United States
Department of
Agriculture

Forest
Service

Environmental Assessment

Glen Haven Fuel Reduction Project

Canyon Lakes Ranger District, Arapaho and Roosevelt National Forests
Larimer County, Colorado

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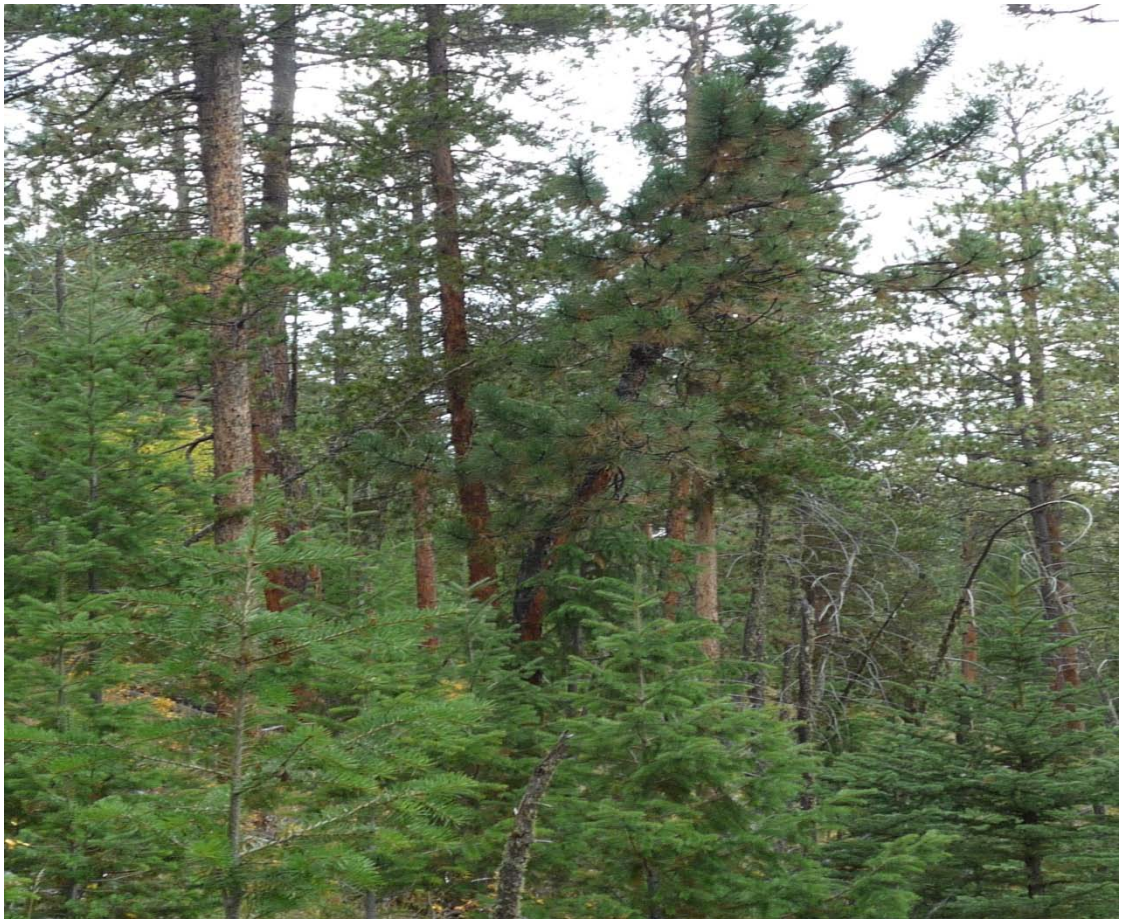

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CHAPTER 1 INTRODUCTION

Background

The Canyon Lakes Ranger District of the Arapaho and Roosevelt National Forests and Pawnee National Grassland is proposing to implement various hazardous fuel reduction treatments within the Glen Haven Project Area. This area has been prioritized for treatment due to the large amount of acres in a high or very high fuel hazard condition and a high percentage of private land and other values at risk within and adjacent to the project area. In addition, private landowners, both individually and as a community, are reducing the amount of flammable fuels around homes and using more fire resistant building products. Reducing the fuel hazard condition on National Forest land combined with defensible space efforts on private lands can increase the effectiveness of both treatments on reducing losses from wildfire.

This project was initiated under the authorities allowed in the Healthy Forests Restoration Act of 2003 (HFRA). To comply with the National Environmental Policy Act (NEPA), the Glen Haven Fuel Reduction Project Environmental Assessment has been prepared. One of the many purposes of NEPA is to reduce agency paperwork and delay in analysis. Therefore, this Environmental Assessment (EA) tiers to the Environmental Impact Statement (EIS) prepared for the 1997 Revision of the Land and Resource Management Plan for the Arapaho and Roosevelt National Forests (Forest Plan). Referring to this document and the analysis completed for the Forest Plan, eliminates repetitive discussions of decisions that have been made previously. These documents, as well as detailed information from resource specialists in the project record, are available upon request from the Canyon Lakes Ranger District, Fort Collins, Colorado.

This EA is not a decision document. Instead, it presents evidence and analysis necessary to determine whether the consequences of the proposed action have "significant" effects on the human environment and therefore, whether an EIS is necessary. Upon completion of this determination, the Responsible Official Kevin W. Atchley, District Ranger, would make a decision to implement the proposed action or any of the alternatives.

Glossary of Terms

The following terms will be used throughout the document and, for the convenience of the reader, definitions are included at the beginning of the document rather than as an appendix.

Aspen Enhancement: A treatment where all conifers within and occasionally surrounding an aspen stand are cut to maintain aspen stand health and vigor.

