, down wood, and clumpy distribution.

Aspen

Quaking aspen was more extensive historically within the Trout-West area and some older stands likely occurred. Today, conifers have encroached and overtopped much of the aspen and the aspen stands are dying or falling apart.

Environmental Consequences

Tables 20 and 21 show the structural stage distribution estimated for pine and fir stands as a result of each alternative, along with the historic condition.

Table 20. Percent of Landscape by Structure Stage, Pine Stands

Structure Stage	Historic Condition	No Action	Proposed Action	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Grass/Forb	20	<1	<1	<1	<1	<1	<1	20
Tall Shrub/Seedling	10	0	0	0	0	0	0	10
Sapling/Pole	20	3	3	3	3	3	3	3
Mature								
10-30 Percent CC Open	25-30	9	7 2	7 1	4 6	7 2	2 1	61
30-40 Percent CC Medium	0-5	30	6	6	25	6	33	1
40-70 Percent CC Medium to Dense	4	4 7	8	9	15	8	32	4
>70 Percent CC Very Dense	1	11	11	11	11	11	11	1
Decadent	15	0	0	0	0	0	0	0

Table 21. Percent of Landscape by Structure Stage, Douglas-fir Stands

Structure Stage	Historic Condition	No Action	Proposed Action	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Grass/Forb	10	0	0	0	0	0	0	10
Tall Shrub/Seedling	5	0	0	0	0	0	0	5
Sapling/Pole	30	0	0	0	0	0	0	0
Mature								
Open to Dense	35	0	69	68	48	69	29	80
Medium to Dense	4	84	15	16	36	15	55	4
Very Dense	1	16	16	16	16	16	16	1
Decadent	15	0	0	0	0	0	0	0

No Action

Under the No Action alternative, all treatments would be deferred to some future time, if they occurred at all. The forest landscape would continue towards homogeneity and away from the complex, heterogeneous landscape typical of the historic condition described above. Stand densities and canopy covers would slowly increase, individual tree growth would continue to be suppressed and the development of mature forest characteristics, such as large trees, would be limited. Douglas-fir would continue to encroach on ponderosa pine stands. Multiple stand layers would increase as regeneration occurs and/or stands continue to develop. Aspen would continue to be shaded out and would eventually die unless a disturbance such as fire or insects removed the pine overstory and released the aspen. In summary, the landscape would have little resemblance to the historic condition.

A 10,500-acre fire is predicted to burn in the project area within the next 10 years. Burned stands would be set back to an early seral condition (i.e. grass and forbs). About 40 percent of the project area would be affected, far above the historic condition of 20 percent for pine and 10 percent for fir. In addition, the early seral condition would be at a landscape level rather than the stand level, creating a homogenous landscape instead of a heterogeneous landscape. If aspen is present, it would likely sprout and could dominate the site for many years. Conifer regeneration along the burn's perimeter would likely occur within the near future (10 to 20 years), but regeneration in the burn's interior would be sparse to non-existent for many years due to lack of a seed source.

Cumulative Effects

The Polhemus Burn and Trout Creek Timber Sale increased the acreage that resembles the historic condition; however, these projects alone are too small to have a significant effect across the watershed.

The Hayman Fire burned approximately 26,800 acres within the analysis area, setting at least half the area back to an early seral condition. An additional 4,700 acres are predicted to burn within the analysis area, but outside the project area, within the next 10 years. This would leave approximately 42,000 acres, or 30 percent, of the landscape in an early seral condition, which is well above the historic condition. Aspen is currently sprouting in areas burned by the Hayman Fire and could become a major landscape component where it existed prior to the burn. The Proposed Hayman Fire Salvage does not change this analysis.

Proposed Action and Alternatives A and C

These alternatives would treat approximately 20,000 acres, or about 75 percent, of the forested landscape in the project area. Treated stands would be thinned to an average canopy cover of 15 to 25 percent. This would largely mimic the historic condition for stands exceeding 10 percent canopy cover. However, these alternatives would not re-create the 30 percent of the landscape that historically had less than 10 percent canopy cover.

On the treated acres all pine stands would be single storied, and Douglas-fir would be mainly restricted to northerly aspects. Pine and Douglas-fir regeneration could occur within five to 10 years or as long as 50+ years after treatment, depending upon cone crops and climatic conditions. After establishment, conifers would require 10 to 20 years of growth before becoming a fuels problem. Where aspen exists it would be released and become a major stand component. Leave-trees would be retained in clumps at a variety of densities to increase stand complexity. An increase in light and moisture would promote the growth and establishment of grasses, forbs, and shrubs.

After 20 years, additional maintenance treatments would likely be needed to maintain desired conditions. All treated acres would likely increase in density uniformly and if follow-up maintenance treatments don't occur, treated stands within the project area would simultaneously return to a level of high susceptibility to stand replacement fire.

About 950 acres would be treated without yarding, likely requiring several entries to complete. The beneficial impacts would be incremental until the treatment is completed, at which time the consequences would be the same as other treated acres.

These alternatives are associated with reduced risk of damaging wildfires. Fires that do occur in the area are less likely to kill leave-trees and change structure class distribution.

Cumulative Effects

The Polhemus Burn and Trout Creek Timber Sale increased the acreage that resembles the historic conditio; however, these projects alone are too small to have a significant effect across the watershed.

The Hayman Fire burned approximately 26,800 acres within the analysis area, setting at least half of the area back to an early seral condition. Aspen is currently sprouting in the areas burned by the Hayman Fire and could become a major landscape component where it existed prior to the burn. The Proposed Hayman Fire Salvage would not change these effects.

Alternative B

Under this alternative, 13,570 acres would be treated. Treated acres would be thinned in a similar fashion as the Proposed Action, except that much of the Phantom project area would remain untreated. Effects on vegetation would be similar to the Proposed Action in treated areas, and similar to No Action in untreated areas.

Alternative D

This alternative treats 6,750 acres with a different prescription than the Proposed Action. A diameter limit would apply to all thinned trees and dwarf mistletoe would not be discriminated against when selecting leave-trees. The diameter limit would likely leave stands or portions of stands at higher percent canopy cover than desired. The effects of Alternative D are most similar to No Action.

Alternative E

This alternative treats approximately 26,320 acres, or about 6,000 more acres than the Proposed Action. Of the acres treated, 70 percent of the pine stands and 85 percent of the Douglas-fir stands would be thinned identically to those in the Proposed Action and would therefore have the same consequences.

Alternative E would create openings ranging from two to 40 acres (averaging 20 acres) in 30 percent of the pine stands and 15 percent of the Douglas-fir stands. One-third of the openings would be actively regenerated. Unregenerated openings would persist as grasses and forbs on southern aspects and lower elevations, and convert to aspen on the northerly aspects and higher elevations. This alternative most closely resembles the historic condition than any other alternative.

If selected, this alternative would likely require a Forest Plan Amendment to allow for persistent unregenerated openings.

In other action alternatives, it was noted that stands would grow at relatively similar rates and simultaneously reach high canopy densities and susceptibility to stand replacement fire. This is also true for thinned stands in this alternative; however, the stands returned to an early seral condition would still have low canopy cover and a higher resistance to stand replacement fire than thinned stands. Cumulative Effects are similar to the Proposed Action.

Effects on Old-Growth

No Action

Based on Mel Mehl's (1992) old-growth descriptions and characteristics, there is little to no old-growth in the analysis area. This is primarily due to the minimum age requirement of 200 years. In 50 to 100 years, most of the landscape would have reached the minimum 10 trees per acre, 16 inches (18" for Douglas-fir) DBH, and 200 years of age. Most, if not all, the pine stands would be multi-storied, which is not an old-growth characteristic for pine. In the absence of treatment, the development of old-growth over time would likely be threatened by forest pathogens (i.e., mountain pine beetle, tussock moth and dwarf mistletoe), which could convert large acres of potential old-growth to an earlier seral condition.

A stand replacement fire is predicted to occur in the project area, potentially converting 10,500 acres to an early seral condition. Stands replaced through wildfire would take centuries to become old-growth.

Cumulative Effects

The Polhemus Burn and Trout Creek Timber Sale will contribute to the old-growth component over time. The Hayman Fire burned approximately 26,800 acres; at least half was returned to an early seral condition, requiring at least 200 years for conifer old-growth to return. Another stand replacement fire is predicted to burn in the analysis area in the coming decade, converting an additional 4,700 acres to an early seral stage.

Proposed Action and Action Alternatives

Though still needing 50 to 100 years to meet the 200-year age requirement for old-growth, treated stands would be in a far better position to attain this goal than untreated stands. Trees in treated stands would increase in size and would likely exceed the minimum DBH requirements of 16" and 18" for pine and fir, respectively. Thinning would effectively reduce the risk of damaging wildfire, so old-growth will more likely develop. No adverse effects to stands mapped as old-growth in the RIS database are anticipated to result from the treatments. The effectiveness of each alternative is directly related to acres treated: the more acres treated, the less likely damaging wildfires will occur..

Alternative E converts 30 percent of the treated acres to an early seral stage. While this is consistent with the historic condition, these acres would require 200 years to reach an old-growth condition. Predicted wildfires would be less likely to return treated stands to early seral conditions.

Cumulative Effects

The Polhemus Burn and Trout Creek Timber Sale will contribute to the old-growth component over time. The Hayman Fire burned approximately 26,800 acres; at least half was returned to an early seral condition, requiring at least 200 years for conifer old-growth to return. The proposed Hayman Fire Salvage would retain adequate snags to provide for future old-growth components in these stands.

Forest Pathogens

Affected Environment

Bark beetles, tussock moth, and dwarf mistletoe are the primary forest pathogens that affect the Trout-West area.

Bark Beetles

Members of the genus *Dendroctonus* are by far the most destructive group of bark beetles in North America. Twelve species occur in the West (Furniss and Carolin 1977), but only the mountain pine beetle (*Dendroctonus ponderosae*) and the Douglas-fir beetle (*Dendroctonus pseudotsugae*) are likely to have a significant effect on the conifers within the Trout-West analysis area.

Mountain pine beetle (MPB) attacks and kills lodgepole, ponderosa, sugar, and western white pines. Outbreaks frequently develop in dense stands of pole-sized ponderosa pine. When outbreaks are extensive, millions of trees may be killed each year, influencing the forest ecosystem (McCambridge et al. 1979). For example, the MPB kills proportionately more large-diameter trees than small-diameter trees and thus alters the diameter distribution (Schmid and Amman 1992).

The Douglas- fir beetle is similar to other *Dendroctonus* bark beetles. Populations can reach epidemic proportions when forests are stressed from overstocking, from drought. or following outbreaks of Douglas-fir tussock moth.

Most of the Trout-West project area consists of multi-storied stands with at least 100 square feet of basal area. These conditions make the area susceptible to mountain pine beetle attack. Several small pockets of mountain pine beetle related mortality was observed in the Long John and Ridgewood project areas in 2002.

Douglas-fir Tussock Moth

Douglas-Fir tussock moth (*Orgyia pseudotsugata*)is a member of a group of insects called defoliators, which feed upon tree foliage. Outbreaks develop explosively and after about 3 years, abruptly subside. Between outbreaks, this insect is seldom seen (Wickman et al. 1981; Furniss and Carolin 1977).

Studies of large Douglas-Fir tussock moth (DFTM) outbreaks in the Northwestern United States have indicated that the underlying cause of a DFTM outbreak is a susceptible forest. A susceptible forest is characterized by dense, uneven-aged and multi-storied stands, of predominately Douglas-fir and/or true firs. Many years of forest management that emphasized fire prevention and suppression, along with other management practices, have resulted in a gradual shift from ponderosa pine to Douglas-fir. This change in forest composition and structure has resulted in large areas along the Front Range of Colorado that are more susceptible to large scale DFTM outbreaks. Approximately 26,000 acres within the project area are currently highly susceptible to a DFTM outbreak.

In 1993, a major outbreak of DFTM occurred in the South Platte watershed just north of the Trout-West analysis area. The outbreak defoliated 7,000 acres of Douglas-fir scattered over a 19,000-acre area, resulting in significant mortality. This was one of the largest outbreaks of DFTM ever recorded in the State of Colorado and resulted in huge numbers of dead trees.

Dwarf Mistletoe

Dwarf mistletoe (*Arceuthobium vaginatum*) is a parasite that affects ponderosa pine throughout the Trout-West project area, particularly within the Long John, Ryan Quinlan, and Ridgewood areas. Dwarf mistletoe causes swelling in pine branches, which ultimately reduces a tree's growth rate in both height and diameter once the upper half of the tree's crown is infected. Severe infection eventually kills the tree. The time required for the parasite to kill a tree varies considerably and depends on many factors.

Alexander and Hawksworth (1975) suggest that dwarf mistletoe abundance has increased throughout the Western U.S., as well as the severity of infection. The dwarf mistletoe seen throughout Trout-West is likely at historically high levels in terms of abundance and degree of infection.

Environmental Consequences of Pathogens

Direct and Indirect Effects of No Action

Dwarf mistletoe infection centers would increase in size, and openings would be created due to tree mortality. Overstory trees with dwarf mistletoe would likely infect ponderosa pine regeneration in the openings. Predicted wildfire would kill trees infected with dwarf mistletoe and pine regeneration after the fire would be less likely to become infected.

Susceptibility to MPB attack is currently high and would increase with stand density. MPBs are currently active throughout the Colorado Front Range, and without disturbance, would eventually attack the Trout-West analysis area. Thousands of acres could be affected by a MPB outbreak. The larger diameter, older trees would be attacked first, followed by the smaller trees. Tree density would be reduced and large openings would be created.

The probability of a DFTM outbreak would also increase as Douglas-fir increases in density and continues to encroach onto ponderosa pine sites. An outbreak would likely affect thousands of acres and kill Douglas-fir of all sizes and age classes, following a similar pattern to the outbreak north of the analysis area in the early 1990s.

A stand replacement fire in the project area would reduce potential pathogen habitat by 10,500 acres but would not reduce the likelihood of bark beetle and tussock moth outbreaks in unburned areas. A stand replacement fire would, however, create a barrier to the spread of dwarf mistletoe.

Cumulative Effects of No Action

The Polhemus Burn, Trout Creek Timber Sale, and the Hayman Fire had some minor beneficial effect but would not significantly slow the spread of bark beetles and tussock moth into the project area.

Dwarf mistletoe is currently found within the project area. The Polhemus and Trout Creek Timber Sales reduced the amount of dwarf mistletoe in treated areas, but alone would not slow the spread of dwarf mistletoe in the project area. The Hayman Fire is likely to form a barrier to the spread of dwarf mistletoe from the project area to the west. Fire salvage will not change these effects.

Direct and Indirect Effects of the Proposed Action and Alternatives A and C

Under the Proposed Action and Alternatives A and C, trees infected with dwarf mistletoe would be heavily thinned. Dwarf mistletoe would not be removed from the landscape, but likely set back to a level more closely resembling the historic condition. With a more open, single-layered forest condition, the spread of dwarf mistletoe would be slowed.

MPB and tussock moth activity would be reduced to historic levels and the chance of a major outbreak would be unlikely. While some untreated stands would still be susceptible, an outbreak is unlikely due to the small size and isolation of untreated stands from other susceptible stands.

Cumulative Effects of the Proposed Action and Alternatives A and C

The project would have cumulatively beneficial effects from the Polhemus Burn and Trout Creek Timber Sale, the Hayman Fire, and future predicted wildfire. The project area would be less susceptible to dwarf mistletoe, tussock moth, and bark beetle activity. Proposed Hayman Fire Salvage would not alter these effects.

Effects of Alternative B

The consequences are the same as the Proposed Action in treated areas. Alternative B would reduce susceptibility to insects and disease over half of the project area. The Phantom Project area would still have high susceptibility. Cumulative effects are similar to No Action for much of the analysis area.

Effects of Alternative D

Alternative D would not reduce the potential for dwarf mistletoe spread, since it would not discriminate against mistletoe-infected trees in the thinning. The diameter limit would leave many stands or portions of stands at higher canopy covers than desired.

Most of the Long John, Ridgewood, Skelton, and about half the Ryan Quinlan project areas would be treated, reducing the potential for large tussock moth and bark beetle infestations. However, the potential for large insect outbreaks would not be reduced to the same extent as under the Proposed Action. Canopies would close in at a faster rate than the Proposed Action.

Cumulative effects are similar to No Action for most of the analysis area.

Effects of Alternative E

The direct, indirect, and cumulative effects of Alternative E would be the same as the Proposed Action, except that more acres would be treated so beneficial effects would be more widespread. In addition, some openings would be located in dwarf mistletoe-infected areas, thereby further reducing its ability to spread.

Soils and Water Quality

Affected Environment

About 90 miles of perennial streams and 130 miles of intermittent streams are mapped in the Trout Creek watershed, and 50 miles of perennial streams and 40 miles of intermittent streams are mapped in the West Creek watershed. The State of Colorado's Department of Health has designated the beneficial uses for these streams as Recreation Class 1, Agriculture, Aquatic Life Cold Water Class 1, and Domestic Water Supply.

The federal Clean Water Act requires states to compile a list of water bodies that are impaired (do not fully or partially support their beneficial uses), known as the 303(d) list. The Department of Health has identified Trout Creek and its tributaries as having impaired water quality, in this case for sediment, and placed Trout Creek on the 303(d) list. Trout Creek also may violate water quality standards for temperature (Gallagher and Saulters 1998), but is not on the 303(d) list for that reason. Excessive nutrient loading was identified in the Upper South Platte Watershed Landscape Assessment as another issue that affects the water quality of Trout Creek (Foster Wheeler 1999). Trail Creek, tributary to West Creek, has been placed on a monitoring and evaluation list for sediment.[12]

Beaver and Sediment

Beaver are an important biological component of these watersheds for maintaining watershed health and function. Sediment in road ditches and ephemeral draws below roads and behind beaver dams are clearly evident. Beaver dams function as grade-control structures built cheaply and effectively with available materials. The continued success of beaver in fulfilling their role in the proper functioning of the watershed depends on habitat quality. As available food supplies decline or the ponds become substantially silted in, the beaver move on, to higher quality habitat. Beaver dams can fail once beaver have moved on and can subsequently become sediment sources.

[12] A stream is placed on the Monitoring and Evaluation list if documentation is not adequate for listing on the 303(d) list, but some concern exists.

Roads and Sediment

Roads within the analysis area provide access for management activities and public use, but can have adverse impacts on watershed function. Potential impacts increase the closer the road is to a stream, the number of times the road crosses a stream, and with overall road density. As a result of use and in the absence of maintenance, road surfacing wears out and the profile becomes more rutted. No matter how shallow the ruts, water will flow down the ruts of roads with a grade and gain energy. This sediment-laden flow often leaves the road surface where the road flattens out at a stream crossing and contributes directly to stream sediment. Maintenance removes the ruts and shapes the road profile with a crown so that water takes the most direct path to leave the road surface and with much less energy.

About 560 miles of roads of all jurisdictions are mapped within the Trout Creek watershed, about 330 miles of which are on National Forest System lands. West Creek watershed contains 240 miles of road of all jurisdictions, 190 miles of which are on national forest system lands. About 109 miles of roads on National Forest system lands are considered "*unclassified*," which means that they are not system roads but were developed by off-road use. Unclassified roads have much higher potential to deliver sediment to streams than roads that are designed and constructed to specifications.

The effect of roads on sediment delivery varies with the distance the road is from a stream. Roads within 300 feet of a stream have the greatest potential to delivery sediment. Road surfacing also affects potential for sediment delivery: paved roads are least prone to erosion, gravel roads are moderately prone to erosion, and natural surface roads are the most prone to erosion.

Table 22 displays the road mileage by jurisdiction, surfacing, and distance from streams.

Table 22. Road Mileage by Watershed, Jurisdiction, and Surfacing

Road Mileage										
Watershed	Within 300'	FS				Other				All Roads
		Paved	Gravel	Native	Total	Paved	Gravel	Native	Total	Grand Total
Trout Creek	No	1.9	90.0	129.0	220.9	47.2	10.4	143.5	201.1	422.0
	Yes	0.9	37.3	42.9	81.1	11.5	0.2	44.9	55.6	137.7
Total		2.8	127.3	171.9	302.0	58.7	10.6	188.4	256.7	559.7
West Creek	No	0.0	82.7	52.9	135.6	0.4	0.0	32.0	32.4	168.0
	Yes	0.0	21.8	12.4	34.2	5.8	0.0	29.5	35.3	69.5
Total		0.0	104.5	65.3	169.8	6.2	0.0	61.5	67.7	237.5

Road density is another measure of potential sediment delivery from roads. Nearly 800 miles of roads of all surface types and ownerships are mapped within the area, averaging 3.9 miles of road per square mile (mi/mi^2).

Table 23 displays the road density by watershed for all jurisdiction roads, all jurisdiction roads within 300 feet of perennial and intermittent streams, and National Forest roads within 300 feet of perennial and intermittent streams. The greatest mileage of roads within 300 feet of a stream are outside Forest Service jurisdiction.

Table 23. Road Density by Watershed (mi/mi^2)

Watershed	All Jurisdiction on All Ownerships	All Jurisdiction Within 300' All Ownerships	Roads Within 300' on NF
Trout Creek	4.13	5.46	3.48
West Creek	3.45	6.21	3.23
AVERAGE	**3.89**	**5.84**	**3.36**

Soils

Soils are important to the productivity of a site and, depending on their characteristics, can be susceptible to erosion. Granitic soils within the project area are highly susceptible to erosion, especially in the absence of ground cover or other erosion control. Wind and water moving across the soil surface, including raindrop impact, are the key soil-disturbance processes contributing to soil erosion in the project area.

The Landscape Assessment (Foster Wheeler 1999) notes that roads, ground-based timber harvesting, rural development, agriculture, and grazing reduce or eliminate infiltration of surface water and water storage capacity and displace or remove nutrient-rich organic and mineral layers from the soil. During rain or snowmelt, decreased infiltration capacity increases the amount of sheet erosion, which can lead to rill and gully formation.

The network of roads and trails can focus overland flow, rills, and streamlets into artificial flow networks that move water and soil downslope (Wemple 1994). The cumulative effect of natural and human-caused disturbance may leave soil layers in an unprotected state, much more susceptible to future erosion events and soil loss.

Two soil units are mapped in the Trout-West project area: the Sphinx-Legault-Rock outcrop and the Boyett-Frenchcreek-Pemdant. These soils are described in Appendix E, Watershed and Soils Specialist Report, which is available electronically at http://www.fs.fed.us/r2/psicc/spl/twest.htm.

Potential Crown Fire Effects on Soils

The effects of wildfire are well documented in the Landscape Assessment (Foster Wheeler 1999). Recent local fires had negative impacts on soils and exposed soil to the forces of erosion. Studies cited in the Landscape Assessment indicate that high severity burn areas experience high rates of soil loss from erosion, increased peak flows of runoff, greater duff reduction, loss in soil nutrients, and soil heating. Water and sediment yields may increase as more of the forest floor is consumed. If a fire consumes the duff and organic layers of the soil and the mineral soil is exposed, soil infiltration and water storage capacities of the soil are reduced. These impacts may last weeks or decades, depending on the fire severity and intensity, remedial measures, and the rate of vegetative recovery.

Environmental Consequences of the Alternatives

Road Density

The Proposed Action has the potential to decrease road density because unclassified roads used during the project may be rehabilitated once they are no longer needed. The most important roads to rehabilitate are within 300 feet of a stream; these are the most likely to deliver sediment.

Table 24 displays road density within 300 feet of streams in Trout and West Creek watersheds. All alternatives may reduce road mileage.

Table 24. Effects on Road Density near Streams

Watershed	No Action	Proposed Action	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Trout Creek	3.48	3.07	3.07	3.29	3.14	3.32	3.07
West Creek	3.23	2.41	2.41	2.76	2.64	2.95	2.41
AVERAGE	**3.36**	**2.74**	**2.74**	**3.03**	**2.89**	**3.14**	**2.74**

Effects on Soil Nutrients

All alternatives would reduce site nutrients to some degree but in different ways. Wildfire has the greatest impact on site nutrients by volatilizing nitrogen found in the foliage and fine twigs of trees and shrubs and the aboveground portions of forbs and grasses. Released nutrients such as phosphorus and potassium can be lost by leaching and surface soil erosion. The action alternatives vary in the mechanism of nutrient loss but would retain sufficient woody debris, ground cover, and biomass to maintain site nutrients and productivity. The Proposed Action and Alternatives B, C, D, and E rely on pile and/or broadcast burning to reduce the excess slash loading, while Alternative A relies on chipping and hauling off the excess fuel loading to meet desired level of woody debris.

Effects on Accelerated Soil Erosion

Sources of accelerated soil erosion that are the direct result of the Proposed Action and action alternatives include yarding, temporary roads, and broadcast burning. In all alternatives, wildfires would occur and lead to accelerated erosion. The No Action alternative is associated with the greatest risk of continued accelerated erosion from wildfire.

The Landscape Assessment (Foster Wheeler 1999) indicates that, in contrast to intense wildfires, low- or moderate-intensity burns generally do not cause a corresponding increase in runoff and erosion. Lower intensity/severity prescribed fire would have less impact on soils than high intensity and severity wildfires. Mitigation measures and design features included in the Proposed Action and all action alternatives would maintain ground cover and reduce erosion risk from the fuels reduction activities.

The Water Erosion Prediction Project (WEPP) model was used to predict accelerated erosion for each alternative from all sources: yarding, temporary roads, broadcast burning, and wildfire. Wildfire is estimated to generate 6.8 tons per acre of soil erosion moving off-site from steeper slopes (50 percent and greater) and 3.6 tons per acre on more gentle slopes (flatter than 20 percent). Broadcast burning is estimated to produce 2.3 tons per acre of soil erosion moving off-site on the steeper slopes and 1.1 tons per acre on the more gentle slopes.

The natural erosion rate in the absence of disturbance is estimated to be 0.06 tons per acre on steeper slopes and 0.01 tons per acre on more gentle slopes. More information about the WEPP model is included in Appendix E, which is available electronically at http://www.fs.fed.us/r2/psicc/spl/twest.htm. The WEPP model was used to predict erosion that may occur from each alternative between 2004 and 2014, where 2004 reflects one full year of implementation for each action alternative. The analysis assumes that one-sixth of the treatment in each alternative would be completed each year and prescribed burning would occur two years after thinning.

During each year of implementation, wildfire risk would be abated to some extent. Wildfire risk would gradually decrease as work was accomplished. This analysis considers the Hayman Fire to be part of the predicted wildfire scenario for this decade. The Hayman Fire burned 26,800 acres of the 42,000 predicted to burn each decade under No Action (see section on Crown Fire Hazard). Therefore, additional wildfire predicted for this decade amounts to 15,200 acres: 10,500 acres within the project area and 4,700 acres in the balance of the analysis area.

Most of the additional acres of predicted wildfire are likely to be in Trout Creek, since most of the Hayman Fire acreage within the analysis area was in West Creek. All alternatives currently have equal probability of predicted wildfire, but this probability decreases annually as the action alternatives are implemented. The soil erosion analysis considers this gradual increase in effectiveness (decrease in likelihood of crown fire).

Table 25 displays WEPP model results for the alternatives for a ten-year period, considering all sources including predicted wildfire and Hayman Salvage Alternative 3.

Table 25. Tons of Sediment Produced from All Sources, Years 2004-2013

Watershed	Alternative	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Avg
Trout Creek	No Action	3.9k	7.6k	10.3k	11.5k	11.7k	11.7k	11.7k	11.7k	11.7k	11.7k	**10.4k**
	Proposed Action	4.0k	7.4k	9.8k	10.3k	9.8k	8.9k	7.9k	7.0k	5.9k	4.8k	**7.6k**
	Alternative A	4.0k	7.4k	9.6k	10.0k	9.3k	8.4k	7.5k	6.5k	5.5k	4.6k	**7.3k**
	Alternative B	4.0k	7.5k	9.9k	10.5k	10.1k	9.5k	8.8k	8.1k	7.4k	6.7k	**8.3k**
	Alternative C	4.0k	7.9k	9.7k	10.3k	9.6k	8.9k	7.9k	7.0k	5.9k	4.8k	**7.6k**
	Alternative D	4.0k	7.7k	12.1k	14.9k	14.3k	12.9k	11.5k	10.8k	10.6k	10.4k	**10.9k**
	Alternative E	4.3k	8.0k	10.7k	11.4k	10.9k	10.0k	8.8k	7.5k	6.1k	4.9k	**8.3k**
West Creek	No Action	1.2k	2.4k	3.3k	3.6k	3.7k	3.7k	3.7k	3.7k	3.7k	3.7k	**3.3k**
	Proposed Action	1.3k	2.5k	4.5k	5.6k	6.4k	6.5k	6.2k	5.8k	4.2k	2.7k	**4.6k**
	Alternative A	1.3k	2.5k	3.3k	3.1k	3.2k	2.9k	2.5k	2.2k	1.8k	1.5k	**2.4k**
	Alternative B	1.3k	2.5k	3.2k	3.5k	3.3k	3.1k	2.8k	2.6k	2.3k	2.1k	**2.7k**
	Alternative C	1.3k	2.5k	4.4k	5.4k	6.4k	6.5k	6.1k	5.8k	4.2k	2.7k	**4.5k**
	Alternative D	1.3k	1.5k	4.2k	5.0k	5.0k	4.5k	3.7k	3.4k	3.3k	3.3k	**3.5k**
	Alternative E	1.9k	3.5k	6.4k	8.0k	9.3k	9.6k	8.7k	7.9k	5.4k	3.3	**6.4k**

Figures 1 and 2 display the information in Table 25 graphically. These figures compare the amount of accelerated erosion from each alternative, considering the project activities for each alternative and risk of additional erosion from wildfire.

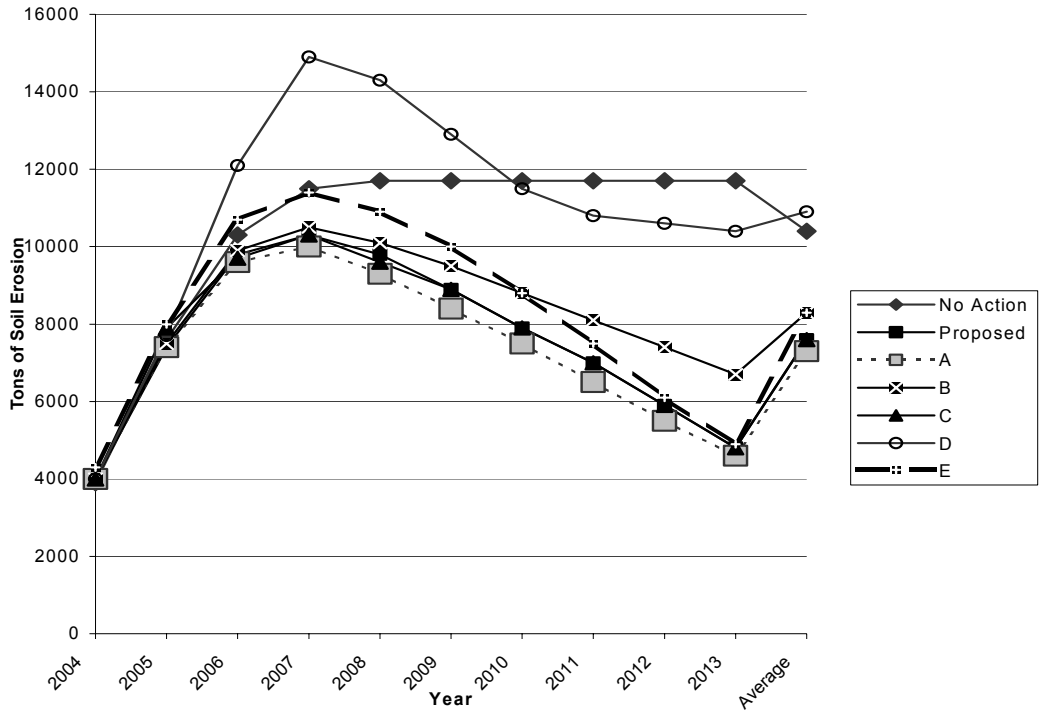


Figure 1. Accelerated Erosion - Trout Creek Watershed, 2004-2013

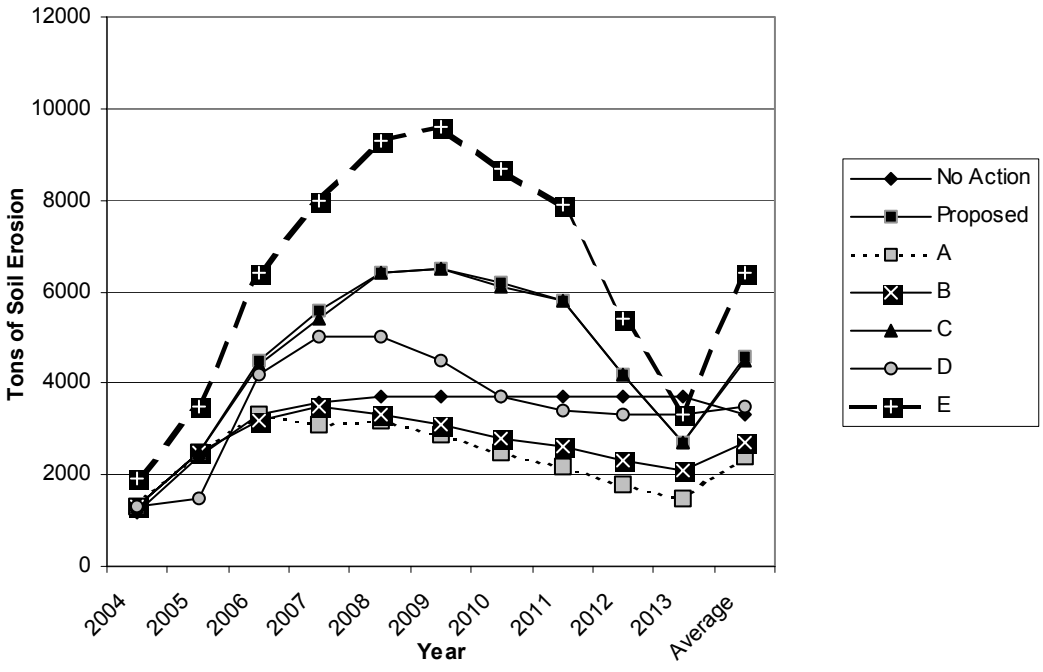


Figure 2. Accelerated Erosion - West Creek Watershed, 2004-2013

Trout Creek

There are minor differences between the Proposed Action and Alternatives A, B, C, and E in Trout Creek watershed. The slight difference between the Proposed Action and Alternative A is due to the relatively few (1,100) acres broadcast burned under the Proposed Action.

The differences between the Proposed Action and Alternative C (no temporary roads) are minor because the roads were initially located where they would cause minimal erosion, are temporary, and the amount of tractor ground (<20% slope) that shifts to helicopter yarding is low (about 13% and mostly in West Creek watershed). The two alternatives appear equal because the differences are slight and drop out when rounding to the nearest 100 tons.

Alternative D generates the most accelerated soil erosion because it would broadcast burn acreage in Trout Creek, but would not significantly reduce wildfire hazard. No Action generates the second highest amount of accelerated soil erosion due to the risk of damaging wildfire occurring throughout the decade.

Alternative B has no broadcast burning but the increased accelerated soil erosion predicted is from the higher risk of damaging wildfire.

Alternative E (persistent openings averaging 20 acres) has a somewhat higher predicted soil erosion in Trout Creek watershed over the Proposed Action due to increased acres treated and the exposed nature of openings, but the number of openings is relatively low (2,800 acres).

West Creek

The Hayman Fire burned many more acres in West Creek than Trout Creek. The WEPP model results are based on the assumption that the Hayman Fire was part of this decade's predicted wildfires. Therefore, remaining risk in West Creek, based on the assumptions used in this model, is relatively lower than Trout Creek.

For West Creek, the Hayman Fire is predicted to produce approximately 68,000 tons of accelerated sediment in the year 2004. By comparsion, the remaining risk for this decade under No Action averages 3,300 tons annually.

Alternatives E, C, and the Proposed Action are predicted to increase accelerated erosion because they include thousands of acres of broadcast burning in West Creek. Alternative E increases accelerated erosion the most because it treats the most acres and includes created openings; Alternative C produces slightly less than the Proposed Action because it does not include temporary roads.

Alternative D is predicted to produce less sediment that Alternatives C, E, and the Proposed Action but more than No Action or Alternatives A and B. This is due to the amount of broadcast burning associated with Alternative D, and its limited effectiveness in reducing crown fire hazard. No Action generates the next highest amount of accelerated soil erosion.

Alternative A generates the least accelerated soil erosion because it reduces the risk of damaging wildfire without broadcast burning. Alternative B generates the second least accelerated soil erosion; similar to Alternative A, it reduces the risk of damaging wildfire without broadcast burning but on a lesser scale than Alternative A.

Summary of Direct Effects, Trout and West Creeks

Figure 3 and Table 26 display the average total accelerated erosion produced from each alternative for the period 2004 to 2013.

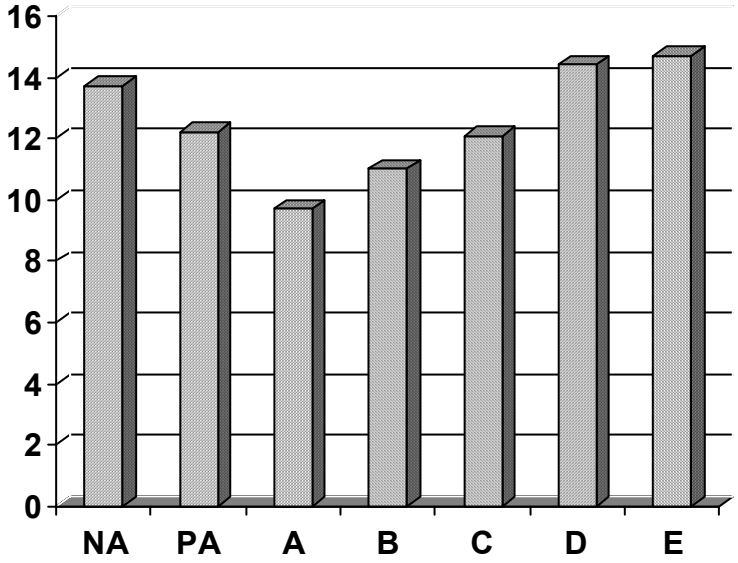


Figure 3. Average Annual Accelerated Erosion in Thousands of Tons

Table 26. Average Annual Accelerated Erosion, 2004-2013

	No Action	Proposed Action	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Average Annual Accelerated Erosion(thousands of tons)	13.7	12.2	9.7	11.0	12.1	14.4	14.7

The WEPP model results indicate that the Proposed Action and Alternatives A, B, and C all reduce erosion potential over a ten-year period as compared to No Action. These alternatives reduce fuels hazard and subsequent erosion estimates and include design features to minimize erosion from operations. Alternative D shows an increase in erosion potential due to a greater proportion of broadcast burning, coupled with less thinning than needed to reduce Condition Class. Alternative E increases erosion compared to No Action because of the high acreage treated.

Indirect Effects

Once soil has eroded it has the potential to enter area streams. Sediment delivered to ephemeral draws, channels, and ditches moves closer to the intermittent and perennials streams with each runoff event. Approximately 60 percent of the soil mobilized through these sources is predicted to eventually reach streams as sediment. Sediment deposited in the streams has the potential to adversely affect fish habitat and water quality. Tables in the Fisheries section of this chapter display average annual sediment delivery to streams for each alternative.

An indirect effect of the action alternatives, especially the Proposed Action and Alternatives A, C, and E, is a reduction of wildfire acres burned and severity. Reduced wildfire risk is expected to last 20 years beyond the timeframe modeled for direct effects.

Under No Action and Alternative D, the potential for damaging wildfires similar to the Hayman Fire is very high, with similar impacts to soil. Table 27 shows Hayman Fire erosion predictions. Action alternatives that effectively reduce crown fire hazard are likely to result in significantly reduced erosion rates. In the long-term (beyond the 10 year implementation period), Alternatives A, C, E, and the Proposed Action would result in less erosion than Alternatives B, D, and No Action.

Cumulative Effects

Additional accelerated erosion can be expected from existing sources. Three sources considered in this analysis include the Polhemus prescribed burn, the Trout Creek Timber Sale, and the Hayman Fire. Table 27 displays predicted accelerated soil erosion from these land disturbing agents. The Hayman Fire Salvage project is expected to result in a net reduction of sediment produced from the fire area because the salvage operation would hasten the placement of woody debris across hillslopes.

Table 27. Predicted Accelerated Soil Erosion to the Nearest Ton

Watershed	Year Treated	2002 (existing)	2003	2004	2005	2006	2007	Beyond
Trout Creek	2001 Polhemus Rx burn	4,330	4,115	3030	1,300	215	0	
	2002 Trout Cr TS 950 ac		75	70	55	25	5	0
	2002 Hayman Fire		21,568	20490	15,098	6,470	1,078	0
	2003-04 Hayman Salvage			-109	-109	-109	-109	-109
	Total	**4,330**	**25,758**	**23481**	**16,344**	**6,601**	**974**	**-109**
West Creek	2002 Hayman Fire		68,748	65311	48,124	20,624	3,437	0
	2003-04 Hayman Salvage			-746	-746	-746	-746	-746
	Total	**0**	**68,748**	**64,565**	**47,378**	**19,878**	**2,691**	**-746**

Conclusion of Effects on Soils and Water

Alternative A has the least direct, indirect, and cumulative effects of all alternatives. It achieves crown fire hazard reduction without burning.

Over time, No Action and Alternative D would have the greatest predicted annual erosion rates. Erosion similar to Hayman Fire would be expected to continue. Alternatives A, C, E, and the Proposed Action would significantly reduce potential future accelerated soil erosion and sediment delivery.

Fish and Wildlife _____

Fisheries Affected Environment

Historically, the longnose sucker, white sucker, longnose dace, and greenback cutthroat trout were known to inhabit the Upper South Platte River. The once-common greenback cutthroat trout is no longer found in the project area. Habitat loss, habitat modification, and hybridization with or displacement by non-native trout species has eliminated greenbacks from most of their native range.

Brook trout were selected as a Management Indicator Species (MIS) because of public concerns for and interest in fishing. Brook trout are a non-native species that has been introduced. They spread quickly throughout Colorado mountain streams, competing directly with native cutthroat trout species. Brook trout have displaced native trout from most of Colorado's high mountain streams (USDA 2000d). Rainbow trout, brown trout, and Snake River cutthroat trout have also been stocked in Manitou Lake, South Platte River, and in private ponds in West Creek (P. Gallagher, Fisheries Biologist, personal communication).

Trout Creek historically supported a larger fishery than today. Habitat degradation from flooding, overgrazing, and development upstream has reduced populations to marginal levels (Winters et al. 1992). High stream temperatures, due to a lack of shading, appear to be a major limiting factor (Gallagher et al. 1994). Trout Creek has been placed on the 303(d) list for sediment. Trout Creek is not on the 303(d) list for temperature, despite the fact that temperatures are high.

Accelerated sediment delivery has also degraded aquatic habitats in Trout Creek. Monitoring in Trout Creek in 1992 showed marked amounts of eroding banks and increases in sediment deposition (Winters et al. 1992). Additional monitoring in 1994 found an increase in eroding banks and sediment deposition. This has reduced the amount of habitat available for trout by filling in pools or has allowed the stream to create new channels.

Stream stabilization structures do not appear to have been effective. Management activities that promote the health of the riparian zones and streamside vegetation have resulted in limited success in this area (Gallagher et al. 1994). Table 28 shows the existing condition of selected streams within the analysis area.

Table 28. Existing Conditions From Selected Streams (based on Wagner 2002)

Stream Reach	Brook Trout Population Trend	Stream Cover	Willow Conditions	Percent Time Temperature Exceeded
Trout	Down	Poor	Poor	26 percent
Rule	Unknown	Poor	Good-Poor	Not sampled
Phantom	Unknown	Poor	Poor	26 percent
West	Unknown	Fair	Fair	Not sampled

Trail Creek, which is a tributary to West Creek, has been placed on a monitoring and evaluation list for sediment but has not been listed under the 303(d) statute.

Fisheries Management Direction

The Forest Plan has some specific fisheries goals, standards, and guidelines. They include the following:

- Improve fish habitat on suitable streams and low elevation ponds and lakes.
- Protect riparian areas and wetlands from degradation.
- Manage fish habitat that is supporting a fish population at or near its potential to maintain fish populations at existing levels. Manage fish habitat that is determined to be limiting a fish population to a level below its potential to improve habitat conditions that may be limiting.

Fisheries Environmental Consequences

All of the alternatives have the potential for accelerated erosion, sediment delivery, and adverse effects on fish. Suspended sediment can affect aquatic organisms by killing them directly, by reducing growth rates and resistance to disease, by preventing successful development of eggs and larvae, by modifying natural movement or migration patterns, or by reducing the natural availabilities of food (Marcus et al. 1990). Deposition of fine sediment can affect survival of salmonids (1) during intergravel incubation of eggs and alevins; (2) as fingerlings; and (3) throughout the winter. Timing, source, and quantity of deposited sediment can affect survival (Marcus et al. 1990). Brook trout, however, are thought to be resilient to sediment impacts.

Mechanical forest treatments can influence riparian habitats: mechanical disturbance may increase sediment moving into the stream; mechanical equipment may increase the potential for pollution to enter the stream; vegetation removal may alter streamflows; and treatments adjacent to riparian zones may decrease shading and result in an increase in water temperatures. Marcus et al. (1990) found that these activities have less impact on fisheries habitat than roads. Prescribed burning can influence vegetation composition, density, size, amount, and distribution and can lead to accelerated erosion and sediment delivery to streams.

Roads and stream crossings can influence aquatic and riparian zones and water quality through changes in hydrology, generation of surface erosion, generation of mass wasting, input of pollutants from roads, changes in terrestrial and aquatic interactions in streams and wetlands, migration and movement barriers, introduction of non-natives, and direct effects of fishing, collecting, and poaching (USDA 1999a).

There are 181 perennial stream crossings in the Trout Creek drainage and 112 perennial stream crossings in the West Creek drainage. Barriers to fish movements would be identified and considered in road reconstruction and rehabilitation. Impacts to streams would be minimized by careful design of temporary roads. All alternatives except E avoid treatments within riparian areas.

The Hayman Fire burned 56 percent of the West Creek watershed and 9 percent of the Trout Creek watershed. In 2003, the fire is predicted to contribute about 41,000 tons of sediment to West Creek and 13,000 tons of sediment to Trout Creek (see WEPP model predictions in the Soil and Water section). Under the Proposed Action, annual predicted sediment from thinning, at its peak, is about 348 tons to West Creek and 200 tons to Trout Creek. Annual predicted sediment from broadcast burning, at its peak, is about 3,630 tons to West Creek and 486 tons to Trout Creek. Temporary roads would produce less than 6 tons of sediment per year to the watershed. For the watershed as a whole, the threat of wildfire as a sediment source far exceeds the sediment that may be delivered as a result of the operation.

No Action

Direct and Indirect Effects

Under the No Action alternative, no fuels reduction treatments would be implemented. Currently, forested habitat types are primarily in the 41-70 percent canopy cover class. As overstory canopy closure has increased, understory vegetation has decreased along with an increase in bare soil. A wildfire would result in a large increase in bare ground, which could result in increased sediment into the streams. The analysis area generally receives 17 inches of precipitation annually, mostly during the summer. While this water comes in the growing season, it often comes in intense thunderstorms so that infiltration capacity is exceeded and runoff increases.

Streamside vegetation would continue to increase over most of the project area, except where limited by recreational use, livestock grazing, or wildfire. If a wildfire occurred, it is expected that riparian zones would be affected as vegetation and fuels accumulate. Over time, fires like Hayman are predicted to occur. These would deliver tens of thousands of tons of sediment and would degrade fisheries.

Direct and Indirect Effects of Action Alternatives (except Alternative E)

The health of riparian zones and streamside vegetation are the most important factors to reduce stream temperatures, eroding streambanks, and sediment deposition into the stream. All action alternatives, except for Alternative E, would include a 100' riparian buffer. No project activities would occur within this buffer, and existing vegetation would be retained. This would maintain overhead vegetation and stream shading and provide a vegetative filter to trap sediments moving down from upland areas.

Proposed Action and Alternatives A, B, and C

Alternative A would produce the least amount of sediment of any alternative. Alternative C is preferable to the Proposed Action from a fisheries point of view, because it does not produce any sediment from temporary roads.

Alternative D

Alternative D would produce less sediment from temporary roads and timber harvest. Broadcast burning would increase in Trout Creek as compared to other alternatives. Over time, this alternative would have fisheries effects similar to No Action. No thinning would occur within riparian buffers.

Alternative E

This alternative would not include a 100' riparian buffer. Project activities would occur in this buffer, and existing vegetation could be removed. This would decrease overhead vegetation and stream shading and could result in an increase in stream temperatures. Stream temperatures have been identified as a significant factor affecting fish habitat in the analysis area, especially in the lower reaches. Activities in the project area would result in an increase in stream temperatures at higher elevations, contributing to problems in the lower stream reaches, where stream temperature is already an issue.

The lack of a vegetative filter to trap sediments moving down from upland areas could result in an increase in sediment reaching the streams. Alternative E would reduce future risk of sediment from wildfires.

Summary of Direct and Indirect Effects

Table 29 and Figure 4 show maximum annual predicted accelerated sediment delivery to both West and Trout Creek, during the period 2004-2014, in thousands of tons. These values include all direct and indirect sources of sediment related to the project, including timber harvest, broadcast burning, and temporary roads, along with potential wildfire risk remaining this decade.

Table 29. Maximum Annual Predicted Accelerated Sediment Delivery to both West and Trout Creek, 2004-2014 (thousands of tons)

	No Action	Proposed Action	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Maximum Annual Predicted Accelerated Sediment Delivery: West and Trout Creek, 2004-2014 (thousands of tons)	8,200	7,300	5,900	6,700	7,300	8,600	8,800

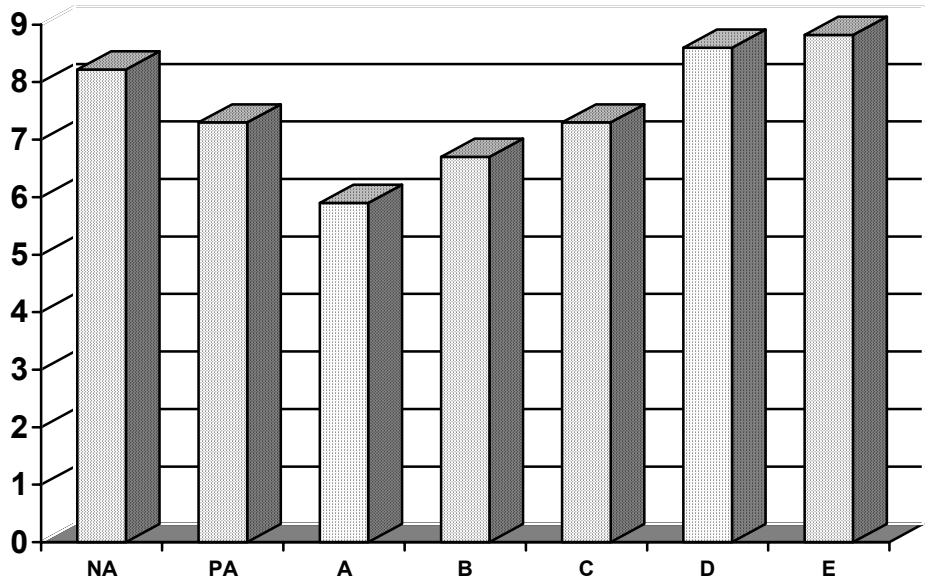


Figure 4. Estimated Accelerated Sediment, 2004-2014

All alternatives except E would maintain stream temperatures. Alternative E would result in an increase in stream temperatures due to loss of streamside vegetation and effects of shading.

Cumulative Effects

Other activities contributing towards cumulative effects on stream habitats include development on adjacent private lands, routine county road maintenance, livestock grazing, dispersed recreation, timber harvest, and off-road vehicle use.

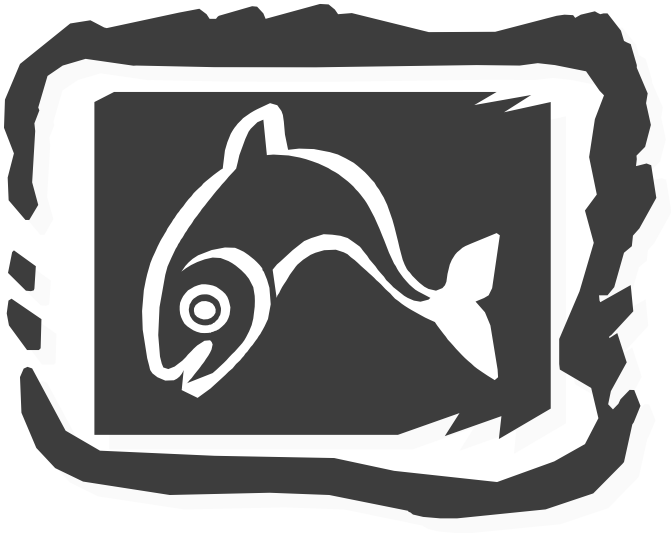
Riparian vegetation is important in providing shade to moderate stream temperatures. Livestock grazing, which affects streamside vegetation, can affect stream temperatures by loss of vegetative cover and streambank trampling, which widens the stream and reduces overhanging banks. Livestock grazing occurs over about half of the proposed treatment units. The Phantom unit, which is grazed, has the largest quantity of perennial streams and riparian habitats. However, Trout Creek is the most impacted by livestock grazing. Livestock grazing is under increased management and impacts from grazing will continue to decline over the long-term.

The Trout Creek Timber Sale and Polhemus Burn were designed to have little measurable adverse effect on fisheries. The Hayman Fire outweighs all other sediment sources, and future fires like Hayman pose serious threats to the watershed and its fishery. Alternatives that reduce risk while protecting riparian areas (Proposed Action and Alternatives A and C) would reduce the long term threat to brook trout.

The Hayman Fire Salvage Preferred Alternative 3 is expected to result in a net reduction of sediment within the fire area.

Consistency with Forest Plan

The Proposed Action and Alternatives A, B, C, and D are consistent with Forest Plan direction to protect riparian areas from degradation (through implementation of a riparian buffer) and to focus on habitat features that are limiting (in this case sediment and stream temperature). Alternative E is not consistent with this direction because it does not maintain riparian buffers, which could influence sediment and stream temperatures. A Forest Plan amendment would be needed to implement this alternative. While the action alternatives would increase sediment over the short-term, the risk of wildfires, which can be a major sediment producer, is reduced and thus the action alternatives would be beneficial over the long-term.



Wildlife Affected Environment

Analysis Area

The area used for this analysis is based on Diversity Units (DUs), as identified in the Forest Plan. There were originally nine DUs affected by the project. As a result of the Hayman wildfire, some areas of proposed treatments were dropped and only seven of the nine DUs would actually be affected. However, because of the location and distribution of the DUs, the seven DUs did not make a logical boundary for analysis. Therefore, all nine DUs were used because they made a logical geographical boundary. The DUs involved are 918 – 925 and 930. Collectively, this area is refered to as the Wildlife Analysis Area (WAA). A map of the DUs is found in the Project File. The WAA comprises about 60 percent of the Trout and West Creek watershed analysis area. Table 30 displays major vegetation types within the WAA.

Table 30. Vegetation Type Distribution in the Wildlife Analysis Area

Vegetation Types	Area (acres)	Area (%)
Coniferous	70,417	91%
Aspen	1,452	2%
Grassland	4,492	6%
Shrubland	1,163	1%

Species Considered

Many species of animals inhabit the analysis area, including several special status species. A Biological Evaluation (BE) was prepared to consider the effects of the alternatives on sensitive, threatened, and endangered species. The BE was appended to the DEIS. A final BE is available electronically at http://www.fs.fed.us/r2/psicc/spl/twest.htm. Findings and conclusions from the BE are summarized in this chapter.

Additional wildlife analysis was completed for Management Indicator Species (MIS) and their habitats. Analysis for MIS species is summarized in this FEIS, with further discussion available in the wildlife report available online (see web address above).

Table 31 lists MIS that may occur in the project area and the habitats they represent. MIS representing habitats that do not occur within the analysis area are not included (e.g., pine marten representing sub-alpine forest, black-throated gray warbler for pinyon-juniper, Virginia warbler for oak habitats, and water pipit for alpine tundra habitats).

Table 31. Management Indicator Species that May Occur in the Project Area

Species	Scientific Name	Habitat represented
Mammals		
Abert's Squirrel	*Sciurus aberti*	Ponderosa pine
Beaver	*Castor canadensis*	Riparian
Elk	*Cervus elaphus*	Semi-open coniferous forests, Shrublands
Mule deer	*Odocoileus hemionus*	Semi-open coniferous forests, Shrublands
Birds		
Lewis' woodpecker	*Melanerpes lewis*	Riparian forests
Mallard	*Anas platyrhynchos*	Water
Mountain bluebird	*Sialia currocoides*	Mountain grassland
Peregrine falcon	*Falco peregrinus*	Cliff habitats
Red-naped sapsucker	*Sphyrapicus nuchalis*	Aspen forests
Three-toed woodpecker	*Picoides tridactylus*	Coniferous forests
Wild turkey	*Meleagris gallopavo*	Mature ponderosa pine
Green-tailed towhee	*Pipilo chlorurus*	Sagebrush
Wilson's warbler	*Wilsonia pusilla*	High elevation riparian

A summary of habitat use and population trends is provided here; more information is found in the Wildlife Report in the Project File. MIS that are also sensitive species (i.e., Lewis' Woodpecker, Three-toed Woodpecker, and Peregrine Falcon) are evaluated in the BE in Appendix B.

Abert's squirrel. Abert's squirrel is distributed from extreme southern Wyoming to the lower mountains of New Mexico and Arizona, with outlying populations in Mexico. This species is ecologically dependent on ponderosa pine for both nesting and foraging. Target feed trees represent less than 10 percent of the trees in stands used by Abert's squirrels and are chemically and physiologically different from trees not selected (Fitzgerald et al. 1994). Approximately 92 percent of the nests were in a tree group, with 75 percent having three or more interlocking tree canopies.

The state population trend is suspected to be stable or increasing (USDA 2001e). These species are "fairly common" in the three local counties (Teller, Douglas, and El Paso). Population dynamics are poorly known, but are believed to fluctuate widely over time and space, possibly due to cyclic variations in biomass of pinecone crops (ibid.). Habitat on federal lands has probably increased over historic conditions due to fire exclusion, but is currently declining from the effects of insect and fire-related activity (ibid.). The Forest Plan includes standards and guidelines for protection or providing nest tree clumps in sale areas. Discussions in a recent workshop highlighted the importance of patchiness for Abert's squirrel; evenly spaced trees are not desired.

Beaver. Beaver commonly inhabit riparian areas of mixed coniferous-deciduous forests and deciduous forests containing abundant foods and lodge-building materials such as aspen, willows, alders, dogwood, and cottonwoods. Beavers and dams trap sediment, reduce stream velocity, elevate water tables, and reduce effects of seasonal fluctuations in the water table. They also encourage growth of willows and riparian plants, stabilize banks, and improve riparian and aquatic habitat (Olson and Hubert 1994).

Colorado beaver populations have declined from historic conditions but have increased or stabilized in the last several decades (USDA 2001e). A 1993 analysis (Flather et al. 1999) suggests that beaver numbers exceed habitat carrying capacity for the state of Colorado, with stable population projections. Population size estimates are available through trapping records. Beaver harvests between 1987 and 1996 for the 13 counties that encompass the Pike and San Isabel National Forests do not show any real trends, if harvest data does reflect population trends. Most beaver trapping stopped after Colorado's Amendment 14 passed in 1996 (ibid.). Currently, most of the available habitat is occupied and Colorado Division of Wildlife (CDOW) Biologists have a hard time identifying areas to relocate beaver (J. Veyhinger, CDOW Biologist, personal communication).

Elk. Because elk have a wide distribution, their preferred habitat also varies widely. During the summer elk spend most of their time in high mountain meadows in the alpine or subalpine zones, or in stream bottoms. Elk may use more open areas during spring and summer because of earlier spring green-up. During hot summer months, elk seek shaded, cool habitats (USDA 2001e). The entire project area is elk summer range. Aspen stands, riparian areas, and north aspects provide cooler, moister habitats in the summer. The CDOW has mapped the southern end of the Rampart Unit as an area that receives concentrated elk use in the summer. The CDOW has mapped "elk production areas" (calving areas); areas that overlap with units are the southeast side of Skelton and the southern portion of the boundary line between Phantom and Ryan Quinlan. These are only known areas and do not include all calving areas.

During severe winter weather, many animals substitute an energy conservation strategy rather than focusing on forage uptake (Christensen et al. 1993). While thermal cover is important in some areas, it is not as important in the analysis area due to mild winters and light snow cover. Winter surveys often find most of the elk wintering on open flats at 9,000 to 10,000 feet (J. Veyhinger, CDOW Biologist, personal communication).

CDOW has mapped the lower portion of Ridgewood, north end of Long John, northeast part of Ryan Quinlan, and extreme southern ends of Phantom and Skelton as winter range. Winter concentrated-use areas are mapped as the extreme northwestern portion of Ridgewood and the extreme southwestern edge of Rampart. These areas may be used in harsher winters. A map of these seasonal elk use areas is found in the Project File.

This species is intensively managed and there is abundant data available on population size and trends. Elk are expanding their range due to reintroductions, management, and habitat conversion. The project area lies in Game Management Unit(GMU) 511, with a very small amount in Unit 51. GMU 511 is managed as part of the 11-Mile Elk Herd, which includes several other GMU's. The long-term population objectives for this herd are 1,180 animals; post-season counts in 2001 estimated the population size to be 1,830 animals. It is felt that the objective was set too low;it will probably be raised in the future. Currently it is hard to keep numbers down due to complex land ownership patterns and subdivisions; private lands and Ft. Carson act as refuges where no hunting is allowed. There are currently around 23 bulls, 100 cows, and 48-50 calves, which meets state population objectives (J. Veyhinger, CDOW Biologist, personal communication).

While the project area is very accessible, the area does not currently have a poaching problem. However, the high accessibility may contribute to displacement of elk onto adjacent private lands. Christensen et al. (1993) evaluated open road densities and effects on summer habitat effectiveness. Based on research and road modeling they felt that in areas intended to benefit elk summer range and retain high use, road densities should be less than about 0.7 mi/mi^2. For areas where elk are one of the primary resource considerations, road densities should be less than 1.9 mi/mi^2. They felt that areas above these road densities make only minor contributions to elk management goals. Road densities in the project area range from 2.6 to 6.0 mi/mi^2 by DU. Elk frequently cross Highway 67 around Rainbow Falls, to the north of the project area.

Mule deer. Mule deer are most likely to be found in open forested regions or on plains and prairies. They prefer rocky or broken terrain at elevations near or at the subalpine zone in the mountainous regions of the west. Mule deer seek shelter at lower elevations when snows become deep (USDA 2001e).

CDOW has mapped the whole project area as year round range. The extreme northeastern corner of Ridgewood has been mapped as critical winter range. This map is found in the Project File. The 2001 Species Trend Assessment (USDA 2001e) states that the Colorado mule deer population increased between 1975 and 1983, then stabilized after 1993. The project area lies in the Rampart Data Analysis Unit. The population objective for this unit is 3,000 deer and currently the population is at that number (B. Davies, CDOW Biologist, personal communication). The buck to doe ratio objective is 40 bucks per 100 does and the ratio currently is 50:100, well above the objective.

Mallard. This species was selected as an MIS for water habitats. They are very adaptable and have few specific requirements: enough dry ground for nesting away from the waters edge and water for feeding. In the southern Rocky Mountains this species inhabits low elevation mountain lakes and streams, marshes, and ponds (USDA 2001e).

Waterfowl have been counted in extensive and systematic surveys of major North American breeding grounds. The Breeding Bird Survey reported an upward trend (+3.5 percent) for mallards from 1966 to 1998.

Mountain Bluebird. This species is a secondary cavity nester and uses open woodland or edge habitat. They will nest in natural cavities, old woodpecker cavities, or in nest boxes. Nest site availability is a limiting factor in mountain bluebird productivity. They perch on dead branches near open areas with sparse ground cover, feed on insects on the ground, and are closely associated with early post-fire conditions (USDA 2001e).

This species is considered abundant. Breeding bird surveys from 1966-1998 in the Southern Rockies Province and in Colorado indicate an increasing but non-significant trend.

Red-naped Sapsucker. This species uses open forest and forest edges. They are found primarily in coniferous/deciduous forests that include aspen and cottonwood. They nest in cavities in live trees, often near water. They will often return to nest in the same tree, but not in the same cavity, year after year. Adept at drilling sap wells, these birds carry sap in their crops to feed their nestlings and teach them to "sapsuck" shortly after fledging. This species feeds mainly on sap, pine pitch, cambium, and some insects and berries (Alsop 2001).

There is no information available to indicate a population trend for this species (USDA 2001e). Breeding bird surveys and Christmas bird counts do not specifically address this species.

Wild Turkey. Two subspecies occur on National Forest lands in the area: Merriam's and Rio Grande. Merriam's is the subspecies present in the project area and is the subspecies that will be considered in this discussion (USDA 2001e). Merriam's turkey is most abundant within its historic range in the southern part of the state, but the species also occurs in the central and western areas of the state.

Wild turkey need mature, open forests interspersed with grassy openings. Amount of openings required varies from 10-25 percent of total occupied range. Scarcity of suitable roost trees may be a limiting factor (USDA 2001e). Roost trees are typically groups of overly mature trees in uneven-aged stands, usually on easterly slopes sheltered from the wind.

Ponderosa pine is preferred and has the following characteristics: 16-42" diameter, 50-100 feet tall, 75 percent flat-topped mature or older trees. There is one known turkey roost site in the Ryan Quinlan area. Turkey must be near water on a daily basis, and nests are usually within ½ mile of water. Of the six treatment units, Rampart and Ryan Quinlan have been identified as receiving the most use by wild turkeys (M. Storey, National Wild Turkey Federation, personal communication).

Green-tailed towhee. This species breeds in shrubby hillsides dominated by Gambel oak and associated shrub species at an average 7,300-foot elevation. They also breed in sagebrush flats, ponderosa pine savannah with shrub understory, scattered aspen with shrub intermixed, and pinyon-juniper hillsides (USDA 2001e).

Colorado contains between 20 – 40 percent of the breeding population of green-tailed towhees. This species ranks as the thirteenth most numerous species in Colorado, with almost 1 million breeding pairs (ibid.). This species is monitored by Colorado Bird Observatory's "Monitoring Colorado's Birds" program using point counts.

Wilson's Warbler. This species is an MIS for high elevation riparian habitats. It is a fairly common summer resident in mountain parks and higher mountains (10,000-13,000 feet) (ibid.). The Breeding Bird Atlas states that this species breeds from 6,000 to 12,000 feet. They nest in willow and alder thickets of stream banks, lakeshores, and wet meadows (ibid.). The elevations in the analysis area range from 7,600 to 9,300 feet and are within the elevation range used by this species. Breeding Bird Survey data in the Southern Rocky Mountain Province for the period 1966 to 1996 do not show a statistically significant annual rate of change.

Wildlife Management Direction

The Forest Plan identifies many goals for wildlife. These goals include the following:

- Increase diversity for wildlife and habitat improvement.
- Increase winter range habitat capability for deer and elk.
- Protect riparian areas and wetlands from degradation.

The Forest Plan also established general management direction, including the following:

- Provide for the habitat needs of management indicator species in the National Forest.
- Manage and provide habitat for recovery of endangered and threatened species.
- Maintain habitat for viable populations of all existing vertebrate wildlife species.
- Establish elk, bighorn sheep, and threatened and endangered species on sites that can supply the habitat needs of the species and the population levels and distribution agreed to with the States.

Wildlife Environmental Consequences

Canopy Closure, Riparian Habitats, and other Habitat Components

Wildlife is sensitive to the structure, density, size, species composition, and vitality of forested habitats. Habitat elements such as canopy closure, rock outcrops, snags, meadows, shrubs, hardwoods, and riparian areas are all important for various species. Canopy cover, riparian habitat, dwarf mistletoe, and snags may be affected by the project.

Canopy Closure

Based on the Resource Inventory System (RIS), nearly 50 percent of forested stands in the WAA are between 41 and 70 percent canopy cover. About 11 percent exceed 70 percent canopy cover and thus meet criteria for thermal cover. These values, displayed in Table 32, were adjusted after the Hayman Fire.

Table 32. Current Canopy Closure

Canopy Closure	Acres	Percent
0-10 Percent	17,240	22
11-40 Percent	7,340	9
41-70 Percent	39,640	51
71-100 Percent	8,150	11

All of the alternatives would affect the proportion of land in each canopy closure class, as indicated in Table 33. This is based on the proposed treatments and the remaining risk of wildlife after the treatments. Table 34 and Figure 5 show the proportion of land in each canopy closure class after the proposed treatments and predicted wildfire.

Table 33. Canopy Closure in WAA following Treatment

Treatment	0-10 Percent	11-40 Percent	41-70 Percent	71-100 Percent
Current Condition	22 percent	9 percent	51 percent	11 percent
No Action	22 percent	9 percent	51 percent	11 percent
Proposed Action	22 percent	33 percent	28 percent	11 percent
Alternative A	22 percent	33 percent	28 percent	11 percent
Alternative B	22 percent	25 percent	35 percent	11 percent
Alternative C	22 percent	33 percent	28 percent	11 percent
Alternative D	22 percent	17 percent	43 percent	11 percent
Alternative E	32 percent	33 percent	23 percent	5 percent

Table 34. Canopy Closure in WAA following Treatment AND Predicted Wildfire

Treatment	0-10 Percent	11-40 Percent	41-70 Percent	71-100 Percent
Current Condition	22 percent	9 percent	51 percent	11 percent
No Action	36 percent	8 percent	41 percent	8 percent
Proposed Action	26 percent	31 percent	26 percent	10 percent
Alternative A	26 percent	31 percent	26 percent	10 percent
Alternative B	29 percent	23 percent	31 percent	10 percent
Alternative C	26 percent	31 percent	26 percent	10 percent
Alternative D	34 percent	14 percent	36 percent	9 percent
Alternative E	37 percent	29 percent	22 percent	5 percent

No Action assumes a 10,500-acre wildfire within the project area and one other fire in the remaining WAA (the WAA is about half the watershed). This scenario would tend to create more openings than any alternative, as stand-replacement fire would be expected over a portion of the area. In the absence of fire or treatment, conifers in the understory would increase, increasing the canopy closure over time. Understory grasses and shrubs would continue to decline, and the risk of stand-replacing fire would increase.

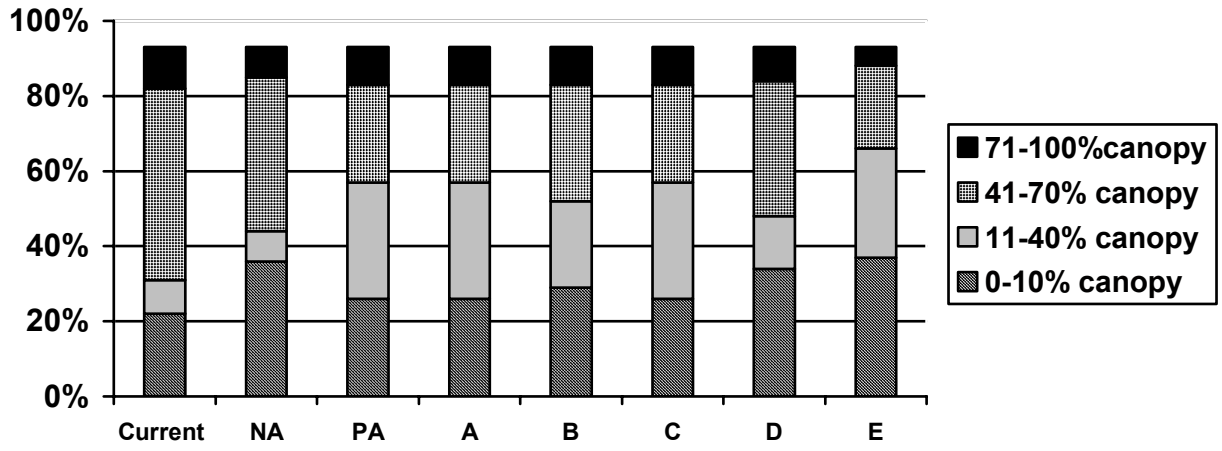


Figure 5. Canopy Cover Distribution Following Treatment AND Wildfire

In the short term, changes in canopy from the Proposed Action and action alternatives would benefit some species and reduce habitat capability for others. In the long term, alternatives that move the area toward the historic condition would benefit wildlife by recreating some of the forest conditions under which they evolved.

Riparian Habitats

In 1997, a riparian inventory was conducted throughout the Pike National Forest (see Table 35). Shrub habitats are the most abundant riparian vegetation type in the Wildlife Analysis Area (WAA).

Table 35. Riparian Vegetation in the Pike National Forest (1997)

Dominant Vegetation In Riparian Zone	Percent Of Riparian Habitats
Shrub	33 percent
Conifer	16 percent
Aspen	13 percent
Deciduous/Conifer	10 percent
Conifer/Shrub	6 percent
Grass	6 percent

Alternatives A, B, C, D, No Action, and the Proposed Action all avoid vegetation management within 100 feet of streams as per Forest Plan Standards and Guidelines. Streamside vegetation would continue to increase over most of the area in these alternatives.

Alternative E would thin and create openings within riparian areas. Some areas of shrub habitats would be affected by harvest or burning activities and shrub riparian habitats could decrease over the short-term. However, over the long-term shrubs would be expected to re-sprout and their distribution would increase.

Dwarf Mistletoe

Several wildlife species are known to use dwarf mistletoe. Hawksworth and Geils (1996) found several species of birds using dwarf mistletoe for food. These include one of the Forest MIS, the mountain bluebird. Bird species that were found to nest in witch's brooms include Mexican spotted owl and goshawk. Mammals that were found to feed on dwarf mistletoe include Abert's squirrel and mule deer; those using it for nesting cover include Abert's squirrel.

Dwarf mistletoe would decrease under all action alternatives. It would not be removed from the landscape, but would be found at levels more closely resembling the historic condition.

Snags

Reynolds et al. (1985) gathered information on snags, spike-topped trees, and live trees with cavities in 395 acres in the Manitou Experiment Forest. They found that ponderosa pine and Douglas-fir are important snag species on all slopes and aspects. Aspen is especially important in moist bottoms. They found an average of 2.5 snags or spike-topped trees per acre. Of these, about 13 percent of the snags and 34 percent of the spike-topped trees had cavities.

Mitigation is included in all action alternatives for soft and hard snag retention. In addition, trees and/or snags with existing cavities and lightening-struck trees would be retained under all alternatives. This would maintain habitat over the short-term, and trees that are currently alive would eventually provide habitat over the long-term.

Old-Growth Habitats

The Forest Plan includes direction to maintain 10 percent of each DU in old-growth forest. Based on pre-Hayman conditions, structural Stage 5 habitats are very limited in the WAA, as shown in Table 36 (site-specific effects of Hayman Fire on this structure class are not known). The fire affected a large part of 921, and all of 922, both of which had some acreage of Structure Stage 5.

Table 36. Percent Structure Stage 5 by Diversity Unit (Pre-Hayman Fire)

Diversity Unit	Percent Structure Stage 5
918	0
919	3
920	3
921	11
922	4
923	0
924	0
925	0
930	0

As discussed in the vegetation section, much of the project area was logged in the late 19th and early 20th centuries; thus, older stands are rare in the project area. No old-growth was identified during field reconnaissance for this project. The fuels reduction prescription is intended to maintain existing old-growth and enhance future old-growth. Old-growth habitat components such as large trees, snags, and variety in density from open to dense would be maintained in all action alternatives. Thinned stands would be managed to sustain late-successional habitats across the project area.

Roads and Wildlife

Roads, trails, and resultant human access can influence wildlife use of an area. Roads fragment habitats and provide access for firewood gathering, hunting, trapping, and poaching. Vehicles on roads can kill animals (USDA 1999s;Wisdom et al. 2000).

Roads and trails remove vegetation from the travel surface. This directly reduces the amount of habitat available and indirectly affects adjacent habitat. The effects of roads, motorized trails, and non-motorized trails on wildlife depend on the species, topography, vegetation type, season, and frequency and predictability of human use. Effects include increased vulnerability of wildlife due to loss of snags and downed logs, disruption of movement patterns, fragmentation of habitat, and displacement/avoidance responses (Wisdom et al. 2000). Access on roads and trails can be restricted to certain times of the year to reduce or eliminate the effects of access.

Currently, poaching is not thought to be a problem in the project area (Vayhinger, personal. communication, 2002). Elk are known to cross Highway 67 around Rainbow Falls and some conflicts could occur there (ibid.). No information suggests that traffic on Highway 67 is currently impacting wildlife populations.

Table 37 shows road and motorized route densities (including trails) for the six treatment units.

Table 37. Current Open Road and Route Density by Unit

Treatment Unit	Road Density	Route Density
Long John	6.0 mi/mi^2	7.0 mi/mi^2
Phantom	2.9 mi/mi^2	4.2 mi/mi^2
Rampart	5.2 mi/mi^2	5.6 mi/mi^2
Ridgewood	2.7 mi/mi^2	2.7 mi/mi^2
Ryan Quinlan	2.9 mi/mi^2	3.4 mi/mi^2
Skelton	2.6 mi/mi^2	4.3 mi/mi^2
Overall Average	3.9 mi/ mi^2	

New construction and reconstruction of roads can include clearing of vegetation, installation of drainage features, construction using cuts and fills, and surfacing. Decommissioning or rehabilitation may include re-contouring, water barring, ripping of the roadbed, and fill pullback. Table 38 depicts the miles of roads constructed and rehabilitated under each action alternative.

Table 38. Miles of Roads Rehabilitated by Alternative

	Proposed Action	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Miles of temporary road constructed	14	14	12	0	0	14
Miles of Existing Road Rehabilitated	48	48	31	48	13	48

The Proposed Action and Alternatives A, C, and E have the most impact on final open road densities (see Table 39). While temporary roads will result in an overall 0.1 mi/mi^2 increase over the Trout and West Creek watersheds over the short-term, rehabilitation of existing unclassified roads at the end of the project will result in a 0.2 mi/mi^2 decrease over the long-term.

Table 39. Open Road Density In Trout and West Creek Watersheds

Timeframe	Proposed Action and Alternatives A, C, and E	Alternative B	Alternative D
Existing condition	3.9 mi/mi^2	3.9 mi/mi^2	3.9 mi/mi^2
With temporary roads	4.0 mi/mi^2	4.0 mi/mi^2	3.9 mi/mi^2
After road rehabilitation	3.7 mi/mi^2	3.8 mi/mi^2	3.8 mi/mi^2

The Proposed Action and Alternatives A, B, and E would temporarily increase road density. All action alternatives would eventually decrease road density as roads are rehabilitated. None of the areas that are accessed by temporary or non-system roads have unique biological characteristics. Decreased road density would benefit most wildlife species. Current high levels of access likely displaced elk onto adjacent areas; once roads are rehabilitated, some areas may provide security and help sustain elk on public lands in the project area.

Threatened, Endangered, and U.S. Forest Service Region 2 Sensitive (TES) Species

The US Fish and Wildlife Service (USFWS) provided a list of Threatened and Endangered Species (dated 3/13/02). The U.S. Forest Service (USFS) Region 2 Sensitive Species list was updated in November 2001. Threatened or endangered species that may occur within the wildlife analysis area, effects determinations, and rationale for all alternatives are shown in Table 40.

Table 40. Threatened and Endangered Species that May Occur in the WAA

Species	Determination	Rationale
Preble's jumping mouse	No effect	No Suitable Habitat Affected[13]
Pawnee montane skipper	No effect	Treatment units outside of distribution of this species
Mexican spotted owl	No effect	The proposal will not destroy or adversely modify critical habitat. Potential for foraging habitat will be maintained by treatments as outlined in the Recovery Plan (1995).
Bald eagle	NLAA*	One stand adjacent to Manitou Lake could provide winter roosting habitat. Currently, only intermittent use reported. Mitigation effective in minimizing impact.

* NLAA = May affect, not likely to adversely affect

[13] Suitable habitat in the Ridgewood area would be avoided.

Sensitive Species may occur within the wildlife analysis area. Table 41 displays a ranking of the alternatives in terms of how well they maintain habitat for sensitive species; all alternatives may impact individuals, but protect the viability of populations of sensitive species. Further information about each of these species is in Appendix B, the Biological Evaluation.

Table 41. Sensitive Species Rankings by Alternative

Alternative	No Action	Proposed Action	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Flammulated owl/ Lewis woodpecker	4	1	1	2	1	4	3
Northern goshawk	1	2	2	3	2	4	4
Three-toed woodpecker/ Golden-crowned kinglet	1	3	3	2	3	2	4
Pygmy nuthatch	4	1	1	2	1	3	1
Fox sparrow	3	1	1	2	1	3	4
Tiger salamander/ Northern leopard frog	3	2	1	1	2	3	3

Note: For these species rankings, 1 = best

Management Indicator Species (MIS)

Affected Environment

MIS represent species associated with a variety of habitats. Habitats and species found in the WAA were listed previously.

Habitat capability analysis using the Habitat Capability (HABCAP) model was completed for the WAA. This model has several assumptions and limitations that are outlined in the User's Guide (USDA 1994). An evaluation of the HABCAP model (Thinnes 2001) states that the implicit assumption is that the forested landscape is capable of providing optimum habitat for each wildlife species evaluated. However, natural processes such as wildfire, insects, and diseases may prevent some habitat conditions from developing across the landscape. Ponderosa pine habitats, which were historically subject to frequent low-intensity fire, are not capable of sustaining optimal habitat for species that depend exclusively on dense forests.

The HABCAP model provides estimates of the capability of habitats to support wildlife based on the mix of vegetation cover types and structure present in an area. Findings are expressed as a percentage of potential habitat capability and are summarized in Table 42. The model findings were evaluated using professional judgment.

The Forest Plan includes a Forest-wide Standard and Guideline (S&G) to maintain habitat for MIS at least at 40 percent or more of potential over the DUs. Many of the Management Areas (MA) in the Forest Plan require maintenance of habitat capabilities greater than 40 percent: MA 2B should be managed to provide at least 60 percent of potential; and MAs 4B and 9A are to be managed to provide at least 80 percent of potential. Currently, several species do not meet even the 40 percent capability standard set forth in the Forest Plan, based on the HABCAP model. However, weaknesses in the HABCAP model make it an unreliable tool for accurate comparisons. The model does not consider all of the design features and mitigation measures included in the project to benefit wildlife.

Table 42. Habitat Capability for MIS by Diversity Unit, Re-Calculated after Hayman Fire

	Diversity Unit									Avg.
MIS	918	919	920	921*	922*	923*	924*	925	930	
Abert's squirrel - summer	36	41	31	10	31	7	16	34	31	26
Abert's squirrel - winter	36	41	31	10	31	7	16	34	32	26
Elk - summer	18	19	20	34	27	24	38	19	15	24
Elk - winter	18	20	19	24	20	13	29	23	17	20
Mule deer - summer	61	63	68	81	72	49	85	70	62	68
Mule deer - winter	28	34	29	22	40	28	44	38	37	33
Mountain bluebird	44	46	49	43	41	41	47	58	49	46
Red-naped sapsucker	43	45	46	23	22	6	18	42	45	32
Merriam's turkey - summer	58	57	53	65	73	75	72	68	53	64
Merriam's turkey - winter	29	32	25	13	33	11	23	27	23	24
Beaver	1	0	2	1	0	0	0	2	1	<1
Mallard - summer	13	8	6	51	51	81	56	11	2	31
Mallard - winter	13	6	2	0	1	5	14	9	1	6
Green-tailed towhee	18	20	21	26	25	29	30	24	20	24
Wilson's warbler	13	7	7	7	9	15	26	14	6	11

* Diversity Units that were affected by Hayman wildfire

Given that the existing condition is below Forest Plan standards, the project needs to be designed to at least maintain current capability, and where possible, increase capability. Model results are displayed as part of the analysis; however, profession judgment was used to integrate all aspects of the project into the description of effects and Forest Plan consistency. In general, all alternatives except E are designed to meet current Forest Plan standards through the design features and mitigation measures included.

Species that are associated with non-forested habitats show low capability, partly because the model doesn't address them well (beaver and mallard), or little suitable habitat is present (green-tailed towhee, and Wilson's warbler). Riparian shrub vegetation won't be affected by any of the alternatives, and aspen is expected to increase under all of the action alternatives, improving habitat for beaver over the long-term. These four species won't be discussed further.

Effects of No Action on Management Indicator Species

Effects of No Action on MIS are described in Table 43. These conditions would be expected to persist under No Action until wildfires or other disturbance changed the vegetation condition. Conifers in the understory would increase, increasing the canopy closure over time. Understory grasses and shrubs would continue to decline, and the risk of stand-replacing fire would increase. Habitat capability for elk, mule deer, Abert's squirrel, mountain bluebird, and turkey would decrease over time.

Table 43. Effects of No Action on Management Indicator Species

Species	Effects of No Action
Abert's squirrel	The area may have been providing more habitat than what occurred during pre-settlement times, due to fire exclusion (USDA 2001e). Before the Hayman Fire, the Habitat Capability Index (HCI) was close to 40 percent for both the summer and winter. However, after the stand-replacing fire that burned over about 45 percent of the area, the HCI dropped to 26 percent. Without any vegetation treatments in the unburned areas, stand density will continue to increase over time. This may result in an eventual decline due to increases in insects or disease. In addition, as trees become denser, cone production on individual trees may decrease. Without any treatments in the unburned areas, habitat capability would decrease slowly over time. When another stand-replacing fire does occur, it is expected that there would be patches of forested stands that would survive, but total amount of habitat and connectivity between patches would greatly decrease and habitat capability would drop to very low levels for the next several decades.
Elk	While the model shows that the area was not meeting the 40 percent habitat capability, discussions with CDOW biologists indicate that over the larger area (11-Mile Elk Herd), population objectives are being met. After the Hayman Fire, summer HCI increased to around 40 percent, while there was no change in winter HCI. Without any vegetation treatments in the unburned areas, stand density will continue to increase over time, decreasing understory (forage) production. Further wildfires will increase the summer habitat capability. Under this alternative, no existing non-system roads would be rehabilitated. It is expected that high road densities would continue to cause disturbance and possible displacement onto adjacent lands.
Mule deer	The model suggests that while overall habitat capability was being met before the Hayman Fire, currently it is being met for mule deer in the summer, but not in winter. State herd objectives are being met. Without any vegetation treatments in the unburned areas, stand density will continue to increase over time, decreasing understory production. Habitat capability will decline over time. However, wildfire will have the effect of increasing forbs and shrubs in the understory would increase somewhat.

Species	Effects of No Action
Mountain bluebird	According to the HABCAP model, all the DUs are currently above the Forest Plan standards and guidelines under existing conditions (after Hayman Fire). Without any treatments stands would become more closed and suitability for this species would decrease, asit needs open stands and open areas for foraging.
Red-naped sapsucker	According to the HABCAP model, all DUs that were not affected by the Hayman Fire are currently above the Forest Plan S&G. Without any treatments in the unburned areas, stand density will continue to increase. When another stand-replacing fire does occur, it is expected that there would be patches of forested stands that would survive, but total amount of habitat and habitat capability would drop to very low levels for the next several decades. However, because this species is often associated with aspen, habitat suitability would increase over the long-term as aspen is regenerated by wildfire.
Merriam's turkey	According to the HABCAP model, all DUs are currently above the Forest Plan S&G for summer habitat. Winter habitat is below 40 percent. This is because the species shifts use into older stands and makes less use of younger stands through the winter. Because this species needs open stands and trees with an open canopy for roosting, habitat capability would decrease over the long-term without any treatments. Stand-replacing wildfire, such as Hayman, reduces availability of winter roosting habitat.

Effects of the Action Alternatives on Management Indicator Species

Proposed Action and Alternative C

The HABCAP model was run for the Proposed Action to evaluate changes to habitat capability for MIS (Table 44). Pluses indicate habitat increases, minuses indicate decreases, and equal signs indicate no change. Where there is no symbol (DUs 922-924), no change is expected because no treatments are proposed in these units under any alternatives.

Table 44. Habitat Capability for Management Indicator Species under the Proposed Action

	Diversity Unit									Avg.
MIS	918	919	920	921*	922*	923*	924*	925	930	
Abert's squirrel - summer	31/-	33/-	17/-	9/-	31	7	16	26/-	30/-	22/-
Abert's squirrel - winter	31/-	33/-	17/-	9/-	31	7	16	26/-	30/-	22/-
Elk - summer	18/=	21/+	27/+	36/+	27	24	38	21/+	16/+	25/+
Elk - winter	21/+	24/+	28/+	25/+	20	13	29	27/+	17/=	23/+
Mule deer - summer	65/+	71/+	87/+	84/+	72	49	85	76/+	65/+	73/+
Mule deer - winter	32/+	39/+	37/+	23/+	40	28	44	42/+	36/-	36/+
Mountain bluebird	51/+	59/+	80/+	48/+	41	41	47	70/+	53/+	54/+
Red-naped sapsucker	41/-	41/-	35/-	22/-	22	6	18	38/-	45/=	30/-
Merriam's turkey - summer	65/+	70/+	77/+	69/+	73	75	72	75/+	56/+	70/+
Merriam's turkey - winter	53/-	25/-	14/-	12/-	33	11	23	20/-	22/-	24/=

Alternative C is very similar to the Proposed Action, since it includes the same thinning and burning prescription. Alternative C eliminates any impact on MIS species from new temporary roads, however these impacts are minimal due to the low impact design and temporary nature of the roads. Alternative C includes more helicopter yarding, which may increase short-term disturbance for some MIS species, but would also reduce the duration of the disturbance.

Table 45 updates population trends for MIS species in the Trout-West WAA. This table has been added to respond to comments on the DEIS.

Table 45. Population Trend and Viability of Management Indicator Species - Proposed Action

Species	Population trend and viability determination
Abert's squirrel	The *Species Trend Evaluation* found that populations in Colorado were stable or increasing. Populations are sufficient to hunt, managed by CDOW. The project area is only a small part of their distribution, as they are found from southern Wyoming and south into Arizona and New Mexico (following the distribution of ponderosa pine). The *PSICC Plan Monitoring Report* (2000) found that ponderosa pine on the Forest is currently about 80% mature and old; this project would maintain that distribution but would open the canopy cover. Cumulative effects are addressed and monitoring includes review of marking guides and modification if needed. Based on all the above factors and in addition to mitigation that has been incorporated to maintain feeding and nesting trees, the Proposed Action would maintain habitat in the analysis area and contribute towards viable populations of this species. *Because there is some uncertainty in this determination, monitoring has been added to the project. This monitoring would inventory pre- and post-treatment densities of Abert's squirrels, using Forest survey protocols.*
Elk and mule deer	The *Species Trend Evaluation* found that populations of these species are increasing. Both species are intensively managed by CDOW. The project area is a very small part of their range. The project has mitigation to address retention of thermal cover and riparian buffers and addresses timing of activities in calving or fawning habitat. The indirect effect of the project would be to increase grasses, forbs, and shrubs in the understory, which will improve forage conditions and possibly improve distribution (more use of public lands). Cumulative effects are addressed and monitoring includes review of marking guides and modification if needed. Based on all the above factors and in addition to mitigation that has been incorporated to maintain thermal cover and riparian buffers, the Proposed Action would maintain habitat in the analysis area and contribute towards viable populations of this species.
Mountain bluebird	The S*pecies Trend Evaluation* reviewed Breeding Bird Survey information from the Southern Rockies and Colorado; both of which indicate an increasing population (but with non-significant trend). The project area is only a small part of the total range (roughly the western half of North America. Cumulative effects are addressed and monitoring includes review of marking guides and modification if needed. Based on all the above factors and in addition to mitigation that has been incorporated to maintain Forest Plan levels of snags plus favoring all trees with existing cavities, the Proposed Action would maintain habitat in the analysis area and contribute towards viable populations of this species.
Red-naped sapsucker	The MIS Review found no population trend data to suggest a decline. Data on a group of three sapsucker species indicate that populations in general are stable in Colorado. The project area is only a small portion of their total range (across the Rocky Mountains, from Canada down into Mexico). This species is strongly associated with aspen, which will be favored by this project over the long-term. Cumulative effects are addressed and monitoring includes review of marking guides and modification if needed. Based on all the above factors and in addition to project design and mitigation, the Proposed Action would maintain habitat in the analysis area and contribute towards viable populations of this species.

Species	Population trend and viability determination
Merriam's turkey	The S*pecies Trend Evaluation* found that turkey populations are suspected to be stable or increasing statewide. This is thought to be due to reintroductions, mild winters, and good food availability. The project area is only a small part of the range of this species, which is found across much of the United States. Cumulative effects are addressed and monitoring includes review of marking guides and modification if needed. Based on all the above factors and in addition to project design and mitigation for retention of roost trees, the Proposed Action would maintain habitat in the analysis area and contribute towards viable populations of this species.

Tables 46 – 49 describe the effects of each alternative based on the HABCAP model, knowledge of habitat associations, incorporation of mitigation, and professional judgment.

Table 46. Effects of the Proposed Action and Alternative C on Management Indicator Species

Species	Effects of the Proposed Action and Alternative C
Abert's squirrel	The model shows a decline in habitat capability for this species. However, it does not incorporate the effects of mitigation. Mitigation associated with these alternatives calls for identification and protection of nest and feed trees during project layout. *Since feed trees are chemically different than most other trees, it is critical to retain trees that are being used rather than designate a number of trees.* Thinning may enhance cone projection in ponderosa pine, which could result in higher squirrel numbers during years of high cone production (USDA 2001e). In addition, there is mitigation to retain trees in patches, rather than evenly spaced. This patchiness, in addition to the retention of thermal cover and stands on extended steeper slopes, will benefit this species. It is expected that habitat suitability and populations will be maintained at the current levels (post-Hayman) under the Proposed Action. The Hayman Fire had a much greater effect on habitat capability over the analysis area (a 13% decrease) than the proposed treatments would (4% decrease). In addition, the wildfire likely burned nesting and feeding clumps, while mitigation for this project would retain these features. The proposed treatments greatly reduce the potential for future damaging crown fires and would benefit this species. Mistletoe has been identified as providing feeding and nesting habitat for this species. While some mistletoe-infected trees would be removed, mistletoe would be retained at near historic levels in the treated areas and would continue to provide habitat for this species.
Elk	The proposed treatments would improve summer and winter habitat for elk. With a decrease in overstory, understory grasses and shrubs would increase, providing more forage. Mitigation limits activities in calving areas. These alternatives also include the construction of about 14 miles of temporary road and around 48 miles of existing roads or trails that would be used and rehabilitated following the treatments. There would be a short-term increase in disturbance as a result of new roads, but over the long-term disturbance would be reduced due to lower road densities. While the changes in open road density are small, some areas may provide security and help retain elk on public lands in the project area. Thermal cover stands are not treated, but could be affected by wildfire. Winter thermal cover acres would be expected to be low but summer thermal cover would increase as aspen regenerates in treated areas and areas burned by wildfire. Habitat suitability and populations for elk are expected to increase under these alternatives.

Species	Effects of the Proposed Action and Alternative C
Mule deer	The proposed treatments would improve summer and winter habitat for mule deer. With a decrease in overstory, understory forbs and shrubs would increase, providing more browse. Mitigation limits activities in fawning areas. Habitat suitability for mule deer would increase under these alternatives, and populations would be expected to increase as well.
Mountain bluebird	Nest site availability is a limiting factor in mountain bluebird productivity. Mitigation measures include a measure that would retain all trees and/or snags with existing cavities, all lightening-struck trees, and a specified number of snags per acres, which would maintain nesting habitat in the treated areas. Mistletoe would still be present in the stand, and would provide foraging habitat. Mountain bluebirds are also associated with open woodland, edge habitats, and early post-fire conditions, and as a result, these alternatives would improve foraging habitat for this species. Habitat suitability would be over the 40% minimum level and numbers would be expected to increase under these alternatives.
Red-naped sapsucker	The HABCAP model suggests a slight decrease in habitat capability for this species as a result of the proposed treatments. However, the Hayman Fire had a much greater effect on habitat capability (12% decrease) and treatments would reduce the potential for further damaging crown fires. Because this species uses live trees in coniferous/deciduous forests that include aspen and cottonwood, all action alternatives would be expected to benefit this species because of expected aspen regeneration. In addition, project design and mitigation retain the older, mature trees that are most suitable for this species.
Merriam's turkey	The HABCAP model suggests an increase in summer habitat and a decrease in winter habitat for this species. Summer habitat is expected to improve because of the preference for small openings with increased ground vegetation. The decrease in winter habitat displayed in the HABCAP model is mitigated through the retention of thermal cover patches, known turkey roost sites, and retention of trees on extended slopes over 20 percent. In Colorado, wild turkeys are on the nest with eggs in late May (Kingery 1998). Since broadcast burning would occur between March and April or September and October, burning would not result in a loss to nests. Thinning activities occurring during May through June could result in loss of eggs or nestlings.

Alternative A

The long-term effects of this alternative would be similar to the effects of the Proposed Action and Alternative C. Vegetation outcomes are the same, except different methods are used to achieve them. This alternative uses mechanical methods to reduce understory fuels instead of broadcast or pile burning as proposed in the Proposed Action. Mechanical methods could occur at any time during the year when soil is frozen or dry (unless in a calving or fawning area, or area with another seasonal restriction), while broadcast burning would likely occur between March and April or September and October.

Table 47. Effects of Alternative A on Management Indicator Species

Species	Effects of Alternative A
Abert's squirrel	Same as Proposed Action.
Elk	Mitigation limits activities in calving areas and there should be no differences in effects from the Proposed Action.
Mule deer	Mitigation limits activities in fawning areas and there should be no differences in effects from the Proposed Action.

Species	Effects of Alternative A
Mountain bluebird	Because mechanical treatments are more controlled, the potential for loss of designated snags and loss of trees with existing cavities and other marked trees is very low. Habitat and populations are expected to increase above current levels.
Red-naped sapsucker	Because mechanical treatments are more controlled than broadcast burning, the potential for loss of trees with existing cavities (mitigation) is very low. Effects similar to Proposed Action.
Merriam's turkey	Because mechanical treatments are more controlled than broadcast burning, the potential for loss of designated turkey roosts (mitigation) is very low. Displacement could occur at any time when soils are dry or frozen enough for project activities to occur. In Colorado, wild turkeys are on the nest with eggs in late May (Kingery 1998). Thinning activities occurring during May through June could result in loss of eggs or nestlings. Effects similar to Proposed Action.

Alternatives B and D

Alternative B treats less acreage than the Proposed Action, Alternative A, and Alternative C. Effects on wildlife in treated areas are similar to the Proposed Action and for untreated areas, similar to No Action. Alternative D treats only 7,000 acres out of the 77,000-acre WAA, with habitat effects on about nine percent of the area. Alternative D is likely to suffer wildfire damage similar to No Action. Alternative B is predicted to reduce risk of damaging wildfire, but not to the extent that the Proposed Action would.

Table 48. Effects of Alternatives B and D on Management Indicator Species

Species	Effects of Alternatives B and D
Abert's squirrel	Mitigation associated with these alternatives would protect nest and feed trees during project layout. Since feed trees are chemically different than most other trees, it is important to retain trees that are being used rather than just a number of trees. It has also been suggested that thinning may enhance cone projection in ponderosa pine, which could result in higher squirrel numbers during years of high cone production (USDA 2001e). Mistletoe would be maintained at higher levels in Alternative D, owing to a specific project design feature that does not select against diseased trees. In both Alternatives B and D, mistletoe would continue as a habitat component for this species. Because these alternatives treat fewer acres, the risk of damaging crown fire would be higher than under the Proposed Action. It is expected that habitat suitability and populations would decrease, as it is predicted that twice as many acres would burn in wildfires under these alternatives.
Elk	The proposed treatments would improve summer and winter habitat for elk. With a decrease in overstory, understory grasses and shrubs would increase, providing more forage. Mitigation limits activities in calving areas. These alternatives also include the construction of about 13 miles of temporary road and the rehabilitation of 31 miles of existing roads or trails. Habitat suitability and populations for elk would be expected to increase under this alternative, although not as much as under the Proposed Action. Thermal cover stands would not be treated, but could be affected by wildfire. Thermal cover acres would be expected to be very low but summer thermal cover would increase as aspen regenerates in treated areas and areas burned by wildfire.

Species	Effects of Alternatives B and D
Mule deer	The proposed treatments would improve summer and winter habitat for mule deer. With a decrease in overstory, understory forbs and shrubs would increase, providing more browse. Mitigation limits activities in fawning areas. Habitat suitability for mule deer would increase under these alternatives, and populations would be expected to increase as well, although not as much as under the Proposed Action.
Mountain bluebird	Nest site availability is a limiting factor in mountain bluebird productivity. Mitigation measures include a measure that retains all trees and/or snags with existing cavities, all lightening-struck trees, and a specified number of snags per acres, which would maintain nesting habitat. Mountain bluebirds are also associated with open woodland, edge habitats, and early post-fire conditions; as a result, these alternatives would improve foraging habitat for this species. However, because of the higher probability of damaging crown fires, nest site availability could decrease. Mistletoe would still be present in the area and provide foraging habitat, although at lower levels than the Proposed Action.
Red-naped sapsucker	The HABCAP model suggest a slight decrease in habitat capability for this species. Because this species uses live trees in coniferous/deciduous forests that include aspen and cottonwood, all action alternatives would be expected to benefit this species. In addition, project design and mitigation would retain the older, mature trees that are most suitable for this species. As ponderosa pine and Douglas-fir are thinned, aspen would be expected to increase in the understory. Because fewer acres are treated, the potential for damaging crown fires would be higher than the Proposed Action. Habitat would decrease over the short-term, but would increase as aspen regenerates in burned areas.
Merriam's turkey	The HABCAP model suggests an increase in summer habitat and a decrease in winter habitat for this species. Summer habitat would be expected to improve because of this species' preference for small openings with increased ground vegetation. The decrease in winter habitat displayed in the HABCAP model is mitigated through the retention of thermal cover patches, known turkey roost sites, and retention of trees on extended slopes over 20%. Because fewer acres are treated, the potential for damaging crown fires would be higher than under the Proposed Action. Roost sites could decrease over the area, reducing habitat capability (but still above the 40% level). In Colorado, wild turkeys are on the nest with eggs in late May (Kingery 1998). Since broadcast burning would occur between March and April, and between September and October, burning would not result in a loss to nests. Thinning activities occurring during May through June could result in loss of eggs or nestlings.

Alternative E

Table 49. Effects of Alternative E on Management Indicator Species

Species	Effects of Alternative E
Abert's squirrel	Based on criteria in the HABCAP model, implementation of this alternative would drop the habitat capability below the 22% level of the Proposed Action. While this alternative does include mitigation to retain existing nesting and foraging trees, much of the project area would be more open between the nesting and foraging clumps. Without the patchiness provided by retention of thermal cover patches, stands would be more open. This may increase seed production, but may decrease suitability of the habitat and increase the species' vulnerability to predators. Mistletoe would be reduced the most over the analysis area with this alternative. This alternative would result in the greatest loss of nesting cover and foraging habitat.

Species	Effects of Alternative E
	Persistent openings proposed in this alternative would not be suitable for this species and habitat would be lost over the long-term.
Elk	The proposed treatments would improve summer and winter habitat for elk. With a decrease in overstory, understory grasses and shrubs would increase, providing more forage. Mitigation limits activities in calving areas. This alternative also includes the construction of about 14 miles of temporary road and rehabilitation of 48 miles of existing roads or trails. Habitat suitability and populations of elk are expected to increase with this alternative. This alternative does not include mitigation to retain thermal cover. There may be an increase in summer thermal cover in the long-term as aspen increases. Winter thermal cover may not be as critical in this area, as winters are mild, snow cover is light, and winter surveys generally find most of the elk at higher elevations on open flats. In addition, this area is part of the 11-mile Elk Herd, which is well above state population objectives. It would appear, based on elk populations, that thermal cover is not limiting, even though most of the DUs are below Forest Plan standards and guidelines.
Mule deer	The proposed treatment would improve summer and winter habitat for mule deer. With a decrease in overstory, understory forbs and shrubs would increase, providing more browse. Mitigation limits activities in fawning areas. Habitat suitability for mule deer would increase under this alternative, and populations would be expected to increase as well.
Mountain bluebird	Nest site availability is a limiting factor in mountain bluebird productivity. Mitigation measures include a measure that would retains all trees and/or snags with existing cavities, all lightening-struck trees, and a specified number of snags per acres, which would maintain nesting habitat. Mountain bluebirds are also associated with open woodland, edge habitats, and early post-fire conditions; as a result, this alternative would improve foraging habitat for this species. Numbers would be expected to increase under this alternative over the short term. Mistletoe would decrease over current conditions, but would be present at near historic levels. This habitat component would continue to provide foraging habitat for this species. Persistent openings would provide foraging habitat, but nesting habitat would be lost over the long-term. Since nest site availability is a limiting factor, the maintenance of persistent openings could reduce populations over the long-term.
Red-naped sapsucker	The HABCAP model suggests a decrease in habitat capability for this species over the short-term. Because this species uses live trees in coniferous/deciduous forests that include aspen and cottonwood, all action alternatives would be expected to benefit this species. In addition, project design and mitigation retain the older, mature trees that are most suitable for this species. As ponderosa pine and Douglas-fir are thinned, aspen would be expected to increase in the understory. At low elevations with southern exposure, persistent openings would convert to grassy openings. At higher elevations with northern exposure, these openings would have increasing aspen. Increased aspen would benefit sapsuckers over the long-term, but habitat would be lost over the long-term in the grassy openings.
Merriam's turkey	The model suggests an increase in summer habitat and a decrease in winter habitat for this species. Summer habitat would be expected to improve because of this species' preference for small openings with increased ground vegetation. The decrease in winter habitat displayed in the HABCAP model would be partially mitigated through the retention of known turkey roost sites. In Colorado, wild turkeys are on the nest with eggs in late May (Kingery 1998). Since broadcast burning would occur between March and April, and between September and October, burning would not result in a loss to nests. Thinning activities occurring during May through June could result in loss of eggs or nestlings.

Cumulative Effects for Management Indicator Species

Ongoing activities contributing towards cumulative effects on wildlife habitats include development on adjacent private lands, timber harvest, prescribed burning, wildfire, livestock grazing, dispersed recreation, hunting, and off-road vehicle use.

Private Land Development

The Teller County population increased by approximately 70 percent from 1990 to 1999. Population and development have similarly increased within the Wildland-Urban interface in the project area. Further population increases are anticipated through 2010. People living near the forest, along with their developments and their pets, reduce habitat suitability and harass wildlife.

Timber Harvest

The Trout Creek Timber Sale is an ongoing timber harvest occurring on federal lands in the watershed. The Trout Creek project mechanically thinned about 950 acres and was going to broadcast burn around 1,200 acres to reduce understory fuels. Part of this area burned in the Hayman wildfire. There is a 40-acre thinning project on the Manitou Experimental Forest. There is also personal-use firewood harvest across the analysis area that results in removal of standing and downed dead trees.

Salvage within the Hayman Fire area is also being proposed, and a portion of the area is within DUs that comprise the WAA The Wildlife Analysis considered the effects of the salvage and concluded that salvage of dead trees would not change the analysis findings. The effects of the fire are already modeled into the wildlife analysis and the fire-killed stands are already considered lacking in live tree canopy. Sufficient numbers of dead trees would be retained within these stands to provide for wildlife needs.

Little private logging in the watershed has been reported by the Colorado State Forest Service. Some selective logging of larger trees on one private parcel was noted in the Trail Creek area. This timber harvest was also conducted in riparian habitats.

Prescribed Burning

The Polhemus Burn included 6,400 acres of National Forest lands within the watershed. See the Crown Fire Hazard and Vegetation section for details.

Wildfire and Associated Salvage

The Hayman Fire burned 26,800 acres within the analysis area. Wildfire risk remains high in the area, and without treatment, a wildfire is likely to occur within the analysis area in this decade. Wildfire would reduce the density of live trees in forested areas and in burned-over areas and decrease habitat for species like Abert's squirrel for several decades. Most species are able to tolerate low-intensity fire with few significant effects to population; however, multiple fires with moderate- and high-intensity burning would likely have cumulatively significant effects.

The Preferred Hayman Salvage Alternative 3 would reduce snags available for snag-dependent species, but the magnitude is considered slight (USDA 2003a).

Livestock Grazing

Livestock grazing occurs on about half of the proposed treatment units, with most of it occurring in the Phantom Unit. This unit also has the largest amount of perennial streams and riparian habitats. Effects of grazing include plant defoliation, mechanical changes to soil and plant material, and nutrient redistribution. These and other factors also influence successional trends. Grazing frequency, duration, intensity, and timing affect succession. Grazing can also alter vegetation composition. These factors affect nesting habitat, foraging habitat, and cover for many species of wildlife. Streamside areas may be especially affected.

Recreation

Joslin and Youmans discussed effects of recreation on wildlife in 1999. Disturbance caused by recreational pursuits or other human activities may elicit behavioral and/or physiological responses in wildlife. An individual's behavioral response may vary according to season, age and sex, body size, motivational state, behavioral response of cohorts, and habitat security. Behavioral responses are also influenced by the disturbance itself, such as type of activity, distance away, direction of movement, speed, predictability, frequency, and magnitude. Behavioral responses may be of short duration, such as temporary displacement, or long-term, such as abandonment of preferred foraging areas.

Developed and dispersed camping can decrease habitat suitability for some species. Species that use snags are usually negatively affected through removal of hazard trees and the use of snags for firewood. Long-term use of dispersed sites can modify the vegetation, decreasing or eliminating suitable habitat. Disturbance during breeding or nesting can also occur. Recreation within riparian areas can reduce habitat capability in these areas.

Increases in population in Teller and adjacent counties has resulted in an increase in recreational use in both developed areas and dispersed use across the area. This use has the potential to result in a loss of habitat (trampling at dispersed sites, development of off-road trails, etc.) and disturbance and displacement as a result of human and motorized use.

Off-Road Motorized Vehicle Use

Off-road motorized use removes vegetation, increases bare soil, and increases the potential for establishment of non-native plant species. Disturbance is less predictable, and habituation of wildlife is less likely to occur.

Table 50 displays the ongoing effects from proposed and existing activities on selected wildlife species. These effects are common to all alternatives.

Table 50. Cumulative Effects on Wildlife Species

Species	Cumulative Effects
Abert's squirrel	Limiting factors for this species are feeding and nesting trees. Since the species uses trees that are chemically distinct, tree removal that does not retain existing feeding and nesting trees could reduce suitable habitat. Currently, very little timber harvest has been done on private lands and harvest on federal lands incorporates mitigation to retain nesting and feeding trees. Wildfire has the greatest potential to affect feeding and nesting trees. Damaging crown fires (moderate and high intensity fires) result in the loss of habitat. The proposed treatments would reduce the potential for damaging crown fires and loss of habitat. An additional factor that can affect populations of this species is hunting. In the 2000-01 season, statewide harvest was up from 1999. Both hunter numbers and days hunted increased during this same time period. Harvest in Teller County was reported to be 160. In the 2001-02 season, only 21 were reported harvested in Teller County. Hunting does not appear to be having a large impact on populations in the state or in Teller County (CDOW website). None of the action alternatives contribute to a loss of habitat or populations over the analysis area, although Alternative E may decrease suitability somewhat by increasing vulnerability to predation by opening up the stands to lower densities.
Elk	Elk are affected by forage availability, can be displaced by subdivision and recreational use, and can be killed when crossing highways and by hunting. High open road densities may be contributing to displacement of elk onto adjacent lands where they have more security. Some larger areas of private land that aren't open to hunters are acting as refuges, and numbers are hard to reduce in areas that are not available to hunters. Currently, numbers are above state population objectives, and none of these factors seem to be occurring at levels that affect populations.
Mule deer	Mule deer are affected by forb and shrub availability, can be displaced by subdivision and recreational use, and can be killed when crossing highways and by hunting. Currently, numbers are above state population objectives, and none of these factors seem to be occurring at levels that affect populations.
Mountain bluebird	Availability of cavities appears to be the limiting factor for this species. There are "bluebird trails" in the project area, a series of bluebird boxes that are maintained by individuals from the area, as well as bluebird houses put up around residences. These nest boxes have increased the availability of nesting habitat. Firewood cutting on federal lands, private timber harvest, and wildfire reduces snag availability. The proposed treatments, with mitigation, would reduce the potential for loss of habitat through wildfire. Based on available population trend information, populations are increasing in Colorado and this trend would be expected to continue.
Red-naped sapsucker	This species uses older, mature, live trees. Harvest on federal or private lands has the potential to reduce habitat. The Trout Creek timber sale on federal lands retained the older, mature trees, and habitat for this species was maintained in the project area and could result in an increase in aspen. The harvest that has been occurring on private land has taken the larger, older trees. Currently this appears to be at very low levels and has no affect on overall habitat in the analysis area. Wildfire also reduces habitat over the short-term, but can result in an increase in aspen stands over the long-term. Habitat for this species should be maintained over the long-term.
Merriam's turkey	This species uses older, mature, live trees. Harvest on federal or private lands has the potential to reduce habitat. The Trout Creek timber sale on federal lands retained the older, mature trees, and habitat for this species was maintained in the project area. The harvest that has been occurring on private land has taken the larger, older trees. Currently this appears to be at very low levels and has no affect on overall habitat in the analysis area. Wildfire also affects habitat; it can be beneficial in improving foraging habitat in the understory, but can also result in the loss of roost habitat in older, larger trees.

Thermal cover

Thermal cover is an issue because there is a Forest Plan Standard and Guideline specifically related to thermal cover, and much of the area is naturally and currently below the Forest Plan threshold.

Thermal cover is cover used by animals to moderate effects of weather (Hoover and Wills 1987). Thermal relief may be supplied by vegetation, topography, other animals; and different combinations of vegetation, water, and air movement (Lyon and Christensen 1992). Structurally, thermal cover is defined for elk as a stand of coniferous trees at least 40 feet tall with average crown closure of 70 percent or more. Forest Plan Standards and Guidelines include thermal cover for winter and spring-summer. Because the Forest Plan direction applies to thermal cover year-round, it was calculated both with and without aspen.

Aspen would provide thermal cover in the summer, but not in the winter. The existing thermal cover indicated by the RIS inventory is well distributed across the WAA (Table 51).

Table 51. Thermal Cover Distribution by Diversity Unit (Includes Hayman Fire Effects)

	Diversity Unit								
	918	**919**	**920**	**921**	**922**	**923**	**924**	**925**	**930**
Percentage Thermal Cover Summer	28	20	14	9	4	0	0	6	8
Percentage Thermal Cover Winter	27	20	13	8	4	0	0	3	7

Three of the DUs met the Forest Plan guidance for thermal cover prior to the Hayman Fire. Following the Hayman Fire, only two DUs met the guideline. Winter thermal cover may not be critical in this area; winters are mild, snow cover is light, and winter surveys generally find most of the elk at higher elevations on open flats. In addition, this area is part of the 11-mile Elk Herd, which is well above state population objectives. The thermal cover objective was developed from research in the Blue Mountains of Oregon and Washington (Thomas 1979). Thomas (1979) stated, "where ponderosa pine stands were used for thermal cover, it is especially rare to find canopy closures approaching 70 percent."

It would appear, based on elk populations, that thermal cover is not limiting numbers even though several of the DUs are below Forest Plan standards and guidelines.

A review of acres not treated by DU for the Proposed Action is shown in Table 52. This table includes stands in the 41-70 percent and 71-100 percent crown closure classes (pole and sawtimber) and mature and old-growth, as identified in the HABCAP model. Table 52 shows that there are significant percentages of areas in these structural stages that are not proposed for treatment. These areas include thermal cover, riparian buffers, extended steep slopes, stands that are already meeting desired conditions, and other areas that are outside of treatment units.

All of the areas that aren't already thermal cover retain the potential to move into thermal cover as stand density increases.

Table 52. Percentage of Diversity Unit in Dense, Mature Stands Following Treatment – Proposed Action

	Diversity Unit								
	918	**919**	**920**	**921**	**922**	**923**	**924**	**925**	**930**
Percent of Diversity Unit	67%	61%	22%	24%*	23%*	37%*	30%*	46%	80%

* These numbers are estimates based on the assumption that about half of Hayman burned as stand-replacing fire, while the other half was low-intensity or didn't burn. There are no treatments proposed in DUs 922-924.

In addition, Higley (project Silviculturist) estimated that the trees left in the thinned stands would increase three percent in canopy cover each year for at least ten years following thinning. So while stands would be more open and canopies reduced over the short-term, thinning would stimulate growth in the remaining trees.

The effects of thinning would likely result in an increase in aspen cover in many areas. An increase in summer thermal cover is expected in thinned areas over the long-term as aspen increases, under all action alternatives.

Sufficient acreage is left unthinned in the Proposed Action and Alternatives A, B, C, and D to meet the Forest Plan Standard. Thermal cover is expected to increase over the long-term in Alternatives A, B, C, and the Proposed Action. Thinning around thermal cover patches would help protect them from future wildfire effects.

Alternative E does not retain existing thermal cover and therefore would not be consistent with current Forest Plan guidelines. Selection of Alternative E would likely require a Forest Plan Amendment.

Landbirds

The WAA provides habitat for numerous species of birds. Because pygmy nuthatches were found to be good indicators of overall "health" of Ponderosa pine communities, they were used to analyze effects for forest-associated bird species. The pygmy nuthatch is a Sensitive Species, and analysis is found in the Biological Evaluation (Appendix B).

Consistency with Forest Plan

General standards and guidelines from the Forest Plan have been incorporated as mitigation measures. These include snag and downed woody debris direction, as well as direction for protection of Abert's squirrel stands, turkey roosts, and goshawk and flammulated owl nest buffers. In addition, the Proposed Action and Alternatives A, B, C, and D incorporate riparian buffers and retention of existing thermal cover.

Alternative E does not incorporate these mitigation features and a site-specific Forest Plan amendment would be needed for implementation of that alternative.

In addition, there is direction for maintenance of at least 40 percent of habitat capability for MIS for each DU. As was shown in the analysis, most of the DUs are not meeting this standard under the existing condition. However, the existing habitat capability was maintained or increased for all except three of the species: Abert's squirrel, red-naped sapsucker and three-toed woodpecker (this was analyzed in the BE, see Appendix B). As was shown in the analysis, the modeling may not have adequately addressed these species (because of mitigation for retention of Abert's nesting and feeding trees, retention of older, mature trees, and expected increase in aspen that are favored by red-naped sapsucker). Alternative E would be less favorable for Abert's squirrel because it does not retain clumpiness in treated stands; this would tend to isolate nesting and feeding trees and make the species more vulnerable to predation when moving between areas. The three-toed woodpecker had a pre-Hayman value of 55 percent, which dropped to 40 percent post-Hayman. The proposed treatments would further reduce this value to 38 percent. While the treatments result in a small decrease in habitat capability, this is offset by the reduced potential for stand-replacing fire.

The Forest Plan also includes direction for habitat capability by MA. While it is predicted that these are also currently below Forest Plan directed levels, it is expected that it will be maintained at least at current levels for all alternatives except E, based on the previous analysis by DU. The two MAs with direction for managing for 80 percent of habitat capability are 4B and 9B. No treatments are proposed in these two management areas, except under Alternative E. Alternative E proposes helicopter logging in 4B and does not include the riparian buffer (9B).

The Forest Plan also contains direction for retention of thermal cover by DU. As described in the previous section, all alternatives except E retain all existing thermal cover. Alternative E would require a site-specific Forest Plan amendment.

Finally, the Plan includes direction for retention of old-growth. As was discussed previously in the Wildlife and Vegetation sections, the project area is currently below the guidelines, largely because of historic logging that took place at the turn of the last century. Because old-growth ponderosa pine stands were open historically and the silvicultural prescriptions retain the larger, older trees, the treatments will actually favor recruitment of old-growth in the future. Remaining trees will see an approximate three percent increase in crown closure by year, and stands will have a reduced risk of loss to wildfire.

Sensitive Plants, Range Resources, and Noxious Weeds

Listed Threatened, Endangered, and Proposed Plant Species

A Biological Assessment (BA) was prepared to consider the effects of the alternatives on Listed Threatened, Endangered, or Proposed (TEP) plant species. No documented sites or potential suitable habitat exists in the Trout-West project area for TEP plants. Determinations of effects of the alternatives are noted in Table 53. None of the alternatives would affect any known TEP plant species. Further information is included in the Plant BA in Appendix J, available electronically at http://www.fs.fed.us/r2/psicc/spl/twest.htm.

Table 53. Effects Determinations Summary for Threatened, Endangered, and Proposed (TEP) Plants

Species Name	Proposed Action	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Spiranthes diluvalis Listed Threatened	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Eutrema edwardsii* ssp. *penlandii Listed Threatened	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect

Sensitive Plant Species

A BE was prepared to consider the effects of the alternatives on sensitive plants in the project area. The BE is included in Appendix J (see website address above). No sensitive plants are known in the treatment areas, but several have potential to occur. Narrow-leaved moonwort (*Botrychium lineare*) is a candidate for listing under the federal Endangered Species Act. Table 54 describes habitat and distribution for Sensitive Plant Species.

Alternatives with the least amount of temporary road building would have the least amount of impacts on unknown sensitive plant sites. In general, No Action will not disturb these plants and would have no effect. A damaging wildfire could eliminate some sites, but no known populations would be affected. The alternatives with greatest amounts of ground disturbance (in ranked order from greatest to least: E, A, Proposed Action, C, B, D, No Action) have the greatest risk of affecting habitat or individual plants.

Table 54. Sensitive Plant Habitat and Distribution

FS Sensitive Plant Species	Habitat and Distribution
Botrychium echo Reflected moonwort	Distribution in Central Colorado includes El Paso and Clear Creek counties. This fern is found growing in gravelly soils near roads and trails, rocky hillsides, grassy slopes, and mountain meadows. Elevations range from 9500 - 11,000 ft. Spores produced in July.
Botrychium pallidum Pale moonwort	Distribution includes Teller County. Found in mountain meadows, grassy slopes, open exposed hillsides, burned or cleared areas, and old mining sites. Elevations range from 9800-10,600 ft. Spores produced July-August.
Botrychium lineare Narrow-leaved moonwort	Distribution includes El Paso County along the Pikes Peak toll road. Other locations of record are Oregon and Quebec. Deep grass and forb meadows, under trees in woods, and on shelves on limestone cliffs, mainly at higher elevations. Elevations range from 8700-11,000 ft. Spores mature in late June and July. CANDIDATE FOR ESA LISTING
Carex livida Livid sedge	Distribution includes Park County. A wetland species occurring in rich fens and wetlands. Elevations range from 9000-10,000 ft.
Malaxis brachyopoda Addersmouth	Occurrences are given as Boulder, Jefferson, and El Paso counties. The El Paso County site is thought to have been destroyed by development. One site is near Bailey on the Pike NF. This plant grows along streams in mosses where it is kept wet by water spray. It is all green in color and difficult to distinguish from streamside vegetation. Elevation ranges from 7200–8000 ft. Flowers in July; fruiting in August.
Potentilla rupincola Rock cinquefoil	Colorado endemic (Boulder, Clear Creek, Larimer and Park counties). This species occurs on granitic outcrops or thin, gravelly-granitic soils with west or north exposure. Often associated with ponderosa pine or limber pine. Elevations range from 6,900-10,500 ft. Flowers in mid-June to August.
Viola selkirkii Spurred violet	Distribution in Colorado includes Douglas County; there is a known site near Devil's Head. It grows in cold mountain (aspen) forests, moist woods, and thickets. Elevations range from 8500-9100 ft. Flowers May-June.

Effects of Alternatives on Sensitive Plants

Table 55 summarizes the determination effects statements on sensitive plants.

Table 55. Effects of the Action Alternatives on Sensitive Plants

Species Name	Proposed Action	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Botrychium lineare Narrow-lvd moonwort	**MIIH***	**MIIH**	**MIIH**	**MIIH**	**MIIH**	**MIIH**
Botrychium echo Reflected moonwort	**MIIH**	**MIIH**	**MIIH**	**MIIH**	**MIIH**	**MIIH**
Botrychium pallidum Pale moonwort1	**MIIH**	**MIIH**	**MIIH**	**MIIH**	**MIIH**	**MIIH**
Carex livida Livid sedge	**NI+**	**NI**	**NI**	**NI**	**NI**	**NI**
Malaxis brachyopoda Addersmouth	**MIIH**	**MIIH**	**MIIH**	**MIIH**	**MIIH**	**MIIH**
Potentilla rupincola Rock cinquefoil	**MIIH**	**MIIH**	**MIIH**	**MIIH**	**MIIH**	**MIIH**
Viola selkirkii Spurred violet	**MIIH**	**MIIH**	**MIIH**	**MIIH**	**MIIH**	**MIIH**

*MIIH = May impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the populations or species.
+NI = No Impact

The effects of the action alternatives vary by the acres of ground disturbing activities that occur. Table 56 comparatively ranks the alternatives and shows that the alternatives with the most acres of ground disturbing activities would have the highest potential to affect sensitive plants.

Table 56. Effects Ranking for Sensitive Plants

Alternative	Acres Treated	Ranking *(1-7, with 1 rated best due to least amount of ground disturbing activities)*
No Action	0	1
Alternative D	6,750	2
Alternative B	13,570	3
Alternative A	19,220	4
Proposed Action	20,170	5
Alternative C	20,170	5
Alternative E	26,320	7

Cumulative Effects on Sensitive Plants

The Polhemus Burn and the Trout Creek Timber Sale did not affect any known sensitive plant populations. Hayman Fire Salvage includes mitigation measures to protect sensitive plants. The cumulative effects of these activities, together with the Trout-West Project, are unlikely to have any impact on population viability for any sensitive plant species.

Range Resources

This section discusses management direction, current conditions, and environmental consequences of the proposed alternatives on range vegetation and livestock grazing resource areas. The analysis area for the range resources discussion is the entire Trout-West Project Watershed.

Affected Environment

Portions of seven allotments are in the project area. The allotments, acres, and class of livestock are summarized in Table 57.

Table 57. Livestock Allotments

Allotment Name	Acres in Project area	Class of Livestock
Beaver Ranch	1,095	Cattle Cow/Calf
Crystal	3	Cattle Cow/Calf
Limbaugh	745	Cattle Cow/Calf
Manitou	1,230	Cattle Cow/Calf
Montague	580	Cattle Cow/Calf
Phantom	14,345	Cattle Cow/Calf
Ryan	2,610	Cattle Cow/Calf

A range analysis survey was completed in the project area and an EA for updating the individual allotment management plans is ongoing (Pikes Peak RAMPS EA). That analysis information showed the area to be in a fair to good vegetative condition with a static trend for some allotments and an upward trend for some allotments. Ponderosa pine/bunchgrass and meadows are the most important habitats for grazing within the allotments.

Effects of No Action

Current grazing practices would continue on all livestock allotments in the project area. Ongoing range structure and improvement maintenance would continue. No Action would have no direct impact to the range resource; however, existing conditions in the project area are characterized by the long-term loss of meadows through conifer encroachment and increased acres of dense forest types with little forage available for livestock. This situation would likely continue under the No Action alternative.

A large, destructive wildfire in the project area would have adverse short-term effects on range resources by damaging soil, watershed resources, and livestock improvements. Livestock grazing operations are usually adversely affected in the short-term (1-3 years post fire) by the management restrictions designed to protect soil and watershed conditions after a large destructive wildfire. Additionally, livestock grazing improvements such as fence lines, water developments, and corrals may be adversely affected by large wildfires. In the long-term, large wildfires can have a positive effect on livestock grazing resources due to the large acres of transitory range that results from post-fire grass seeding on areas affected by high-intensity wildfires.

Effects of the Proposed Action

Forest stand thinning and prescribed burning would positively affect both the short-term and long-term range conditions by reducing conifer density in forested stands, increasing transitory range forage, reducing conifer encroachment in meadows, and re-invigorating vegetation by prescribed fire. All the proposed treatments in the Proposed Action would have a positive effect on range conditions and increase available forage for livestock. The threat of large, destructive wildfires will be reduced with the potential for loss of short-term grazing access and existing range improvements. This alternative would have a beneficial long-term effect for livestock grazing on an estimated 20,170 acres.

Effects of Alternatives A-E

The effects of all the other action alternatives are similar to the Proposed Action. Long-term impacts for the grazing resource will be beneficial due to the more open condition of the forested stands that allows more grass species to thrive. Short-term impacts are the restrictions to livestock grazing and movements caused by logging slash and logging equipment safety zones restricting access to permittees. Short-term impacts would be limited to those acres treated each year; thus, the area of short-term impactwould vary in the project area from year to year. Long-term impacts will depend on how effective inventory and control measures are for noxious weeds on the Pike-San Isabel National Forest and adjacent lands.

Summary of Effects of the Alternatives

The effects of the alternatives on the livestock grazing resource are summarized in Table 58, which uses the acres treated as the indicator of long-term beneficial effects. The alternatives are ranked by acres treated.

Table 58. Effects Ranking - Livestock Grazing

Alternative	Acres Treated	Beneficial Ranking *(1-7, with 1 rated highest)*
Alternative E	26,320	1
Proposed Action	20,170	2
Alternative C	20,170	3
Alternative A	19,220	4
Alternative B	13,570	5
Alternative D	6,750	6
No Action	0	7

Cumulative Effects

The Polhemus Burn, Trout Creek Timber Sale, and Hayman Fire and subsequent salvage have already, and will likely continue to result in short-term restrictions on livestock use; however, long-term beneficial effects to livestock grazing would occur due to increased transitory range created by opening of forested stands by the planned management activities and the Hayman wildfire. The cumulative effects of these activities and the project activities would result in long-term increases in forage for the livestock grazing resource.

Noxious Weeds

Noxious weeds are alien species that are deemed detrimental to economic crops, can carry diseases or insects, are poisonous to livestock, and may be detrimental to an agricultural or environmentally sound ecosystem (USDA 1998). They are typically introduced to an area, often from a different continent, and would not occur there naturally. Noxious weeds can be very disruptive and have the potential to take over complete plant communities. Controlling noxious weed species is very difficult due to their ability to adapt to an ecosystem relatively quickly (Foster Wheeler 1999).

Noxious weeds known to occur in the project area include Canada thistle, musk thistle, yellow toadflax, and leafy spurge. A field survey for noxious weeds was planned by contract for the 2002 season and the results of that survey was made available in October 2002. That information will be used for noxious weed control activities in the project area.

Effects of No Action

Ongoing activities such as hunting, logging, grazing, firewood cutting, and other uses of the forest may continue to spread existing noxious weeds and could possibly introduce new species. Ongoing control of noxious weeds is accomplished by a cooperative approach between the Forest Service and local County weed boards. There is currently an agreement in place between the Pike San Isabel NF and Teller, Douglas, and El Paso Counties to use Integrated Pest Management practices to control noxious weeds using chemical, mechanical, and biological control measures.

Integrated Pest Management practices are expected to avoid new noxious weed infestations and control existing noxious weed populations. The No Action alternative should not result in any significant increases in acres of noxious weeds in the project area due to lack of ground disturbing logging and road-building activities. However, without fire hazard reduction management activities, the risk for a large stand-replacing wildfire is increased and most fire suppression and post-fire activities result in the introduction and spread of noxious weeds. The analysis for this project uses a model that forecasts the likelihood of a 42,000-acre wildfire occurring within the next 10 years in the project area watershed. Increased noxious weeds would depend on the amount of ground-disturbing salvage and other fire suppression and post-fire activities that occur.

Effects from the Proposed Action

Activities proposed under the Proposed Action will likely result in a short-term increase in acres of noxious weeds (all known species) and may introduce new noxious weed species to the area. Activities such as logging and burning would introduce increased vehicle and equipment use into areas and create more disturbed soils. Contractors bringing in equipment from other areas have the potential to introduce more infestations of existing noxious weeds and also to introduce new noxious weed species. The actual acres of noxious weed increases that may occur from the Proposed Action is not known; however, the potential for an increase in noxious weed acreage is highly probable due to the widespread populations of Canada thistle and yellow toadflax that currently exist in the project area. A recent monitoring study done on another National Forest noted that noxious weeds increased an average of three percent of the ground-disturbing activities such as ground-based logging and road construction.[14] If the estimate of three percent is used for this project area, an estimated[15] 417 acres of potential new noxious weed infestation would occur in the short-term. Integrated Pest Management procedures and mitigation measures are intended to control the increase in noxious weeds in the long-term; however, significant increases in noxious weed infestation may occur in the short-term.

[14] Source: Black Hills Forest Plan EIS, Dec. 1996, pg III-192.
[15] Based on 3 percent of 13,380 acres of ground-based logging = 401 acres; and 130 miles of road use/construction at 4 acres per mile (based on 30 ft. width of road surface) = 520 acres x 3 percent = 16 acres. Total is 401 + 16 = 417 acres of potential noxious weed increases.

Effects of Alternatives A - E

The effects of all the other action alternatives differ from the Proposed Action based on the amount of ground-disturbing logging methods and road use/construction activities proposed. Short-term effects will result in increases in noxious weed infestations for all the action alternatives. Long-term impacts will depend on how effective inventory and control measures are for noxious weeds on the Pike San Isabel NF and Teller County.

Summary of Effects of the Alternatives on Noxious Weeds

The effects of the alternatives on noxious weeds are summarized in Table 59, using the acres treated as the indicator of short-term effects. The alternatives are ranked by the acres treated with ground-based methods and the amount of road use/construction impact acres.

Table 59. Effects of Alternatives on Noxious Weeds

Alternative	Acres Treated With Ground-Based Harvest Methods	Road Use/Construction *(estimated in acres using a 30 ft surface width, resulting in 4 ac. per running mile)*	Estimated Acres of New Noxious Weed Infestation *(based on 3 percent of acres disturbed)*	Ranking *(1-7, with 1 rated best due to least amount of new infestation acres for noxious weeds)*
No Action	0	0	0[16]	1
Alternative D	3,130	49 miles = 196 acres	98 acres	2
Alternative B	9,270	93 miles = 372 acres	289 acres	3
Alternative C	11,220	116 miles = 464 acres	350 acres	4
Proposed Action	13.380	130 miles = 520 acres	417 acres	5
Alternative A	13,380	130 miles = 520 acres	417 acres	6
Alternative E	19,380	130 miles = 520 acres	597 acres	7

[16] Noxious weeds would likely increase in the event of a wildfire. The extent of the increase would depend on suppression and recovery activities in response to the fire.

Cumulative Effects

The Polhemus Burn and the Trout Creek Timber Sale are previous and ongoing activities that would result in short-term increases in noxious weeds. Long-term effects would depend on noxious weed control measures for those projects. The 2002 Hayman Fire affected the Trout-West Project area and would also result in increases in noxious weeds due to suppression activities and fire recovery activities. Fire salvage activities may also increase spread of noxious weeds. The cumulative effects of these activities and the Trout-West project activities would result in an increase in noxious weeds acreage for the analysis area. Integrated control measures are intended to control noxious weeds in the long term.

Air Quality

Affected Environment

The climate of the area is profoundly affected by differences in elevation and, to a lesser degree, by orientation of mountain ranges and valleys with respect to air movement. Wide variations occur within short distances. The difference in annual mean temperature between Pikes Peak and Las Animas, located 90 miles to the southeast, is about the same as that between southern Florida and Iceland.

Locals refer to Woodland Park as "the city above the clouds." Air movement is generally brisk at these high elevations and air quality is considered good. Temperature inversions throughout the year, most commonly in winter, can adversely affect air quality.

Predominate winds in the area are from the south and west for most of the year, although changes occur with passing weather fronts. Because the area is mountainous, topographic features and the heating and cooling of the earth's surface tend to modify winds. Topography and weather patterns determine the extent to which airborne particulate matter accumulates within the project area. Air flows upward within valleys with the heating of the earth's surface. At night, the cool, denser air near the surface of slopes flows downward, much like water following a natural drainage (USDA 1970).

Management Direction

Congress passed the Clean Air Act in 1960 with major amendments to the Act in 1967, 1970, 1977, and 1990. In 1971, the United States Environmental Protection Agency (EPA) adopted National Ambient Air Quality Standards (NAAQS) under the authority of Section 109 of the Clean Air Act.

The state of Colorado regulates air quality through a citizen board called the Colorado Air Quality Control Commission, created by the Colorado Air Quality Control Act. The role of the Commission is to; 1) adopt an air quality program for the state, 2) assure the state's program meets the requirements of the Federal Clean Air Act, and 3) issue or deny permits and enforce orders.

The Forest Service is a signatory to a joint Memorandum of Understanding (MOU) established by the Colorado Department of Public Health and Environment. Prescribed fire operations must be consistent with the Clean Air Act, the Colorado Smoke Management MOU, Colorado Air Quality Control Commission Regulation No. 9, applicable Forest Service Manuals and Handbooks, and project level Prescribed Fire Burn Plans and Permits. All projects will be planned and conducted in an attempt to balance the needs of the ecosystem and the general public, with the utmost concern for public health and welfare (USDA 2002).

Many sources of air pollution exist in the analysis area, including vehicles, wood-burning stoves, dust, and road construction/maintenance activities. These sources are discussed more fully in the Air Quality Specialist Report (Appendix D), which is available electronically at the following web address: http://www.fs.fed.us/r2/psicc/spl/twest.htm. The focus of this analysis and alternatives comparison is smoke from prescribed burning and wildfire and their contribution to reducing air quality.

The EPA has an interim policy on wildland and prescribed fires that integrates two public policy goals: 1) to allow fire to function, as nearly as possible, in its natural role of maintaining healthy wildland ecosystems, and 2) to protect public health and welfare by mitigating the impacts of air pollutant emissions on air quality and visibility. The policy encourages thoughtful use of fire by private, public, and tribal wildland owners/managers under smoke management plans to maintain healthy wildland ecosystems (EPA 1998).

Particulate Emissions From Smoke

Smoke from wildfires and prescribed burns can contain high concentrations of fine particulates and have adverse health effects. These effects have been shown to be reversible in most cases. Long-term exposure has the potential to cause or exacerbate heath problems such as coronary artery disease, chronic obstructive pulmonary disease, and cancer. Individuals with asthma, allergies, or the capacity to develop reactive airways are more likely to be susceptible to the effects of smoke.

Wildfires are more likely to produce unhealthful amounts of smoke. Concentrations of 5,000 micrograms per cubic meter ($\mu g/m^3$) of PM_{10}[17] have been measured during some wildland fires (USDA 2000a). .[18] Large wildfires have been common in recent years near the project area: the Buffalo Creek Fire in 1996, the Hi Meadow Fire in 2001, and the Hayman Fire in 2002. These hot, fast moving fires ranged in size from 10,000 to over 100,000 acres and contributed smoke for weeks. Smoke from the Hayman Fire was noticeable for hundreds of miles.

Prescribed fires can be conducted under conditions intended to minimize emissions. Estimates of emissions range from 20 to 500 pounds of carbon monoxide, 17 to 67 pounds of total suspended particulates, 10 to 40 pounds of hydrocarbons, and two to six pounds of nitrogen oxides for every ton of fuel burned (ibid.). Actual emissions, however, depend upon the amount, size, and condition of the fuel burned, weather conditions, and burning techniques. In general, smoke production increases with fuel consumption. Mitigation measures and design features described in Chapter Two are intended to reduce PM emissions associated with the Proposed Action and action alternatives.

Effective prescribed burning requires that burning plans be developed to specify the objectives of each burn and prescribe the conditions, techniques, and precautions required to meet those objectives. Important factors that determine the effects of prescribed burning on air quality include the ignition pattern employed, local weather conditions at the time of burning, and fuel characteristics.

Current Air Quality Monitoring

Monitoring data from the EPA AIR*Data* summaries (2002) indicate that PM_{10} annual averages have been decreasing since about 1998 for Teller and Douglas Counties. Figure 6 displays the annual mean concentrations of PM_{10} for Teller and Douglas Counties for the period 1996-2001.

[17] PM-10 has particulates less than 10 micrograms. This size can be inhaled and is therefore a health hazard.
[18] The EPA 24-hour standard for PM_{10} is $150\mu g/m^3$.

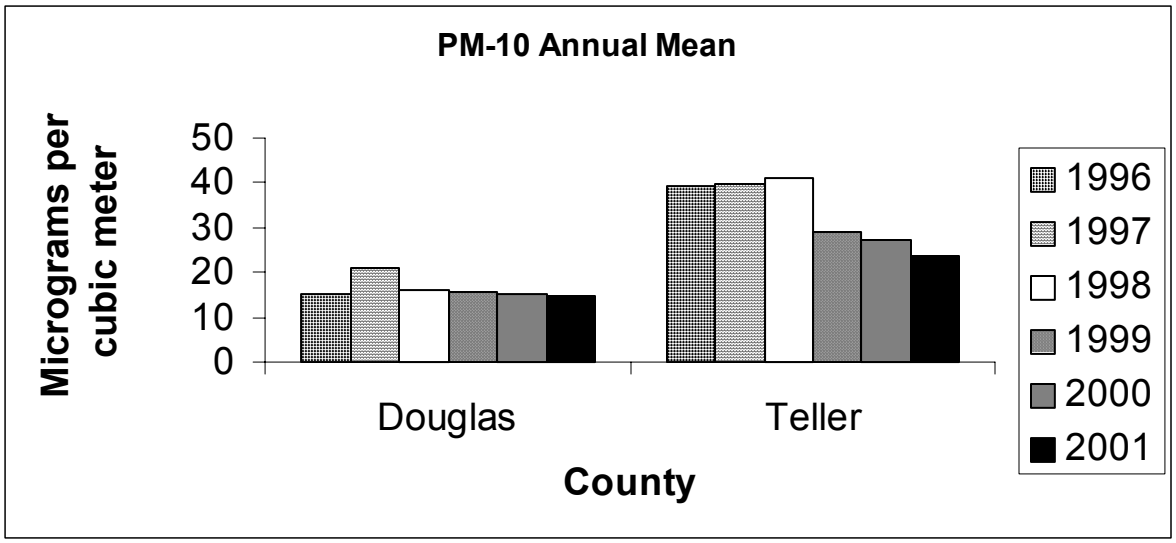


Figure 6. PM-10 Annual Mean Concentrations, 1996-2001

The annual allowable mean PM_{10} particulate emission is 50 $\mu g/m^3$. The maximum allowable emission for any 24-hour period is 150 $\mu g/m^3$.

Areas Potentially Affected by Smoke from Prescribed Burning

Table 60 lists areas within the Trout-West watersheds and downwind that could be affected by smoke from prescribed burning in the project area.

Table 60. Locations Potentially Affected by Smoke

Identified Area	Approximate Distance from Project Area (air miles)	Approximate Direction from Project Area	Downwind from Project Area (Y/N)	Possible Residual Nighttime Flow Potential
Denver	42	North	Y	N
Roxborough Park	20	North	Y	N
Woodland Park	2	Southeast	N	Y
Castle Rock	20	Northeast	Y	N
Deckers	8	North	Y	Y
US Air Force Academy	10	East	Y	N
Oxyoke	12	North	Y	Y
Sprucewood	15	North	Y	Y

Identified Area	Approximate Distance from Project Area (air miles)	Approximate Direction from Project Area	Downwind from Project Area (Y/N)	Possible Residual Nighttime Flow Potential
Monument	12	Northeast	Y	N
Ridgewood Subdivision	<1	Within	Y	Y
Quinlan Gulch Unincorporated	<1	Within	Y	Y
West Creek	<1	Within	Y	Y
Tranquil Acres	<1	Within	Y	N
Devils Head Tower	8	North	Y	N
State Hwy 67	1	North	Y	Y
Interstate Hwy 25	18	East	Y	N
State Hwy 24	2	South	N	Y

The assessment concentrates on the potential effects of smoke resulting from prescribed burning on these areas. Several environmental and social issues are associated with smoke that may be produced from the Trout-West Project. People are concerned about the duration of prescribed burning and potential health effects of smoke from this project.

Environmental Consequences From Burning

Modeling fire emissions and dispersions to predict compliance with the NAAQS is a difficult and complex process and is subject to a variety of uncertainties in the choice of input data and assumptions. To more directly assess the air quality impacts from the proposed prescribed burning in the project area, air quality monitoring would need to be conducted. Monitoring recommendations are included in Chapter Two.

The Simple Approach Smoke Estimation Model (SASEM) (USDI/BLM 1993) was used to estimate emissions. Table 61 provides a summary of emissions based on estimated annual acreage burned under each alternative. More information about the SASEM model is in the Air Quality Specialist Report in the Project File.

Indirect effects from the project include a reduction in risk of wildfire. Smoke from wildfire is predicted for all alternatives; however, the No Action has the greatest potential for wildfires and associated smoke emissions. The First-Order Fire Effects Model, Version 5 (FOFEM-5) was used to assess PM_{10} emissions produced by wildfire. The fuels report includes predictions for acres burned over a 10-year period under No Action and for each alternative, once fuels reduction projects are complete. These predictions were used to model wildfire emissions.

Table 61. Smoke Production Estimates

Alternative	Project Area		Balance of Analysis Area		
	Acres Estimated to Burn Per Decade	Tons PM_{10} (Wildfire)	Acres Estimated to Burn Per Decade	Tons PM_{10} (Wildfire)	Total PM_{10} (Wildfire)
No Action	10,500	5,145	31,500	15,435	20,580
Proposed Action	2,100	1,029	9,450	4,630	5,659
Alternative A	2,100	1,029	9,450	4,630	5,659
Alternative B	4,200	2,058	18,900	9,261	11,319
Alternative C	2,100	1,029	9,450	4,630	5,659
Alternative D	8,400	4,116	31,500	15,435	19,551
Alternative E	2,100	1,029	9,450	4,630	5,659

No Action Alternative

Direct Effects

The No Action alternative would have no direct effects on air quality or human health because it does not propose prescribed burning. Impacts from dust, vehicle emissions, and other sources would not change from current conditions.

Indirect Effects

Wildfires would continue to occur within the project area and smoke from these fires would not be manageable, especially under severe burning conditions during summer. This smoke could occur when dispersion is poor, and would likely produce more smoke and particulate matter and last longer than planned ignitions. Under this alternative the fuels analysis assumes that a wildfire of approximately 10,500 acres is 100 percent probable in the project area within a decade. The fuels analysis also assumes there is a 100 percent probability of three such fires occurring in the balance of the watershed (analysis area) within the next decade. Wildfires of this magnitude could generate approximately 20,580 tons of $PM_{10.}$

A large wildfire has the potential to emit large amounts of smoke that could remain in the local airsheds for a few days to several weeks, depending on the size and intensity of the fire. The Hi Meadow, Buffalo Creek, and Hayman Fires provide local examples of smoke effects from wildfire. These wildfires consumed from 10,000 to approximately 137,000 acres of forest vegetation. Each had impacts on air quality. The resultant emissions from a wildfire of these proportions could release from 4,900 to 67,130 tons of PM_{10}, respectively, over a period of a few days.

Many of the small communities within the project area would be affected if a wildfire did develop. Wildfires can occur when weather conditions are not good for dispersal. Smoke generated from a wildfire could be caught within an inversion layer along the Trout and West Creek drainages and into the Upper South Platte River drainage, reducing visibility in the area. Depending on the size of the fire and weather conditions, these effects could last anywhere from one night to several weeks and have an effect on public health. The Hayman Fire that occurred in June 2002 is a good example of significant impacts on visibility and regional haze. Moderate to heavy, dense smoke from the Hayman Fire impacted Denver and other surrounding communities for several days.

Cumulative Effects

Past activities having the greatest effect on air quality were wildfires such as the Buffalo Creek fire in 1996, the Hi Meadows fire in 2000, and the most recent Hayman Fire in June 2002. Smoke from wildfires such as these contributes high amounts of emissions to the local air shed for a period of a few days to several weeks. These fires had a large, immediate effect on the air quality of the area, the District, and beyond. However, those effects, as great as they were, are gone and cannot be viewed cumulatively. Other past activities include the Polhemus prescribed burn in 2001, which was approximately 8,000 acres in size. Effects from this burning are also gone and cannot be viewed cumulatively with current and foreseeable activities.

Present and reasonably foreseeable activities include 500 acres of prescribed burning on the Trout Creek Timber Sale located within the project area. The Hayman Fire consumed a large portion of the Trout Creek Timber Sale. The Trout Creek project is in the implementation stage. The purpose of burning is to clean up woody debris after harvest is completed. Burning is scheduled to take place within a year. According to The SASEM Model, approximately 89 tons of PM_{10} emissions could be generated from this activity.

The Proposed Action and Alternative C

Direct Effects

The Proposed Action and Alternative C include the same quantity of prescribed burning, so they are analyzed together. Under these alternatives, approximately 10,660 acres would be piled and burned and 6,600 acres would be broadcast burned. Based on the SASEM computer model, an estimated 2,063 tons of PM_{10} could be released if all acres were ignited at once. However, the prescribed burns are likely to be implemented over a 10-year period, releasing an estimated average of 206 tons of PM_{10} annually. Effects on air quality are expected to be short-term.

Sensitive receptors near the burn units could be affected by nuisance smoke during prescribed burning. It is estimated that six to 10 days per year could be affected by smoke during burning operations. Smoke from the proposed burning and the associated emissions would reside in the local airsheds a relatively short time, from a few hours to several days, depending on the weather. This could cause irritation to sensitive persons, create traffic hazards, and settle in low-lying areas during the evening hours.

Smoke may settle into the Trout Creek and West Creek Watersheds with some eventual flow into the Upper South Platte during the evenings following a prescribed burn. Smoke trapped in low-lying areas would be expected to dissipate once morning temperatures rose and the nighttime inversion lifted. Some decreased visibility along travel corridors such as Highway 67 could occur. Little impact is expected on Interstate Highway 25 and State Highway 24.

Dispersed smoke could drift as far as Denver; however, little visibility impairment would be expected. Prescribed burning would be conducted when weather conditions are predicted to be good for smoke dispersal. According to the SASEM model, no exceedances of PM_{10} or $PM_{2.5}$are expected; therefore, no violation of the NAAQS are anticipated. This alternative is not likely to violate air quality standards.

Indirect Effects

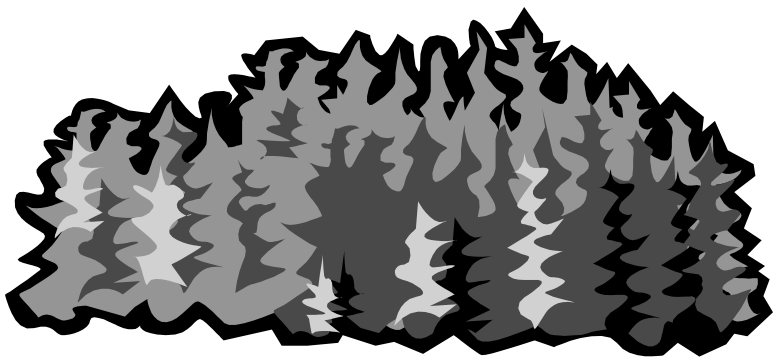
An indirect effect of the Proposed Action is a reduction in the emissions that would be released from wildfires in the area. Under this alternative, the fuels analysis assumes a wildfire of approximately 10,500 acres is 20 percent probable within the project area. It also assumes there is a 30 percent likelihood of three such fires occurring within the balance of the watershed. The risk of reduction is applied to the 10-year period following project completion. Based on FOFEM, approximately 5,659 tons of PM_{10} emissions could be generated from these wildfires.

Cumulative Effects

Past activities and their effects are the same as those described under the No Action alternative. Under the Proposed Action and Alternative C, prescribed burning would be approved for approximately 17,260 acres. This burning is unlikely to occur at the same time as burning under the Trout Creek timber sale.

Alternative A

This alternative proposes no burning. Fuels would be manipulated mechanically and whole trees removed. This alternative would have direct air quality effects similar to those of the No Action Alternative. Alternative A reduces risk of wildfire similarly to the Proposed Action; indirect and cumulative effects would be similar to those previously described.



Alternative B

Direct Effects

Under this alternative, approximately 10,660 acres would be piled and burned. No broadcast burning is proposed. An estimated 885 tons of PM_{10} could be released as a result of the burning operations. If these burns were conducted over a 10-year period, an average of 88 tons of PM_{10} would be released annually. Estimated emissions are lower than for the Proposed Action Alternative because of lesser quantities of fuels burned.

Sensitive receptors near the burn units could be affected by nuisance smoke during prescribed burning. It is estimated that three to five days per year could be affected by smoke during burning operations. Burning would be conducted over a fewer number of days as compared to the Proposed Action. This alternative is not likely to violate air quality standards.

Indirect Effects

An indirect effect of this alternative is a reduction in the emissions that would be released from wildfires in the area. Under this alternative, the fuels analysis assumes a wildfire of approximately 10,500 acres is 40 percent probable within the project area. It also assumes there is a 60 percent likelihood of three such fires occurring within the balance of the watershed (analysis area). The risk of reduction is applied to the 10-year period following project completion. Based on the FOFEM model, approximately 11,319 tons of PM_{10} emissions could be generated from these wildfires.

Cumulative Effects

Past activities and their effects are the same as those described under the No Action alternative. Under Alternative B, prescribed burning would be approved for approximately 10,660 acres. This burning is unlikely to occur at the same time as burning under the Trout Creek timber sale.

Alternative D

Direct Effects

Under this alternative, approximately 3,840 acres would be piled and burned or broadcast burned. Assumptions for modeling were based on broadcast burning since it tends to generate greater emissions outputs. Based on the SASEM model, an estimated 685 tons of PM_{10} could be released if all acres were ignited at once. If these burns were conducted over a 10-year period, an average of 68 tons of PM_{10} would be released annually. Estimated emissions under this alternative are lower than other action alternatives because of the lesser quantities of fuels proposed for burning. Effects on air quality are expected to be short-term.

Sensitive receptors near the burn units could be affected by nuisance smoke during prescribed burning. Approximately one to three days per year could be affected by smoke during burning operations. This alternative is not likely to violate air quality standards.

Indirect Effects

An indirect effect of this alternative is a reduction in the emissions that would be released from wildfires in the area. Under this alternative, the fuels analysis assumes a wildfire of approximately 10,500 acres is 80 percent probable within the project area. It also assumes there is a 100 percent likelihood of three such fires occurring within the balance of the watershed. The risk of reduction is applied to the 10-year period following project completion. Based on the FOFEM model, approximately 19,551 tons of PM_{10} emissions could be generated from these wildfires. This alternative predicts the greatest impact on air quality from wildfire of all the action alternatives.

Cumulative Effects

Past activities and their effects are the same as those described under the No Action alternative. Under Alternative D, prescribed burning would be approved for approximately 3,840 acres. This burning is unlikely to occur at the same time as burning under the Trout Creek timber sale. No additional smoke would be produced from the proposed Hayman Fire Salvage.

Alternative E

Direct Effects

Under this alternative, approximately 13,500 acres would be piled and burned and 9,410 acres would be piled and burned or broadcast burned. Based on the SASEM computer model, a maximum of 2,800 tons of PM_{10} could be released if all acres were ignited at once. However, these burns are likely to be implemented over a 10-year period. If these burns were conducted over a 10-year period, an average of 280 tons of PM_{10} would be released annually. As with all the action alternatives, effects on air quality are expected to be short-term.

Sensitive receptors near the burn units could be affected by smoke during prescribed burning. Approximately 10-13 days per year could be affected by smoke during burning operations. Of all the action alternatives, this alternative is expected to produce the most number of smoky days because more burning is proposed. Prescribed burning would be conducted when weather conditions are predicted to be good for smoke dispersal. According to the SASEM model, no exceedances of PM_{10} or $PM_{2.5}$ are expected; therefore, no violation of the NAAQS is anticipated. Since no exceedance is predicted, this would also indicate no health hazards are likely. This alternative is not likely to violate air quality standards.

Indirect Effects

An indirect effect of this alternative is a reduction in the emissions that would be released from wildfires in the area. Under this alternative, the fuels analysis assumes a wildfire of approximately 10,500 acres is 20 percent probable within the project area. It also assumes there is a 30 percent likelihood of three such fires occurring within the balance of the watershed (analysis area). The risk of reduction is applied to the 10-year period following project completion. Based on the FOFEM model, approximately 5,659 tons of PM_{10} emissions could be generated from these wildfires.

Because of the change in stand structure, the potential of a crown fire developing within these stands would be reduced. The post treatment stand structures and the location of these stands across the landscape would result in a decreased potential for crown fires and help to reduce the extent of wildfires in the area. These reductions in intensity and extent of wildfires would also result in a reduction in the amount of PM_{10} released if a wildfire developed.

Cumulative Effects

Past activities and their effects are the same as those described under the No Action alternative. Under the Proposed Action and Alternative C, prescribed burning would be approved for approximately 17,260 acres. This burning is unlikely to occur at the same time as burning under the Trout Creek timber sale.

Alternatives Comparison

Table 62 summarizes the direct and indirect effects of prescribed burning. Table 63 summarizes the maximum effects from prescribed burning, including wildfire.

Table 62. Summary of Direct and Indirect Effects of Prescribed Burning

Alternative	Pile Only		Pile or Broadcast		Maximum Total PM_{10} Tons	Estimated Annual PM_{10} Tons	Compliance with NAAQS	Estimated Annual Days of Burning
	Acres	PM_{10} Tons	Acres	PM_{10} Tons				
No Action	0	0	0	0	0	0	NA	0
Proposed Action	10,660	885	6,600	1,178	2,063	206	Yes	6-10
Alternative A	0	0	0	0	0	0	Yes	0
Alternative B	10,660	885	0	0	885	88	Yes	3-5
Alternative C	10,660	885	6,660	1,178	2,063	206	Yes	6-10
Alternative D	0	0	3,840	685	685	68	Yes	1-3
Alternative E	13,500	1,120	9,410	1,680	2,800	280	Yes	10-13

Table 63. Summary of Effects including Wildfire

Alternative	Maximum PM_{10}Tons From All Proposed Prescribed Burning	Maximum PM_{10}Tons From Future Foreseeable Prescribed Burning	Maximum PM_{10}Tons From Wildfire
No Action	0	89	20,580
Proposed Action	2,063	89	5,659
Alternative A	0	89	5,659
Alternative B	885	89	11,319
Alternative C	2,063	89	5,659
Alternative D	685	89	19,551
Alternative E	2,800	89	5,659

Further information about Air Quality is in the Air Quality Specialist Report, Appendix D, which is available electronically at the following web address:
http://www.fs.fed.us/r2/psicc/spl/twest.htm.

Visual Resources

Affected Environment

As discussed previously, forests in the Trout and West Creek watersheds are uncharacteristically dense. Many people value the denser forests and are unaware that the forest they see is not in a sustainable condition. The Trout-West Project is intended to return the forest to an open condition more like historic conditions. However, the changes across the landscape may appear dramatic and some people may prefer a more densely forested landscape.

Wildfire can also change the visual quality of the landscape. Wildfires are nearly certain to occur within the Trout and West Creek watersheds, and without action, are likely to have serious consequences.

Management Direction

Forest management on the Pike-San Isabel National Forest is associated with the Visual Quality Guidelines listed in Table 64.

Table 64. Visual Quality Objectives (VQOs)

Management Area	Management Emphasis	VQO Guidelines
2B	Rural and roaded-natural recreation	Partial retention and modification.
4B	Management Indicator Species	Modification.
7A & 7D	Wood fiber production and utilization	Retention and partial retention along Forest arterial and collector roads and primary trails. In other areas, modification.
10B	Experimental Forest	Apply forest-wide Standards and Guidelines.

Most of the undeveloped portions of the project area currently meet the assigned Visual Quality Objectives (VQOs). Private land development adjacent to National Forest may contribute to a cumulative effect that does not meet the assigned objectives; however, the VQOs do not apply to private land.

Environmental Consequences

No Action Alternative

No Action would maintain the existing condition. Fuels reduction projects and associated roadwork would not occur.

Direct and Indirect Effects

With No Action, the vegetation found across the Trout-West analysis area would be maintained in the short term, until events such as a fire, insects, or disease affected the forest. The scale of the change would depend on the extent of the disturbance. The recent Hayman Fire provides an extreme example of the effects of damaging wildfire on visual quality. Several thousand contiguous acres were scorched in the Hayman Fire.

Changes caused by insect and disease would be more gradual and less noticeable. A severe epidemic would likely lead to large-scale changes to the visual environment. An epidemic could result in hillsides with standing dead trees, which often appear reddish brown. Endemic insect populations may cause pockets of standing dead trees. Endemic populations could even add visual variety to the landscape as the pockets of dead trees revegetate. Over the long term, the watershed would likely be subject to wildfires. A cumulative decrease in the visual quality of burned-over areas would be expected.

Cumulative Effects

Small forest management projects have occurred within the project area and represent improved visual conditions as forests are thinned to a more sustainable density. The Hayman Fire has not changed the VQOs in the project area, because fire is considered a natural part of the ecosystem. Unfortunately, most people viewing a burned forest do not have the same feeling of visual quality that they have while viewing an unburned forest. As vegetation becomes established in burned areas, VQOs will be used to re-establish a desired landscape.

The Hayman Fire Salvage EA does not predict significant or long-term effects to visuals from proposed salvage logging, which will be designed to meet Scenery Management guidelines.

Proposed Action

Effects of Vegetative Treatments on Visual Resources

The Proposed Action would have relatively minor effects on visual resources, given the site-specific mitigation for treatment areas that would be visible from primary viewing locations and routes. The use of tractor/cable to access timber in certain areas could have minor short-term effects on visual quality in a few locations.

Some people would likely find the more open and less dense forest in the project area less aesthetically appealing than the current condition. Short-term visual effects would include slash remaining from harvest and smoke from prescribed burns. The visual effect of the slash would last from one to two years, until the area underwent slash treatment that would include burning the remaining slash. The burned area would likely be visually unappealing for a short time until the underbrush is reestablished. Smoke from the prescribed burns would be a short-term effect (see the Air Quality section of this chapter for details).

The Proposed Action would reduce the risk of adverse visual effects caused by a large wildfire. However, fires and insect and disease epidemics could still occur and alter the visual quality of the area.

The Proposed Action proposes thinning to reduce the canopy cover from greater than 40 percent to 20 percent. These changes are likely to appear natural and, over time, blend with the landscape so that a visitor new to the area may not notice the project. The thinned areas would be blended with the adjacent forest by using different intensities of thinning, particularly along the edge of the treatment area. This would prevent an abrupt change in texture of the forest and would avoid creating artificial-looking lines.

Several no-treatment areas are distributed throughout the landscape. These are likely to provide scenic variety and screening.

Effects on Viewing Sensitivity – Level I Locations and Routes

Treatment areas along the corridors of State Highway 67 and County Roads 5, 79, 78, 51, 25, and 511 are assigned a VQO of retention in the foreground and partial retention in the middle ground. Viewers driving along the roads would notice a more open forest with better viewing opportunities. Changes to background views from these travel routes would be less evident because of topography, rock outcroppings, and the speed at which motorists travel.

Several developed facilities along the Highway 67 corridor would be in or near the treatment areas. Thinning near the Manitou Lake Picnic Area, Painted Rocks Campground, Colorado Campground, Pike Community Campground, South Park Meadows Campground, Red Rocks Campground, and Centennial Trail would be designed to meet the VQO of retention in the foreground. Specific design features described in Chapter Two are necessary to meet the VQO.

Effects on Viewing Sensitivity – Level II Locations and Routes

County Roads 3 and 782, along with Forest Development Roads 362, 363, 364, 357, and 300 offer opportunities for scenic vistas. Most of these roads are located on ridge tops where treatment areas would be visible. Treatments along these corridors would be designed to meet VQOs of partial retention in the foreground and modification in the middle and background. As long as the mitigation measures are followed as recommended, no long-term adverse impacts on visual quality are expected.

The North Divide Trail is located within Management Areas 2B, 7A, and 7D. The VQOs set for these areas are partial retention in the foreground and modification in the rest of the area. Short-term and long-term effects would be the same as those identified for Forest Development Roads.

Private lands scattered throughout the project area would be subject to the same effects as described above for viewing locations and routes. Mitigation measures and design features that would apply to all action alternatives regarding private land are described in Chapter Two.

Effects of Road/Trail Reclamation

Proposed reclamation of the unclassified roads would enhance the visual environment by reducing the evidence of resource damage from numerous social trails. New temporary roads would have a short-term negative impact on visuals until the roads are reclaimed.

This project would contribute to a cumulative change in the area when considered with the Trout Creek Timber Sale, the Hayman Fire, and other activities in the watershed. Wildfires such as Hayman would be far more detrimental to the visual resource than the Proposed Action. This alternative complies with VQOs in the Forest Plan.

Alternative A

Alternative A would essentially have similar effects on visual resources as the Proposed Action, except prescribed burn impacts such as smoke and blackened areas would not occur.

Alternative B

Alternative B would essentially have the same effects on visual resources as described in the Proposed Action for the Manitou Park Recreation Area, the Manitou Experimental Forest, the Ryan Quinlan treatment unit, the southern portion of Phantom, and the Skelton treatment units. Alternative B is associated with a greater likelihood of catastrophic fire than the Proposed Action.

Alternative B would improve fewer miles of Forest Development roads and unclassified roads and trails than the Proposed Action and Alternative A. Because less area would be treated, visual effects would be less than the previous alternatives. However, in areas not being treated, unclassified roads and trails would not be reclaimed, decreasing visual quality.

Alternative C

Alternative C would essentially have the same effects on visual resources as the Proposed Action, except that no new temporary roads would be built to access treatment units, so more land would be yarded by helicopter. This alternative would reduce the amount and intensity of ground disturbance in the Phantom, Skelton, and Ryan Quinlan treatment units. There would be less effect on visual resources as compared to the Proposed Action.

Alternative D

Short-term effects would be similar to the Proposed Action and Alternative B in treated areas. The long-term effect would result in the greatest risk, among all action alternatives, of a damaging wildfire occurring in the watershed.

Alternative E

More acreage would be treated under Alternative E than under the Proposed Action and other action alternatives. Alternative E would eliminate the variety and screening inherent in no-treatment areas. Tractors would be used extensively in this alternative, and the potential effect of private landowners and recreationists observing the tractor "paths" would be greatest with this alternative.

Alternative E also includes created openings on over 30 percent of the landscape. These openings would create more dramatic change from the current landscape than the other action alternatives. The VQO of retention would not be met, and a Forest Plan Amendment may be required. This alternative would reflect the historic condition more closely than other alternatives. Other effects of Alternative E would be the same as the Proposed Action.

Recreation

The Pikes Peak Ranger District is a Wildland-Urban Interface management district, with heavy to extreme recreational use. An estimated 550,000 people live adjacent to or within the district. Approximately two million people live in the Front Range urban corridor, from Fort Collins south to Pueblo. The user population is ethnically and culturally diverse, and includes four military installations: North American Aerospace Defense Command, Peterson Air Force Base, the Air Force Academy, and the Fort Carson Army base. The Trout-West project area is easily accessible to all of these user groups.

The project area is a popular day use area. Most use occurs in the Manitou Park Recreation Area, the Manitou Experimental Forest, the North Divide Trail 717, and the Rampart Range Road. Paved and improved gravel roads, many of which are open year-round, provide easy and rapid access.

Some of the recreational use reflects social issues in neighboring urban areas and can degrade environmental quality; the area has experienced trash dumping, crime, vandalism, drug use and manufacturing, arson, unruly behavior by youths, and illegal shooting. People who overstay the 14-day camping limit tend to have greater effects on the land than other visitors. Increased demand for an agency presence, including law enforcement, has been raised as an issue in the area.

Off-road and trail vehicle use is also increasing throughout the project area; much of this can be attributed to the day use accessibility to the urban area. In addition, residential subdivisions, which share a common boundary to National Forest lands, continue to grow. It is common to find unclassified roads leading from private land onto the adjacent National Forest. These roads attract illegal use of motorized vehicles and such use continues to increase (USDA 2001b).

Management Direction

Each Forest Plan Management Area is associated with a Recreation Opportunity Spectrum (ROS). The emphasis placed on recreation varies between Management Areas. ROS settings are formally applied only to National Forest land and not to adjacent private lands. However, the presence and condition of private lands influence the ROS settings assigned to National Forest lands. ROS settings found in the Trout-West project area, from least developed to most, are as follows:

Roaded Natural (RN) - A natural, or natural-appearing, environment of moderate size with moderate evidence of the sights and sounds of humans. Such evidence usually harmonizes with the natural environment. Interaction between users may be moderate to high, with evidence of other users prevalent. Motorized use is allowed.

Rural (R) - An area characterized by a substantially modified natural environment. The sights and sounds of humans are readily evident, and the interaction between users is often moderate to high. A considerable number of facilities are designed for use by a large number of people. Facilities for intensified motorized use and parking areas are available.

The Forest Plan provides guidance for the management of forested areas on the Pike and San Isabel National Forests through its stated goals and objectives, and through the objectives for each Management Area. The Forest Plan also sets standards and guidelines that apply to the entire Forest. A detailed list of these can be found in the Forest Plan. The standards and guidelines for recreation that apply to the proposed actions are listed below. A list of the Management Area objectives can be found in the Forest Plan.

Forest-Wide Direction

Forest-Wide Goals

- Provide a broad spectrum of developed and dispersed recreation opportunities in accordance with identified needs and demands.
- Maintain approximately the current ratio of ROS classes for dispersed recreation.

Forest-wide Standards and Guidelines

- Provide a broad spectrum of dispersed recreation opportunities in accordance with the established ROS classification for the management area.
- Close or rehabilitate dispersed sites where unacceptable environmental damage is occurring.
- Manage dispersed recreation activities to not exceed the established ROS People at One Time (PAOT)/acre capacity.
- Manage use of trails in dispersed areas to not exceed the established PAOT/mile of trails guidelines.

Affected Environment

Opportunities for motorized recreation are plentiful on the trails and roads in the southern, western, and eastern portions of the project area. Most of the recreation use is concentrated in a few areas.

Manitou Park Recreation Area

Developed recreation resources within the Trout-West project area can be found in the Manitou Park Recreation Area (Manitou Park). The Manitou Park runs along both sides of State Highway 67, a north-south highway with the city of Woodland Park at the southern end and the town of Deckers at the northern end. Manitou Park is the most popular recreation attraction on the Pikes Peak Ranger District. Much of the area is in private land ownership.

Manitou Park provides a myriad of recreational opportunities, such as scenic driving along State Highway 67, which offers views of Pikes Peak and the Rampart Range. There are a number of undeveloped scenic pullouts along the corridor. Table 65 lists the developed recreational facilities, which include three family campgrounds at Painted Rocks; Colorado and South Meadows Campgrounds; two group campgrounds at Pike Community and Red Rocks Group Campgrounds; the Centennial Trail; Manitou Lake Picnic Area; and a Dump Station. Many users stay at the campgrounds due to their close proximity to Colorado Springs, Pikes Peak, the Air Force Academy, and the Garden of the Gods (see following table).

Table 65. Recreation Sites in the Manitou Park Area

Facility (ROS Classification)	No. Sites	PAOTs*	Weekday Occupancy (percent)	Weekend Occupancy (percent)
Painted Rock Campground (RN)	18	90	25	75
Colorado Campground (R)	81	405	25	75
South Meadows Campground (R)	64	320	25	65
Red Rocks Group Campground (R)	3	125	15	90
Pike Community Group (R)	1	150	30	90
Manitou Lake Picnic Area (R)	42	210+	35	90

Source: Manitou Park Recreation Corridor Master Plan (USDA 2001a).
*PAOTs indicates the maximum number of people the site is designed to accommodate at any one time.

Manitou Park is readily accessible by the population of Colorado Springs, which makes group sites at Manitou Lake Picnic area and the Red Rocks Group and Pike Community Group sites extremely popular for family reunions and company outings (as indicated by 90 percent occupancy on the weekends). To accommodate large groups, other recreational amenities include an amphitheater, softball fields, horseshoe pits, and volleyball courts.

The Manitou Lake Picnic Area has a nature trail that circles the lake and connects the sites in both loops to the lake. Five interpretive signs are located along the trail. A historic, stone picnic shelter is located near the southern end of the picnic area. The site is a fee site and is open year-round. The area has 42 picnic sites, but use can be even greater as visitors bring their own furniture for fishing around the lake. Parking is the limiting factor.

The Centennial Trail is also a major attraction within Manitou Park; it provides a hiking and biking path that connects the Manitou Lake Picnic Area to the town of Woodland Park, located eight miles south. The trail encompasses 4.2 miles of Forest Development Trail (FDT) 699 and 699.1A, which connect the various campgrounds and picnic areas. Other recreational activities include fishing along trout creek and at Manitou Lake (when filled and stocked).

The Manitou Park Recreation Corridor Master Plan (USDA 2001a), identifies proposed improvements to all facilities within the corridor. The Plan states that the Manitou Lake Picnic Area and Red Rocks Group Site need additional trees to be planted between US 67 and the picnic area and between sites for screening, respectively. Major reconstruction is planned for South Meadows and Colorado Campgrounds.

The Manitou Park Recreation Area is regulated under Special Order Number 86-01, which was signed by Forest Supervisor Jack Weissling on May 6, 1986. The order prohibits camping and fires outside of the developed campgrounds listed in the table above and prohibits motorized use on FDT 699 and 699.A1.

Manitou Experimental Forest (Non-Motorized Use)

The Manitou Experimental Forest encompasses the entire Ridgewood treatment unit and parts of the Rampart and Long John units of the Trout-West Project. The recreation resources described in this section will focus on recreational activities in the Ridgewood unit.

The primary recreational activities are hiking on designated non-motorized trails and fishing along Trout Creek and Missouri Creek. There are no developed recreational sites within the Ridgewood treatment unit. The Experimental Forest has restrictions on motorized trail use, dispersed camping, and campfires. The Manitou Experimental Forest Headquarters (a National Register of Historic Places site) is in the southern part of the Ridgewood unit.

Motorized Trail System

The Phantom, Ryan Quinlan, Rampart, and Skelton units are open to motorized trail riding on designated trails. All legal motorized routes are marked with a white arrow signing system at trailheads, intersections, and periodically along the trail.

One of the most popular trail systems is referred to as the North Divide Trail 717, which consists of 54.5 miles of multi-use trail open to hiking, biking, cross-country skiing, motorcycling, and All-Terrain Vehicles (ATVs). The trails are designed for motorcycling and parts of the trail are not wide enough for ATVs. This trail system is found in the Phantom and Ryan Quinlan treatment units.

The Pikes Peak Enduro motorcycle race is a recreation event that has been issued a special use permit on a biennial basis in the past. According to the Pikes Peak Ranger District, the race was not permitted for the 2002 season because the proper environmental compliance documents were not completed by the permittee. The race has attracted over 500 participants in the past.

The Rampart Range Motorized Recreation Area (RRMRA) is another very popular multi-use trail system in the Front Range and its popularity increases annually. Only a seven-mile portion of the RRMRA is included in the Trout-West project area. Other popular motorized trails are located in the Skelton treatment units.

Resource damage is occurring throughout the project area, especially adjacent to existing roads. Motorists create new routes up hills and across creeks, causing erosion and stream bank degradation. These new routes are referred to as unclassified roads. About 107 miles of unclassified roads occur in the Trout-West project area.

Other Recreation Resources

This section will describe the other recreational uses in the Phantom, Ryan Quinlan, Rampart, and Skelton treatment units.

Dispersed camping is popular along roads throughout the project area. Dispersed campers are recreationists who come to the area to fish, hunt, trail ride, etc. Often the 14-day stay limit is abused and resource damage occurs due to the lack of sanitation facilities. Another source of impacts in the dispersed camping areas is residential campers who live on National Forest lands and work in nearby towns.

Other dispersed recreational activities that mainly occur off trails are fishing, hunting, and rock and mineral collecting. Scenic driving occurs along State Highway 67, the Rampart Range Road, County Road 3 and, to a lesser extent, along forest development roads that allow low-clearance vehicles. Winter sports are dependent upon the weather. In most years, there is not enough snow for snowmobiling to occur.

In the past, the Pikes Peak Ranger District designated approximately 10,000 acres in the Trail Creek, Phantom, and Ryan Quinlan treatment units as a **Holiday Tree Cutting Area**. More than 5000 Christmas trees were sold each year as part of a Recreation Fee Demonstration Project. Due to the Hayman Fire, the cutting area was moved to the Rampart Range area.

Recreation Resources on Private Land. A number of recreational opportunities exist on private lands. The Lutheran Valley Retreat and Ranch and the Colorado Lions Camp are examples of such resources in and around the Trout-West project area. Lutheran Valley serves approximately 200 campers during the summer and is interested in fuels reduction around their camp. The Lions Camp serves about 400 disabled campers in the summer and serves organizational groups (approximately 100 people) in the fall and spring. Smoke inhalation is a concern during the summer months, when disabled campers are present at the camp. Although the camps are not open to the general public, they are a recreational resource.

Cumulative Effects Analysis Considerations

Several on-going actions in and around the Trout-West analysis area that may have the potential to affect recreational resources include the 2002 Hayman Fire, the 2000 Buffalo Creek Fire, and the South Platte Ranger District dispersed camping and shooting closures. Activities that are unlikely to affect recreation because the activities have been completed or the effects have been minimal to date are the 2001 Polhemus Burn, Manitou Lake Dredging Project (2003 completion date), the Trout Creek Timber Sale (2003), the Trail Creek timber sale (on private land), and the Manitou Experimental Forest 40-acre thin.

Hayman Salvage is unlikely to have cumulative effects beyond those described for the fire. Short-term effects from the salvage operations are similar to effects predicted for the Trout-West Project. The salvage operation will likely be completed before the fuels reduction project begins. Increased ATV use has been observed in the fire area (Landis, personal communication, 2003).

Environmental Consequences

No Action

Direct and Indirect Effects

No Action would have no direct effects on the recreational resource. An indirect effect of No Action would be a continuation of the trend towards increasing forest fuel loads and fire risk. This alternative would have the greatest potential for a large, catastrophic fire that could substantially damage recreational resources in the project area. Examples of the effects of catastrophic fires were observed after the Hayman, Buffalo Creek, High Meadow, Big Turkey, and Berry Fires. These fires caused major damage to recreational facilities such as trails and campgrounds and destroyed others. Recreational use was either banned or restricted during and for some time after these fires, reducing the recreational opportunities in those areas.

A major fire in the Trout-West project area would potentially result in the temporary or permanent loss of recreational facilities. This area is heavily used for recreation and users could be displaced to other facilities in other locations. Because the project area is so close to the Colorado Springs and Denver metropolitan areas, it can be assumed that recreationists would go to other similar facilities near Denver to recreate. This would put additional pressure on those facilities. However, the project area offers a unique combination of recreation opportunities close to a major metropolitan area and replacement recreational opportunities may not exist for some types of use. Recreationists might return to the project area if facilities impacted by a fire had been rebuilt and the nearby landscape was beginning to revegetate. The Economic Analysis contains more information about wildfire losses to Forest Service recreation facilities.

The No Action alternative does not propose to unclassified roads or improve the design of system roads in the project area. Recreationists using these areas who wander off the main trails onto the various social trails would continue to disturb riparian areas and erode stream banks and hillsides, potentially degrading water quality and fish habitat. Over time, the increasingly degraded conditions would negatively affect the recreation experience.

Cumulative Effects

The Hayman Fire, the Buffalo Creek Fire, the South Platte Ranger District dispersed camping and shooting closures, the Polhemus Burn, the Manitou Lake Dredging Project, the Trout Creek Timber Sale, the Trail Creek timber sale, and the Manitou Experimental Forest 40-acre thin have short-term effects on recreational resources together with the No Action alternative. These events and activities would primarily affect recreation by increasing vehicle activity on Forest Development roads and increase occupancy at developed campgrounds in the project area.

Several campgrounds that burned in the Hayman Fire will take years to rebuild. In the interim, users may be displaced to recreational facilities in the Manitou Park recreation area.

Conclusion

No Action would not have any direct effects on recreation. Indirectly, this alternative would continue the trend toward increasing fire risk and potential damage to recreational resources. Resource damage on unclassified trails and roads from motorcycles and other all-terrain vehicles would continue.

Proposed Action

Effects of Vegetative Treatments on Recreation

The proposed vegetation treatments would change the character of portions of the project area where recreation takes place. The treatment units would still have a natural appearance, but the forest would be less dense. Recreationists would likely become accustomed to these changes.

The Proposed Action would not change the ROS settings of the project area. The temporary roads and the vegetation treatments would not change the long-term recreational use (see below for a discussion on the effects of road reclamation). The Proposed Action would use tractor/cable, helicopter, on-site, and light methods for thinning and biomass treatment. Areas treated with tractors would be the most obvious to recreationists. In some areas, a "path" of disturbed ground and vegetation would be evident. The paths would remain noticeable until they were rehabilitated. Tractor paths could be used as motorcycle trails, establishing a new use which could lead to soil erosion and other adverse conditions. Mitigation measures described in Chapter Two are recommended to reduce potential impacts on resources and recreational activities.

Vegetation treatments would reduce the potential damage to recreation resources from a wildfire. However, some recreationists could be temporarily displaced during project operations. Recreationists using facilities outside the project area could notice more use, which could negatively affect their recreation experience. This type of displacement could occur during harvest activity, prescribed burning, and reclamation efforts. However, the effect would be minor, as all of the activities would be scheduled over a number of years, reducing the displacement effect.

Effects on Recreation Facilities

Manitou Park Recreation Area

Recreation facilities that could be affected by the Proposed Action include the Manitou Experimental Forest Headquarters, Manitou Lake Picnic Area, Painted Rocks Campground, Colorado Campground, Dump station, South Meadows Campground, Pike Community Group Campground, Red Rocks Group Campground, Centennial Trail (which includes FDT 699 and 699.1A), and State Highway 67.

Developed recreation facilities would likely be temporarily closed during harvest and prescribed burn activities or the prescribed treatments would be scheduled when the facilities are closed for the season. Closing these campgrounds during peak season would cause displacement of recreationists to other facilities. This could increase crowding in other areas, potentially negatively affecting the recreation experience at those facilities. However, the closures would be temporary and result in only minor, short-term effects. Cumulative effects with displacement of recreationists caused by the Hayman Fire may occur and cause some inconvenience or distress as people crowd into unaffected areas.

Short-term effects of the harvest activity would include noise, visual activity, smells, and smoke that could affect the experience of people using these facilities. Traffic associated with the harvest and prescribed burning would also affect recreationists using this area. Prior to the prescribed burning, logging slash may be noticeable to visitors in some areas. Although these effects would be considered minor, some recreationists may choose to avoid the affected areas while harvest activities are being conducted.

Prescribed burning would also have a short-term effect in the treatment units. Recreationists would need to avoid areas being burned because of public safety and smoke. This would temporarily reduce the use of this area. However, the duration of the effect is short and therefore the overall effect of the burning would be considered minor.

The primary long-term effect to visitors of these facilities would be visual. Areas where the forest has been thinned would have a different visual character than the existing, dense forest. The effect of this change would depend upon the sensitivity of the individual. The overall difference in appearance would be a change to a more open condition, which would more closely emulate the historic forest conditions. The treated areas would retain a natural character. The change in appearance of the treated areas may be noticeable but would not be expected to cause any adverse effects to recreationists.

Manitou Experimental Forest

Recreation activities within the Manitou Experimental Forest include motorized travel on Forest System Roads and non-motorized use on Forest system trails. There are no developed recreation facilities in the Ridgewood portion of the Experimental Forest. Some unclassified roads/trails in the area would be rehabilitated at the end of the project, which would deter illegal off-road vehicle use. The short-term and long-term effects to recreationists would be similar to those mentioned in the Manitou Park Recreation Area.

Motorized and Non-Motorized Trail System

The Phantom, Ryan Quinlan, Rampart, and Skelton treatment units have similar recreation resources. The primary recreational resource to be affected in these areas is the extensive multi-use trail system. The highest concentration of designated motorized trails occurs in the Phantom and Rampart areas. Some of the most popular of these trails, including the North Divide Trail 717 and the trails off of the Rampart Range Road, would pass through treatment areas.

One short-term effect of logging and prescribed burning is closing trails for varying periods of time. After treatment, ATV and OHV riders using the portions of trails that pass through the project area would observe a more open forest. The treatments would not affect their ability to use the trails or adversely affect their recreational experience. There may be a short-term effect in use along tracks and paths created by mechanical logging devices (skidders, tractor, etc.) until operations are completed.

An indirect effect of a more open forest may be increased use and development of unclassified trails and roads.

Other Recreational Resources

In other areas where dispersed camping is allowed, the effects would be similar to those described for the developed sites in the Manitou Park Recreation Area. In areas where dispersed camping is occurring in and around unclassified roads scheduled to be reclaimed upon completion of the project, the campsites would be eliminated, causing user displacement into other areas. The effect on recreation resources would likely be minor, since there are many other opportunities in the area for recreational activities.

Recreational Resources on Private Land

The Lutheran Valley Retreat Ranch, located outside the Trout-West project area, the Colorado Lions Camp, located on Highway 67, and similar facilities located on private land are still considered recreational resources potentially affected by the Proposed Action. Recreationists who use private lands in and around the project area would notice a change in the forest conditions. The short-term and long-term effects would be the same as discussed for the Manitou Park Recreation Area.

Effects of Road Reclamation

The Proposed Action would upgrade 68 miles of system roads, upgrade then reclaim 48 miles of unclassified roads/trails, and build then reclaim 14 miles of temporary roads in the Trout-West project area. None of the roads that would be reclaimed have been designated for use.

The unclassified roads and trails provide access to and along riparian areas, private lands, and ridge tops. Overuse has damaged riparian vegetation and aquatic habitat and caused erosion in many areas. By reclaiming the existing unclassified roads and trails, routes will be restored to a near natural condition and blocked, if need be, to discourage use and to allow vegetation to become reestablished.

There could be some short-term disruption for recreationists while the work is being completed. These disruptions would include noise, traffic, and reclamation activities on the trails and at parking areas. These disruptions would be considered minor.

Reclaiming unclassified roads would not change the ROS setting because these roads are not recognized as authorized Forest Development Roads. In addition, unclassified roads have not been developed or maintained to Forest Service standards and should be removed from the landscape per Forest Policy. The reclamation could displace individuals who may use the unclassified roads for OHV, ATV, hiking, and biking but there are many other opportunities in the area for these activities to take place, so the effect would be minor.

Cumulative Effects

The Hayman Fire and Buffalo Creek Fire resulted in dispersed camping closures. Some of that use may potentially be diverted to this project area. Developed campgrounds in the project area have additional capacity to accommodate most of the displaced use. Trail use may increase, causing a short-term negative effect on users. When the areas affected by the burns begin to revegetate and facilities are re-built, the use would shift back to the burned areas. Since the duration of the effect is relatively short and use can be accommodated in the project area, the effect would be considered minor.

The Polhemus Burn, Manitou Lake Dredging, the Trout Creek Timber Sale, the Trail Creek timber sale (on private land), and the 40-acre thin on the Manitou Experimental Forest combined with the Proposed Action would result in a cumulative increase in management activity in the project area. For the period when activities are concurrent, the cumulative effects may increase the feeling of crowding and negatively affect the recreation experience. This effect would be short-term and would last until activities are completed. The same holds true for the Hayman Fire Salvage within the Trout and West Creek watersheds.

The long-term cumulative effect of these combined actions would be a reduction in fire risk and, therefore, a reduction in the potential for adverse effects to recreational resources due to a large catastrophic fire. This alternative is consistent with the Forest Plan direction for management of recreational resources.

Alternative A

Alternative A would have similar effects to the Proposed Action, except that there would be no effect from burning.

Alternative B

Alternative B would have similar effects to the Proposed Action, but at a smaller scale. Fewer roads would be reclaimed than in the Proposed Action.

Alternative C

Alternative C proposes to treat the same number of acres as the Proposed Action, without building any new roads. Alternative C would have less effect on motorized and non-motorized trail recreation in the Phantom, Ryan Quinlan, and Skelton treatment units than the Proposed Action. The impacts of tractor yarding and temporary roads would not be evident in the helicopter treatment areas. Therefore, the potential for new non-system roads and trails to be developed would be less under Alternative C than the Proposed Action.

Short-term direct effects of Alternative C on private landowners during harvest activity would include noise and visual activity. There would be less traffic on local roads and the long-term effect of road scars and skidder trails would be greatly reduced under this alternative. Indirect effects are similar to those described for the Proposed Action.

The combination of no temporary roads, upgrading 68 miles of system roads, and rehabilitating 48 miles of unclassified roads and trails would have a greater positive effect on the recreational resources and private lands than the Proposed Action.

Alternative D

Alternative D would have effects similar to Alternative B, but at a smaller scale. Risks from wildfire would be similar to No Action.

Alternative E

Alternative E would have the greatest direct impact of all the action alternatives. This alternative proposes to treat the greatest number of acres, including riparian areas, and would create openings on over 30 percent of the landscape. These openings could lead to an increase in off-road vehicle use as recreationists find easier access through these areas. Mitigation measures that apply specifically to openings are included in the description of Alternative E in Chapter Two.

Alternative E would have a greater short-term effect on developed recreation in the Long John treatment unit with increased traffic, noise, and smoke from tractor harvesting and prescribed burning in and around Red Rock, Colorado, Pike Community, and South Meadows campgrounds. In addition, visual impacts will be more evident from developed sites.

Alternative E would have similar effects on dispersed recreation trails, camping, hunting, and fishing as the Proposed Action. Approximately the same number of unclassified and temporary roads would be reclaimed in Alternative E. The direct and indirect effects of Alternative E from road reclamation would be the same as the Proposed Action.

Socio-Economics

Introduction

This socio-economic analysis covers a variety of topics, including Environmental Justice, financial efficiency, economic efficiency, public safety, and effects on residents. The analysis was revised following public comments on the Trout-West DEIS. The Socio-Economic Specialist Report is included in Appendix H, and is available electronically at the following web address: http://www.fs.fed.us/r2/psicc/spl/twest.htm.

The proposed actions have the potential to affect local communities and people who live, work, and play in the Trout-West project area and immediate vicinity. The project area is located almost entirely in Teller County. The analysis area also includes acreage in Douglas and El Paso Counties. Communities most affected by the Project include Woodland Park and Divide in Teller County and Colorado Springs in El Paso County. Florissant, Trumbull, and Palmer Lake are other nearby communities.

The Forest Plan management goals include the following:

- Maximize present net value while emphasizing opportunities to improve water, fish and wildlife, outdoor recreation, and other amenity values.
- Manage resources at economically and environmentally feasible levels, consistent with the emphasis on amenity values.
- Provide for increased production and productive use of wood fiber while maintaining or improving other resource values.
- Provide the opportunity for economic growth of industries and communities dependent upon Forest outputs.

The Forest-wide management objectives include the following:

- Forest-wide standards supplementing National and Regional policies, standards, and guidelines found in Forest Service Manuals, Handbooks, and the Rocky Mountain Region Guide relevant to timber harvesting.
- Providing well-designed timber sales to be affordable under average market condition at time of sale.
- Increasing the use of available wood fiber consistent with management objectives and economic principles.

Federal regulations under 36 CFR 219.27 set forth the minimum specific management requirements for accomplishing goals and objectives for the National Forest System. Those management requirements are addressed as follows:

- Section (b) Vegetative Manipulation: (1) Multiple-use; (3) Not chosen for greatest dollar return; (7) Practical transportation, harvest requirements, and preparation and administration.
- Forest Service policy sets a minimum level of financial analysis for project planning (FSH 1909.17).

Environmental Justice

Population

Douglas and Teller counties are two of the 10 fastest growing counties in Colorado, based on percentage change between 1990 and 1999 (US Census 2000). Population within El Paso County grew by 25 percent during the same period.

Population is projected to have grown between three and 14 percent in the three counties since 1999. Douglas County has grown the most of the three counties; all are growing at least as fast as the state average.

Population growth has many implications on the need for fuels reduction. With more people comes greater risk of human-caused wildfire. Increased population would also tend to increase property values and development, which increases potential losses from wildfire. Table 66 displays population by race in the three counties for the period 1990-1999.

Table 66. Population by Colorado County, 1990-1999

County	1990 Population	1999 Population	Percent Change 1990-1999
Douglas	60,391	164,495	172.4
Elbert	9,646	19,810	105.4
Park	7,174	14,218	98.2
Custer	1,926	3,596	86.7
Archuleta	5,345	9,581	79.3
Teller	12,468	21,303	70.9
San Miguel	3,653	6,003	64.3
Eagle	21,928	35,522	62.0
Hinsdale	467	750	60.6
Summit	12,881	20,435	58.6

Source: US Census

Table 67 shows population by race in Colorado and in selected counties. Census data reports that the overwhelming majority of the three counties, along with the rest of the state, identify themselves as white (Table 68).

Table 67. Population by Race in Colorado and Selected Counties

Geographic Area	Grand Total (2000)	Total One Race	White	Black or African American	American Indian and Alaska Native	Asian	Hispanic or Latino (of any race)	Some other race	Two or more races
State of Colorado	4,301,261	4,179,074	3,560,005	165,063	44,241	95,213	735,601	309,931	122,187
COUNTY									
Douglas	175,766	172,470	163,064	1,676	716	4,404	8,886	2,513	3,296
El Paso	516,929	496,716	419,673	33,670	4,725	13,099	58,401	24,293	20,213
Teller	20,555	20,144	19,510	113	200	120	718	185	411

Source: US Census

Table 68. White Population as Percentage of County

Geographic Area	Total Population	Population One Race - White	Percent One Race-White
Douglas	175,766	163,064	93
El Paso	516,929	496,716	96
Teller	20,555	19,510	95
State-Wide	4,301,261	3,560,005	83

Source: US Census

Income within the Teller and El Paso Counties in the analysis area is similar to the average for the state. Douglas County has exceptionally high income and has the highest average income of any county in the state (Table 69).

Table 69. Estimated Median Household Income: Colorado and Selected Counties (1998)

Geographic Area	Median Household Income	
	Estimate	90 Percent Confidence Interval
Colorado	$43,402	$41,386 to $45,417
-Douglas County	$84,645	$80,687 to $88,582
-El Paso County	$43,755	$41,041 to $46,454
-Teller County	$48,476	$45,337 to $51,598

Source: US Census

The project is not expected to disproportionately affect low income or minority populations. No environmental justice issues have been raised during the scoping process.

Social Issues

Many social issues have been raised regarding the Trout-West Project and its potential effects on the human environment.

Soils, Water, and Air Quality

Soils, water, and air quality are discussed as part of the environmental impact analysis for the project. These are ultimately social issues. The project has the potential to produce sediment and smoke. Wildfires would also produce sediment and smoke. Comparisons between alternatives are elsewhere in this FEIS. Dust would be abated in all alternatives.

Wildlife, Plants, Noxious Weeds, and Range Resources

Effects are discussed elsewhere in the FEIS.

Public and Worker Safety

Public and worker safety is always of significant concern in forestry projects. Occupational Health and Safety Administration (OSHA) guidelines would be followed in all alternatives. Traffic controls to reduce conflicts between operations and visitors would be required in all alternatives. An increase in log truck traffic would likely occur under all alternatives, with numbers of trucks increasing with potential volume of timber removed. Over the ten-year operating period, approximately 4,000 log truck loads of sawtimber could be hauled away under the Proposed Action and Alternatives A and C.

Alternative A would generate approximately 50,000 tons of non-merchantable material, which could require about 1,800 10-yard trucks to haul away. The Proposed Action and Alternative C could generate equal amounts, but some of the material could be burned at the landing.

Alternative E would have the potential to nearly double these amounts. Alternatives B and D would have proportionally less logging truck traffic.

Haul routes would likely include Highways 67 and 24. County roads may also be used. Although trucks regularly travel along roads in the project area, the introduction of project-related truck traffic would be noticeable to local residents. Potential impacts would be greater for the loaded trips.

Increased truck traffic would also contribute to wear on local roads, particularly those designed to handle relatively low volumes of traffic. Teller County has expressed concern that the roads could be damaged by log truck traffic. A project design feature requires the Forest Service to include road maintenance agreements as part of any Trout-West work contract. Agreements with the County may require the operation to cover road maintenance through user fees. Some of the same roads would be used for both the Hayman Fire Salvage and the Trout-West Project, but the operations would not occur concurrently.

The Fire Salvage is expected to be completed before the fuels reduction project begins. Project-related activities would generate noise. Sound is typically described using the decibel (dB) scale, a logarithmic rating system that accounts for large differences in audible sound intensities. Studies addressing the effects of noise on people need to consider the frequency response of the human ear. Sound measuring instruments are therefore often designed to respond to or ignore certain frequencies. The frequency-weighting most often used to evaluate environmental noise is A-weighting. Measurements from instruments using this system are reported in "A-weighted decibels," or dBA. This scale accounts for the human perception of a doubling of loudness as an increase of 10 dBA. A 70-dBA sound level, for example, sounds twice as loud as a 60-dBA sound level. Factors affecting potential noise impacts include distance from the source, frequency of the sound, absorbency of the ground, the presence of obstructions, and the duration of the sound.

Light automobile traffic at 100 feet has a typical sound level of 50 dBA. A heavy truck at 50 feet has a typical sound level of 90 dBA. Because the dB scale used to describe noise is logarithmic, a doubling of a traffic noise source (i.e., twice as much traffic on a road) produces a 3-dBA increase average roadway noise. Average sound levels due to line sources, such as traffic, decrease with distance from the road at a rate of three to 4.5 dBA per doubling of distance from the road. Vegetation attenuates noise if it is dense and deep enough. Intervening vegetation may also create a soft surface over which the noise would travel and would be expected to absorb sound energy.

Project-related logging truck trips would likely be spread throughout the day and limited to weekdays and business hours when resident and visitor populations are less. Each truck would likely represent a discrete rather than a cumulative addition from a noise perspective and would be comparable to the sound level presently generated by other trucks using project area roads.

Vegetation treatment and revegetation activities would also generate noise. Possible vegetation treatment noise sources include chain saws and loaders. A chain saw has a specific event sound level of 110 dBA and the Forest Service requires that chain saw operators wear earplugs. A front-end loader going through various cycles has a typical hourly average sound of 75 dBA at 100 feet. Average sound levels due to discrete point sources, such as chainsaws, decrease at a rate of six dBA per doubling of distance from the source. Intervening vegetation would be expected to absorb some sound energy.

Control of Prescribed Burns

One major public issue is the potential for prescribed burns to get away. This risk is inherent in prescribed burning. Many design features and mitigation measures have been built into the project to reduce the risk of prescribed burns getting out of control.

1. The application of prescribed burning zones, where the least risky fuels reduction methods approved within 600 feet of private lands (whole tree yarding, no burning); piling and burning (low risk of burns getting away) approvied within 1 mile of private lands; and prescribed burning only approved greater than one mile from private land.

2. A Prescribed Fire Burn Plan and Smoke Management Plan must be approved before any proposed prescribed burn can be implemented. The purpose of this plan is to prevent the possibility of a prescribed fire escape. There are 19 elements in the Burn Plan. All elements are designed to structure a safe and controlled burn to meet management objectives for that area. Some of the required components are very specific. Among those elements are the following: fuel characteristics, protection of sensitive features, prescribed fire prescriptions, predicted fire behavior in the units, predicted fire behavior outside the burn unit(s) under worst-case weather conditions for contingency planning, weather data collection, smoke management and air quality, ignition procedures, test fire and recording results, holding procedures, safety and special considerations, public relations, escaped fire contingency plan, burn day go/no-go checklist, technical review, and National Wildfire Coordination Group (NWCG) complexity rating.

No Action and Alternative A have no risk of controlled burns getting away. However, the No Action alternative has the greatest risk of wildfire, which would likely have greater adverse effects than an uncontrolled burn (depending on circumstances like time of year, weather, etc).

Alternative B does not include any broadcast burning, thus would have fewer risks of escaped fire than the Proposed Action or Alternatives C and E.

Alternative D includes broadcast burns closer than one mile from private land, so this alternative has slightly greater risks to private property. The alternative would be feasible and careful burn planning would reduce potential risks of escaped fire.

Economic Analysis

General Economic Effects

The analysis area will continue to be economically dependent on recreation and tourism. Over the long term, the region as a whole will likely continue to grow, with continued emphasis on preserving the integrity of the rural character of the area. Seasonal fluctuations in the unemployment rate are likely to continue.

Short-term social effects to residences and businesses, as well as visitors in and around the fuels reduction operation, would occur. These effects would continue for up to ten years. Businesses and residences around Woodland Park could be affected by logging activity, especially during the summer months. Visitors to the area may choose not to come to the area because of the fuels reduction activities, or may enjoy their experience less. Recreation outfitters may experience short term, negative effects due to operations. Some roads would likely be closed during felling, skidding, or decking. Specific economic effects to residents and businesses in and around the fuels reduction operation are unknown but would likely increase with acres treated.

The No Action Alternative would not result in any direct economic effects to residents or businesses from operations, but has the greatest risk of Hayman-type wildlife effects. Tourism was severely affected by the Hayman Fire. The fire caused many lost workdays and shut down businesses during evacuation periods.

Costs of Operations

Operations costs applied to the action alternatives are displayed in Table 70 and depicted in Figure 7. No Action is not associated with any operations costs.

Table 70. Cost of Operations for Alternatives By Element

Alternative	Cost Element/Dollars				
	Yarding	Burning/ Chipping	Roads	Other	Total
Proposed Action	7,886,221	6,218,400	2,058,000	870,000	17,032,621
Alternative A	11,055,450	5,000,000	2,058,000	585,000	18,698,450
Alternative B	7,015,938	4,333,400	1,457,000	420,000	13,226,338
Alternative C	8,943,344	7,868,400	1,568,000	870,000	17,599,744
Alternative D	2,674,814	2,861,000	495,000	180,000	6,210,814
Alternative E	14,183,214	9,194,600	2,058,000	375,000	25,810,814

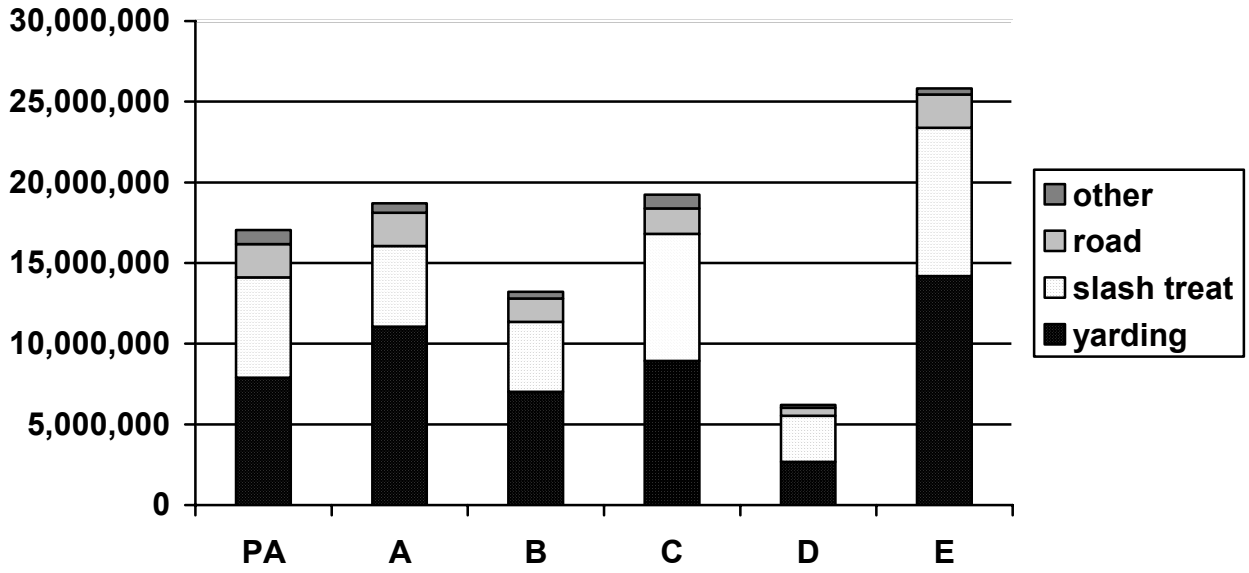


Figure 7. Operations Costs of Action Alternatives

Operations Costs – Net Value

Merchantable timber (i.e., ponderosa pine and Douglas-fir) may be produced as a by-product of fuels reduction and sold. Unmerchantable timber would also be produced and could be sold as chips or fuelwood. Any wood sold would offset the costs of operations, depending on market conditions. Table 71 shows the present value and costs of operations over a nine-year period.

No value was attributed to merchantable or unmerchantable volume. The timber industry in the Rocky Mountain states is undergoing major shifts. The sale of mills, retooling mills, changing product mixes, changing timber supplies, and low prices are occurring throughout Colorado, Wyoming, and South Dakota. A "regional" stud mill today may be a "local" niche mill tomorrow. Narrowly-defined timber demand is not as helpful as it once was.

Continued declines in the relative economic contribution of the wood products industry are likely. It is increasingly difficult to find mills in close proximity to timber sources. It is common to transport timber 250 to 300 miles.

Sawlogs and unmerchantable material would be disposed of by burning or chipping, or would be exported off-site as a wood product. Selling sawlogs produced as a result of fuels reduction would improve the economic efficiency of the project.

Table 71. Present Value, Costs of Operations Over a Nine Year Period

Alternative	Present Value, Operations Costs *(applied to a 9-year period, 4% discount rate)*
No Action	0
Proposed Action	-$14.6 million
Alternative A	-$16.0 million
Alternative B	-$11.4 million
Alternative C	-$15. 1 million
Alternative D	-$5.3 million
Alternative E	-$22.2 million

No Action has the greatest present value, since it requires no funding. Alternatives D and B have less cost than the other action alternatives, but with a relative loss of effectiveness. The Proposed Action and Alternatives A, C, and E are all effective in reducing potential for damaging wildfire. The Proposed Action is most efficient, followed by Alternatives C, A, and E.

Alternatives A and C treat the same acreage as the Proposed Action, with the same effectiveness. Alternative A is more costly because completion of the project entirely by mechanical means is more expensive than doing some burning. Alternative C is more costly because the cost of increased helicopter yarding exceeds the cost of building and rehabilitating some temporary roads. Alternative E treats the most acreage and is therefore most expensive.

Wildfire Costs

The Hayman Fire demonstrates the catastrophic costs associated with wildfire. Wildfires are a certainty in the Trout-West project area and across the National Forest throughout the western U.S. The existing condition is associated with serious wildfire risk: without fuels reduction, the entire analysis area is likely to burn in a 30-year period.

Wildfire costs were estimated using data from a variety of sources, including County Assessors, the Denver Water Board, and the USFS (Table 72). Based on assumptions described below, the cost of wildfire for a 30-year period under No Action is approximately $240 million dollars.

The $240 million dollars are costs and damages borne by 1) Forest Service; 2) other firefighting agencies including federal, state and local entities; 3) Private Landowners; and 4) Denver Water Providers. This figure also includes costs of operations as described above. Operations costs are applied solely to USFS (Figure 8).

Table 72. Wildfire and Operations Costs: All Alternatives

Alternative	US Forest Service	Interagency Fire Suppression and Emergency Recovery	Private Landowners	Denver Water Providers	All Partners
No Action	$13 million	$16 million	$189 million	$23 million	$240 million
Proposed Action	$18 million	$2.5 million	$58 million	$6 million	$84 million
Alternative A	$19 million	$2.5 million	$58 million	$6 million	$86 million
Alternative B	$16 million	$3.3 million	$82 million	$13 million	$115 million
Alternative C	$18 million	$2.5 million	$58 million	$6 million	$85 million
Alternative D	$23 million	$15 million	$178 million	$22 million	$237 million
Alternative E	$24 million	$2.5 million	$58 million	$6 million	$91 million

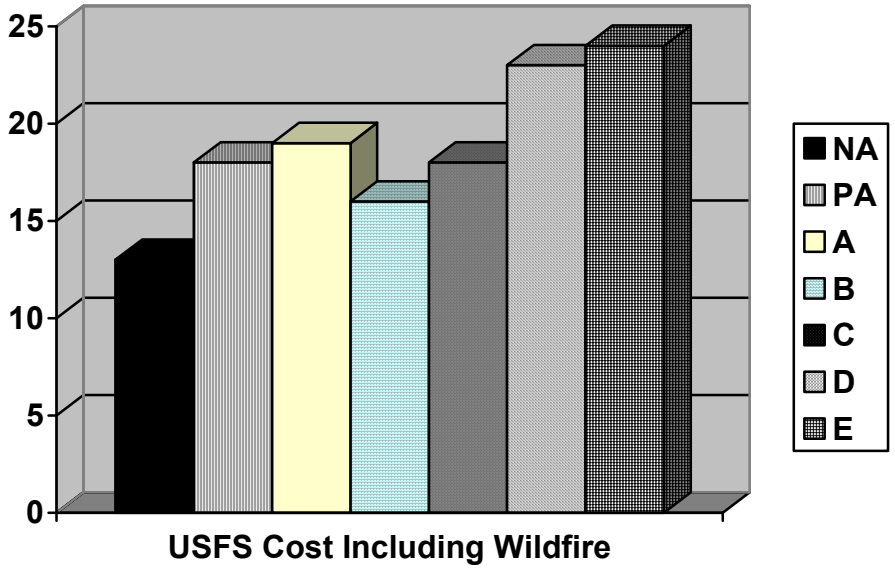


Figure 8. USFS Costs From the Trout-West Project Plus Wildfire (in Millions of Dollars)

Forest Service Financial Efficiency

If only USFS costs and damages are considered (and interagency fire suppression and emergency recovery costs are not included), No Action costs the least of all alternatives. No Action has no operations costs and predicted losses to Forest Service infrastructure are relatively minimal. Alternative B is the next most efficient. The Proposed Action and Alternatives A and C have similar costs and mid-range efficiency. Alternatives D and E are the least efficient.

Depending on the origin of a wildfire, Interagency Fire Costs may be borne by the USFS or other firefighting agency. Quicksilver was run with all interagency fire costs and emergency rehabilitation attributed to the USFS (Table 73).

Table 73. All Firefighting and Emergency Recovery Costs for Predicted Wildfires, USFS Only

Alternative	Total Costs - USFS
No Action	$28.4 million
Proposed Action	$20.5 million
Alternative A	$21.9 million
Alternative B	$19 million
Alternative C	$21 million
Alternative D	$37.8 million
Alternative E	$26.6 million

When all firefighting and emergency recovery costs are added for the predicted wildfires under each alternative, the most efficient alternative is B, followed by the Proposed Action, Alternative C, Alternative A, Alternative E, Alternative D, and No Action.

Economic Analysis – All Partners

When other partners who may be affected by predicted wildfire are factored in, No Action becomes the most costly alternative. Private landowners and Denver Water Providers have much to lose from wildfire damage. Private property damage over a 30-year period is estimated at $189 million for No Action. Alternative D would reduce this to approximately $178 million. Alternative B reduces potential wildfire damage to $82 million. The Proposed Action and Alternatives A, C, and E reduce potential wildfire private property damage to $58 million dollars.

For Denver Water Providers, No Action is predicted to cost about $23 million in wildfire damage. Alternative D would cost $22 million and Alternative B would cost $13 million. The remaining alternatives are predicted to cost about $6 million each.

The total costs of each alternative, including operations costs over a nine-year period and predicted losses due to wildfires over a 30-year period, are displayed in Figure 9 and Table 74.

Alternatives that reduce Condition Class across the watershed are more economically effective than those that do not.

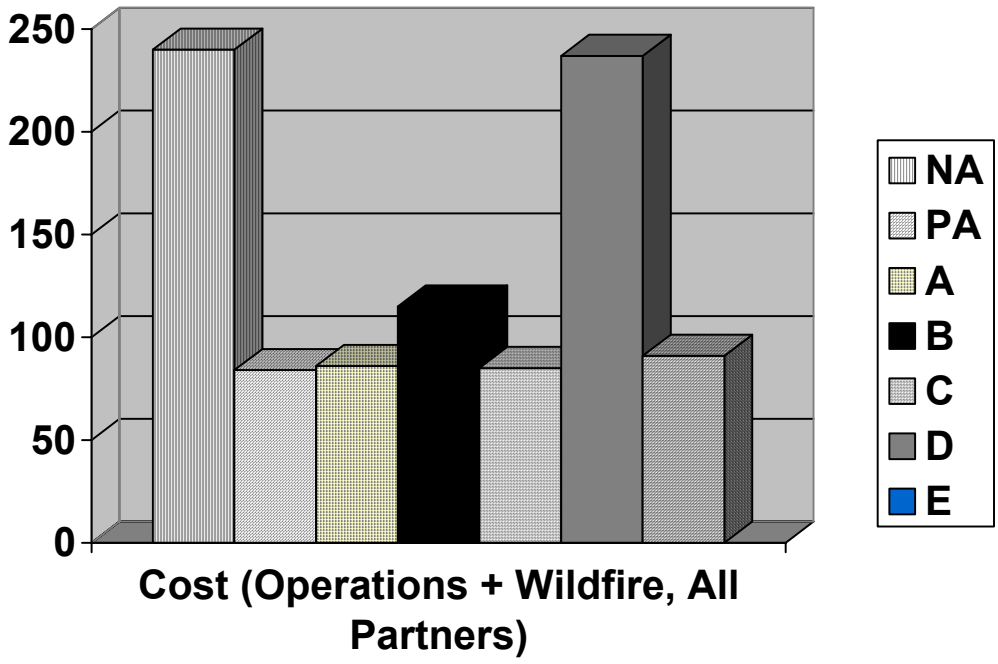


Figure 9. Total Costs (Operations + Wildfire, All Partners)

Table 74. Total Costs (Operations + Wildfire, All Partners)

Alternative	Total Costs - All Partners
No Action	$240 million
Proposed Action	$84 million
Alternative A	$86 million
Alternative B	$115 million
Alternative C	$85 million
Alternative D	$237 million
Alternative E	$91 million

Proponents of Alternative D claim that the project would be more effective than predicted by the IDT in reducing wildfire damage, particularly when homes are the item considered. Alternative D treats acreage within ½ mile of private land, or about 30% of the Proposed Action. However, it is only predicted to slightly reduce wildfire damage because not enough acreage would be treated to slow the progress of a crown wildfire.

A second economic analysis was run with Alternative D equally effective as Alternative B in reducing wildfire damage to private property. This would reduce the total operations plus wildfire damage costs to about $142 million, similar to Alternative B.

Opportunity Costs

The Trout-West Project alternatives represent a variety of trade-offs. In general, short-term costs of the operation are more than recovered by reduced wildfire losses. The alternatives that cost the least to implement (i.e., No Action, Alternatives B and D) will not likely treat sufficient acreage to reduce Condition Class and potential for wildfire damage.

Over a 30-year period, the Proposed Action and Alternatives A and C have roughly equal opportunity costs. The effects of each of the alternatives are discussed throughout the FEIS. The temporary roads forgone in Alternative C are not expected to result in unacceptable results. The burning forgone in Alternative A is feasible and can be accomplished in a safe manner.

Alternative E costs the most to implement but best meet the goal of promoting vegetation that resembles historic conditions.

The action alternatives are relatively expensive from a per-acre point of view. Each acre could cost more than $1,000 to treat, especially when monitoring and administration costs are included (adds up to 20% to the total). Part of the reason for this expense is the extensive design features intended to reduce impacts to soils and water, fish and wildlife, and scenery (among other topics). Given the design features, the IDT does not predict any direct loss of resource values from any of the action alternatives. The potential losses from wildfire far exceed those predicted for the project.

Jobs and Employment

Without knowing where the timber will be processed, we cannot estimate which communities or areas will benefit. Some local economic impacts will follow work in the woods, while others will follow processing in the mills. Assuming each acre of treatment is equal to two person-days of employment (one day for initial treatment, one day for follow up surface fuels treatment), the Proposed Action has the potential to require about 40,000 person-days spread out over ten years and employ about 20 people (assuming 200 workdays per year). Alternative E would provide proportionately more jobs, Alternatives B and D proportionately fewer.

Recent analyses on the Medicine Bow National Forest estimated that $335,000 of earnings are created or sustained for every million board feet harvested and processed (Mike Retzlaff, personal communication). The Proposed Action would result in earnings of at least $6,700,000 over a ten-year period.

At least half the firms that stand to benefit from these earnings are likely to be located within the Rocky Mountain region (Mike Retzlaff, personal communication). Many local contractors have expressed interest in the Trout-West Project.

Cumulative Effects

This project would have additive economic effects with the Hayman Salvage project. Both projects would cost taxpayer dollars and both would result in some wood products becoming available for sale. The Hayman Salvage Alternative 3 would cost approximately $1.3 million dollars to implement, but would result in a return of about $0.5 million from timber products sold. The Hayman Salvage project is likely to be implemented ahead of the Trout-West Fuels Reduction Project.

Citizen Involvement

Citizens have expressed interest in remaining involved with the project from planning through implementation and monitoring. Future opportunities for citizen involvement are associated with the project. The public is encouraged to contact Pikes Peak District Fire Management Officer, Mike Kerrigan, at 719-477-4218, to express interest and discuss specifics.

Private landowners adjacent to the treatment areas would be contacted to determine potential partnerships to implement the project in ways that are compatible with the landowners' interests. Cooperative funding partnerships are particularly important so that private land may be treated along with the National Forest. Private landowners would have particular influence on the specific treatment methods on National Forest located within 600 feet of residences. Private landowners may also help reduce the cost of the project or reduce environmental impacts by allowing access through private property, where appropriate.

Heritage Resources

Surveys for heritage resources and scoping with American Indian tribes have been completed and about 100 historic (75 percent) and prehistoric (25 percent) sites were located in the project area. Of the known sites, 13 are considered eligible for listing on the State Historic Register. Specific locations of sites are typically withheld from the public to avoid disturbance to sensitive resources.

No known heritage sites would be adversely impacted by the Trout-West Project. The boundaries of proposed treatment areas would be modified in the immediate vicinity of any cultural property potentially impacted by thinning or follow-up surface fuels treatment.

The project fits under the umbrella of the MOU for the National Fire Plan between the Forest Service and State Historic Preservation Office. All aspects of the MOU would be followed in the project.

Short-Term Uses and Long-Term Productivity ___

The National Environmental Policy Act (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 project would improve (or not affect) short-term productivity and is likely to restore long-term productivity, given maintenance. No Action has worse effects on productivity than other alternatives.

Unavoidable Adverse Effects_____

Some adverse effects are unavoidable. The context and relative significance of these impacts are described for each alternative in Chapter 3. Many mitigation measures and design features of the alternatives minimize the significance of the adverse effects. All alternatives except E meet all Standards & Guidelines in the Forest Plan. ***In many cases, No Action has the most serious impacts of all alternatives.***

- Prescribed burning has some short-term adverse effects. Burning produces smoke, which can cause adverse effects on some individuals' health. Prescribed burning can also escape control (risks mitigated in this project). Smoke can degrade visual quality. Smoke from wildfires tends to have more significant effects than prescribed burning.

- An unavoidable, slight, temporary reduction in productivity could occur from exporting nutrients off-site with trees. Productivity would be more seriously reduced given a damaging wildfire that volatilizes nutrients and scorches soils.

- Some accelerated erosion and sediment delivery is associated with all alternatives; accelerated erosion and sediment could adversely affect aquatic habitats and fishing opportunities. Accelerated erosion is most likely with the No Action alternative.

- The project would likely benefit many wildlife species in the long run. Some temporary loss of habitat and habitat capability is associated with the project. Animals may be displaced to other locations. Minor, short-term adverse impacts on individual sensitive plants are likely.

- Noxious weeds could spread as a result of human use in the area, even if all design features and mitigation measures are applied.

- Thinning and created openings unavoidably reduce vegetative barriers to off-road vehicles. More open terrain increases potential for illegal or irresponsible use.

- Change in visual condition (more open) may be adverse for some people. This effect is also likely under No Action due to the chances of wildfire.

- Short-term displacement of developed and dispersed recreation could occur under all alternatives including No Action.

- Thinning, yarding, and burning operations can be dangerous and injure people.

- Firewood could be made available immediately as a result of the project. Fuels reduction projects are likely to continue to provide firewood throughout the foreseeable future.

Irreversible and Irretrievable Commitments of Resources

The project is associated with some irreversible and irretrievable commitments of resources. All applicable laws that apply to the project would be followed. Unclassified and temporary roads that are rehabilitated reduce vehicular access. A future decision to construct a road would be needed to restore the lost access.

Eroded soils can be considered an irreversible commitment of resources, since it takes so long for soils to develop. All of the alternatives, including No Action, are associated with accelerated erosion. All action alternatives are associated with an irretrievable loss of nutrients due to trees exported off the site. Alternative E has irretrievable loss of forest cover in areas maintained as persistent openings. Without disturbance or maintenance, the openings would likely eventually become forested.

Specifically Required Disclosures

This project does not affect any prime forest or farmland. No floodplains would be directly affected. Small wetlands and riparian areas may be affected, but mitigation measures in the Proposed Action reduce risks to these habitats.

Coordination with the State Historic Preservation Office, USFWS, Colorado State Forest Service, EPA, and Teller County has occurred and is ongoing. No conflicts with objectives of Federal, regional, State, or local land use plans, policies, or controls have been identified for this project. The project will require continued coordination with local, state and federal entities.

Minority populations would not be disproportionately affected by the project. The project is not associated with any unusual energy requirements.

CHAPTER 4. CONSULTATION AND COORDINATION

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US Dept. of Interior
US Federal Highway Administration
US Fish and Wildlife Service
US Federal Aviation Administration
US Senator Allard
US Senator Campbell
US Representative Beauprez

Index

Scientific And Common Names Of Species _____

Table 75. Scientific and Common Names of Species

SCIENTIFIC NAME	COMMON NAME
Accipiter gentilis	Northern goshawk
Ambystoma tigrinum	Tiger salamander
Anas platyrhynchos	Mallard
Arceuthobium vaginatum	Dwarf Mistletoe
Bassariscus astutus	Ringtail
Botrychium echo	Reflected Moonwort
Botrychium lineare	Narrow-lvd Moonwort
Botrychium pallidum	Pale Moonwort
Bufo boreas boreas	Boreal toad
Carex livida	Livid sedge
Castor canadensis	Beaver
Cervus elaphus	Elk
Chlidonias niger	Black tern
Contopus borealis	Olive-sided flycatcher
Cynomys ludovicianus	Black-tailed Prairie Dog
Dendroctonus species	Bark Beetle (various species)
Dendroctonus ponderosae	Mountain pine beetle
Dendroctonus pseudotsugae	Douglas-fir beetle
Falco columbarius	Merlin
Falco peregrinus	Peregrine falcon
Haliaeetus leucocephalus	Bald eagle
Hesperia leonardus montana	Pawnee Montane Skipper
Malaxis brachyopoda	Addersmouth
Melanerpes lewis	Lewis' woodpecker
Meleagris gallopavo	Wild turkey
Myotis thysanodes pahasapensis	Fringed-tailed myotis
Odocoileus hemionus	Mule deer
Orgyia pseudotsugata	Douglas-Fir Tussock Moth
Otus flammeolus	Flammulated owl
Pandion haliaetus	Osprey
Passerella iliaca	Fox sparrow
Picoides tridactylus	Three-toed woodpecker
Pinus contorta variety latifolia	Lodgepole Pine
Pinus monticola	Western White Pine

SCIENTIFIC NAME	COMMON NAME
Pinus ponderosa	Ponderosa Pine
Pipilo chlorurus	Green-tailed towhee
Plecotus townsendii	Townsend's big-eared bat
Potentilla rupincola	Rock cinquefoil
Pseudotsuga menziesii	Douglas-fir
Rana pipiens	Northern leopard frog
Regulus satrapa	Golden-crowned kinglet
Populus tremuloides	Quaking Aspen
Sciurus aberti	Abert's Squirrel
Sialia currocoides	Mountain bluebird
Sitta pygmaea	Pygmy nuthatch
Sorex nanus	Dwarf shrew
Sphyrapicus nuchalis	Red-naped sap sucker
Strix occidentalis lucida	Mexican spotted owl
Viola selkirkii	Spurred violet
Wilsonia pusilla	Wilsons' warbler
Zapus hudsonius preblei	Preble's meadow jumping mouse

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Glossary

Aerial Fuels – All live and dead vegetation in the forest canopy or above surface fuels, including tree branches, twigs and cones, snags, moss, and high brush.

Alternative – A mix of management prescriptions applied to specific land areas to achieve a set of goals and objectives. The alternative provides management direction for the proposed project that reflects identified public and management concerns for the Decision Area.

Aspect – Direction towards which a slope faces.

Best Management Practices (BMPs) – Practices determined by the State to be the most effective and practical means of preventing or reducing the amount of water pollution generated by non-point sources, to meet water quality goals.

Broadcast Burn – Allowing a prescribed fire to burn over a designated area within well-defined boundaries for reduction of a fuel hazard or as a silvicultural treatment, or both.

Canopy – The more-or-less continuous cover of branches and foliage formed collectively by the crown of adjacent trees.

Chipping – The reduction of woody residue by a portable chipper to chips that are left to decay on the forest floor.

Classified road – A road within National Forest System lands planned or managed for motor vehicle access including state roads, county roads, private roads, permitted roads, and Forest Service roads.

Crown Fire (Crowning) – The movement of fire through the crowns of trees or shrubs more or less independently of the surface fire.

Dead Fuels – Fuels with no living tissue in which moisture content is governed almost entirely by atmospheric moisture (relative humidity and precipitation), dry-bulb temperature, and solar radiation.

Diameter at Breast Height (dbh) – The diameter of a tree measured 4 feet 6 inches above the ground.

Displacement of Soil – The movement of the forest floor (litter, duff, and humus layers) and surface soils from one place to another by mechanical forces such as a blade used in piling and windrowing.

Duff – An organic surface soil layer below the litter layer in which the original form of plant and animal matter cannot be identified with the unaided eye.

Effective ground cover – Any vegetation, litter, or debris in direct contact with the surface soil. This cover effectively intercepts rain and provides erosion protection.

Ephemeral Streams – Streams that flow only as a direct response to rainfall or snowmelt events. They have no baseflow and usually no defined channel.

Erosion – The detachment and transport of individual soil particles by wind, water, or gravity.

Extreme Fire Behavior – "Extreme" implies a level of fire behavior characteristics that ordinarily precludes methods of direct control action. One of more of the following is usually involved: high rate of spread, prolific crowning and/or spotting, presence of fire whirls, or strong convection column. Predictability is difficult because such fires often exercise some degree of influence on their environment and behave erratically, sometimes dangerously.

Fine (Light) Fuels – Fast-drying fuels, generally with a comparatively high surface area-to-volume ratio, which are less than one-quarter inch in diameter and have a timelag of one hour or less. These fuels readily ignite and are rapidly consumed by fire when dry.

Fire Behavior – The manner in which a fire reacts to the influences of fuel, weather, and topography.

Fire Intensity – A general term relating to the heat energy released by a fire.

Flame Height – The average maximum vertical extension of flames at the leading edge of the fire front. Occasional flashes that rise above the general level of flames are not considered. This distance is less than the flame length if flames are titled due to wind or slope.

Flame Length – The distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface); an indicator of fire intensity.

Forb – Any herbaceous plant other than those in the grass, sedge and rush families.
Forest Development Road – A road wholly or partially within or adjacent to a National Forest System boundary that the Forest Service has authorized and maintains jurisdiction over and that is necessary for the protection, administration, and use of lands under the agency's jurisdiction.

Fuel – Combustible material. Includes vegetation, such as grass, leaves, ground litter, plants, shrubs, and trees, which feed a fire. (See Surface Fuels.)

Fuel Bed – An array of fuels usually constructed with specific loading, depth, and particle size to meet experimental requirements; also, commonly used to describe the fuel composition in natural settings.

Fuel Loading – The amount of fuel present expressed quantitatively in terms of weight of fuel per unit area and commonly expressed in tons per acre.

Fuel Reduction – Manipulation, including combustion, or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control.

Fuel Treatment – Manipulation or reduction of natural or activity fuels (generated by a management activity such as slash left from logging) to reduce fire hazard.

Fuel Type – An identifiable association of fuel elements of a distinctive plant species, form, size, arrangement, or other characteristics that will cause a predictable rate of fire spread or difficulty of control under specified weather conditions.

Ground Fuel – All combustible materials below the surface litter, including duff, tree or shrub roots, punchy wood, peat, and sawdust that normally support a glowing combustion without flame.

Hazard Reduction – Any treatment of a hazard that reduces the threat of ignition and fire intensity or rate of spread.

Heavy Fuels – Fuels of large diameter such as snags, logs, and large limb wood, which ignite and are consumed more slowly than flash fuels.

Hydrophobicity – A discontinuous water-repellant layer that forms under coniferous cover naturally at the mineral surface in coarse soils; also, a water-repellant layer of varying depths that forms during fire, the heat from which creates a waxy residue from coniferous litter that is consumed.

Improvement – Construction activity that raises the traffic service level of a road or improves its safety or operation efficiency.

Incident – A human-caused or natural occurrence, such as wildland fire, that requires emergency service action to prevent or reduce the loss of life or damage to property or natural resources.

Intermittent Stream – A stream that runs water in most months, but does not run water during the dry season of most years. They have a defined channel.

Ladder Fuels (sometimes referred to as Fuel Ladders) – Fuels that provide vertical continuity between strata, thereby allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease. They help initiate and assure the continuation of crowning.

Large Fire – 1) For statistical purposes, a fire burning more than a specified area of land, e.g., 300 acres. 2) A fire burning with a size and intensity such that its behavior is determined by interaction between its own convection column and weather conditions above the surface.

Litter – Top layer of the forest, scrubland, or grassland floor, directly above the fermentation layer, composed of loose debris of dead sticks, branches, twigs, and recently fallen leaves or needles, little altered in structure by decomposition.

Live Fuels – Living plants, such as trees, grasses, and shrubs, in which the seasonal moisture content cycle is controlled largely by internal physiological mechanisms rather than by external weather influences.

Lop and Scatter – Fuel treatment where, following tree felling, limbs and branches are cut off and scattered in the unit.

National Fire Danger Rating System (NFDRS) – A uniform fire danger rating system that focuses on the environmental factors that control the moisture content of fuels.

Peak Flow – The greatest flow attained during the melting of the winter snowpack or following a storm event.

Perennial Streams – Streams that flow continuously throughout the year.

Prescribed Burning – The application of fire to fuels in either a natural or modified state under such conditions as to allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to further certain planned objectives (i.e., silviculture, wildlife management, reduction of fuel hazard, etc.).

Prescribed Fire – Any fire ignited by management actions under certain predetermined conditions to meet specific objectives related to hazardous fuels or habitat improvement. A written, approved prescribed fire plan must exist, and NEPA requirements must be met, prior to ignition.

Prescribed Fire Plan (Burn Plan) – This document provides the prescribed fire burn Boss with information needed to implement an individual prescribed fire project.

Prescription – Measurable criteria that define conditions under which a prescribed fire may be ignited, guide selection of appropriate management responses, and indicate other required actions. Prescription criteria may include safety, economic, public health, environmental, geographic, administrative, social, or legal considerations.

Resources – 1) Personnel, equipment, services, and supplies available, or potentially available, for assignment to incidents. 2) The natural resources of an area, such as timber, crass, watershed values, recreation values, and wildlife habitat.

Riparian – Pertaining to areas of land directly influence by water. Riparian areas usually have visible vegetative or physical characteristics reflecting this water influence. Stream banks, lake borders, or marshes are typical riparian areas. Vegetation bordering watercourses, lakes or swamps; it requires a high water table.

Road – A motor vehicle travelway over 50 inches wide, unless classified and managed as a trail. A road may be classified or unclassified.

Road Reconstruction – Construction activity that results in improvement, restoration, or realignment of a road.

Road Decommissioning or Obliteration – Various levels of treatment to stabilize are rehabilitate unneeded roads, such as blocking the entrance, revegetating, water barring, removing fills and culverts, reestablishing drainage-ways, removing unstable road shoulders, or full obliteration by recontouring and restoring natural slopes.

Road Rehabilitation – Same as decommissioning (above) as it applies to unclassified roads.

Sediment Delivery – The amount of sediment moved from an uphill position by forces of water, wind, or gravity (erosional forces) that reaches a stream that has net been trapped by a buffer, i.e. a riparian area.

Sedimentation – A general term describing both the erosion and sediment delivery process.

Seral stage – Successional plant communities are often classified into quantitative seral stages to depict the relative position on a classical successional pathway.

Slash – Debris left after logging, pruning, thinning or brush cutting; includes logs, chips, bark, branches, stumps, and broken understory trees or brush.

Snag – A standing dead tree or part of a dead tree from which at least the smaller branches have fallen.

Stand Replacing Fire – A fire that consumes an entire stand of trees. These fires are generally of high to extreme intensities and burn large numbers of acres.

Stream Order – It is often convenient to classify streams within a drainage basin by systematically defining the network of branches. Each non-branching channel segment (smallest size) is designated a *first-order stream*. A stream which receives only first-order segments is termed a *second-order stream*, and so on. The order of a particular drainage basin is determined by the order of the principle or largest segment.

Suppression – All the work of extinguishing or containing a fire, beginning with its discovery.

Surface Fuels – Loose surface litter on the soil surface, normally consisting of fallen leaves or needles, twigs, bark, cones, and small branches that have not yet decayed enough to lose their identity; also grasses, forbs, low and medium shrubs, tree seedlings, heavier branchwood, downed logs, and stumps interspersed with or partially replacing the litter.

Temporary road – A road associated with timber sale contracts, fire activities, or other short-term access needs that are unnecessary for future resource management and are not intended to be a part of the forest transportation plan.

Unclassified road – A road not intended to be part of, and not managed as part of, the National forest transportation system such as temporary road, an unplanned road, an off-road vehicle track, and an abandoned travelway.

Thinning – Cutting trees to reduce the number of stems per acre to redistribute growth potential or benefit the quality of the residual stand.

Timelag – Time needed under specified conditions for a fuel particle to lose approximately 63 percent of the difference between its initial moisture content and its equilibrium moisture content. If conditions remain unchanged, a fuel will reach 95 percent of its equilibrium moisture content after four timelag periods.

Underburn – A fire that consumes surface fuels but not trees or shrubs. (See Surface Fuels.)

Water-barring – Refers to the process of installing waterbars to direct drainage off of a road, skid-trail, or trail. Spacing and size is dependent on material and slope.

Watershed – Entire area that contributes water to a drainage system or stream.

Wildfire (Wildland Fire) – Any nonstructure fire, other than prescribed fire, which occurs on wildland.

Wildland – Land other than that dedicated for other uses such as agriculture, urban, mining, or parks.

Wildland-Urban Interface – The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

Acronyms and Abbreviations

$\mu g/m^3$	micrograms per cubic meter
ATV	All-Terrain Vehicle
BA	Biological Assessment
BE	Biological Evaluation
CDOW	Colorado Division of Wildlife
dB	decibel
dBA	A-weighted decibels
DEIS	Draft Environmental Impact Statement
DTFM	Douglas-fir tussock moth
DU	Diversity Unit
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FDT	Forest Development Trail
FEIS	Final Environmental Impact Statement
FOFEM-5	First-Order Fire Effects Model, Version 5
Forest Plan	Pike and San Isabel National Forests; Comanche and Cimarron National Grasslands Land and Resource Management Plan
HABCAP	Habitat Capability (Model)
HCI	Habitat Capability Index
IDT	Interdisciplinary Team
MA	Management Area
mi/mi^2	miles per square mile
MIS	Management Indicator Species
MOU	Memorandum of Understanding
MPB	mountain pine beetle
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NLAA	Not Likely to Adversely Affect
NWCG	National Wildfire Coordination Group
OSHA	Occupational Safety and Health Administration

PAOT	people at one time
PM	Particulate Matter
PM_{10}	particulate matter less than 10 micrograms in aerodynamic diameter
R	Rural
RIS	Resource Inventory System
RN	Roaded Natural
ROS	Recreation Opportunity Spectrum
RRMRA	Rampart Range Motorized Recreation Area
SASEM	Simple Approach Smoke Estimation Model
S&G	Standard and Guideline
TEP	Threatened, Endangered, and Proposed
TES	Threatened, Endangered, and Sensitive
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
VQO	Visual Quality Objective
WEPP	Water Erosion
WRIS	Wildland Resource Inventory System