At-Risk Community: As defined by the HFRA, Title I, Section 101, (1), the term ''at-risk community'' means an area:

(A) that is comprised of:

(i) an interface community as defined in the notice entitled ‘‘Wildland Urban Interface Communities Within the Vicinity of Federal Lands That Are at High Risk From Wildfire’’ issued by the Secretary of Agriculture and the Secretary of the Interior in accordance with title IV of the Department of the Interior and Related Agencies Appropriations Act, 2001 (114 Stat. 1009) (66 Fed. Reg. 753, January 4, 2001); or

(ii) a group of homes and other structures with basic infrastructure and services (such as utilities and collectively maintained transportation routes) within or adjacent to Federal land;

(B) in which conditions are conducive to a large-scale wildland fire disturbance event; and

(C) for which a significant threat to human life or property exists as a result of a wildland fire disturbance event.

Blackline: Pre-burning of fuels adjacent to a control line before igniting a prescribed burn. Blacklining is usually done in heavy fuels adjacent to a control line during periods of low fire danger to reduce heat on holding crews and lessen chances for spotting across control lines.

Broadcast Burn (a type of prescribed fire): Controlled application of fire to fuels in either their natural or modified state (such as slash), under specified environmental conditions that allows the fire to be confined to a predetermined area, and produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives.

Burn Severity: Qualitative measure of the amount of heat released to the soil by the consumption of surface fuels and duff during a fire. Burn severity relates to soil heating, large fuel and duff consumption, consumption of the litter and organic layer beneath trees and isolated shrubs, and mortality of buried plant parts. Severity classes are measured as unburned, scorched, low severity, moderate severity, and high severity. A high severity burn would describe a condition in which most woody debris and the entire forest floor is consumed down to bare mineral soil. Soil may turn red due to extreme heat. Also, fine roots and organic matter are charred in the upper one-half inch of mineral soil.

Chipping: The process of reducing larger woody slash into smaller material that is generally three inches and smaller. Material is generally brought to a chipping machine. Chips are then randomly scattered so as not to exceed three inches in depth.

Community Wildfire Protection Plan: As defined by the HFRA, Title I, Section 101, (3), the term ‘‘community wildfire protection plan’’ means a plan for an at-risk community that:

(A) is developed within the context of the collaborative agreements and the guidance established by the Wildland Fire Leadership Council and agreed to by the applicable local government, local fire department, and State agency responsible for forest management, in consultation with interested parties and the Federal land management agencies managing land in the vicinity of the at-risk community;

(B) identifies and prioritizes areas for hazardous fuel reduction treatments and recommends the types and methods of treatment on Federal and non-Federal land that will protect 1 or more at-risk communities and essential infrastructure; and

(C) recommends measures to reduce structural ignitability throughout the at-risk community.

Condition Class: Condition classification is defined as a qualitative measure describing the degree of departure from historical fire return intervals and measuring the risk of losing key ecosystem components such as species composition, stand age, and canopy closure. One or more of the following activities may have caused this departure: fire suppression, timber harvesting, livestock grazing, introduction and establishment of exotic plant species, introduced insects or disease, or other past management activities.

Defensible Fuel Profile: A strategic area in the landscape where the vertical and horizontal arrangement of the fuels has been altered through some type of treatment with the intent of reducing the intensity and severity of wildfires. By reducing wildfire intensity, firefighters have increased opportunities to implement suppression tactics to protect at-risk values.

Defensible Space: Defensible space is an area between houses/structures, which is either man-made or natural where the vegetation is modified and maintained to slow the rate and intensity of an oncoming wildfire. It also provides an opportunity for firefighters to work and defend the house and helps protect the surrounding forest from igniting in the event of a structure fire.

Fire Regime: Fire Regime Class is defined as the fire return interval (frequency) and expected severity of a fire in different vegetation types.

Healthy Forests Restoration Act of 2003: The Healthy Forests Restoration Act of 2003 (P.L. 108-148) contains a variety of provisions to expedite hazardous fuel reduction projects on specific types of Federal land that contain wildland urban interface, municipal watersheds, threatened and endangered species habitat that are at risk of wildland fire or insect and disease epidemics.

Intensity: Describes the nature of a wildfire in terms of its rate of energy release. It is the amount of heat given off by a wildfire over a period of time. Increasing heat released over shorter lengths of time, indicate high intensity wildfire.

Interior Forest: Interior Forests are considered contiguous areas of relatively dense and large trees that are buffered from temperature, light and humidity differences of sizable forest openings, and from human disturbances along regularly used roads and trails.

Ladder Fuel: Fuels that bridge the gap between surface fuels and the tops, or crowns, of a tree. For example, intermediate trees or trees with low hanging branches can provide pathways for a wildfire to move from the ground to the tops of larger trees.

Mastication: The process of reducing larger woody slash and surface fuels into smaller material. Material is generally masticated in place with equipment.

Mulching: The process of reducing larger woody slash into finer material and mixing with soil. Material is generally mulched in place with equipment.

Pile Burn (a type of prescribed fire): A slash treatment where piles created by tree cutting operations are burned. Piles can be created by machine or by hand.

Primary Burn Area: Areas of a prescribed burn project that are actively ignited under specific weather and fuel moisture conditions. The use of prescribed fire within primary burn areas must have written pre-approved plans.

Secondary Burn Area: Deliberate ignition of prescribed fire may not occur in secondary burn area unless needed for control. The fire may also be allowed to extinguish itself when it reaches non-burnable barriers, change in fuels or topography, or when the weather moderates.

Slash: Fuels resulting from treatment activities, such as thinning and clearcutting; and natural events, such as wind or insect and disease. Slash can consist of branches, tree tops, logs, and broken or uprooted trees.

Surface Fuels: Fuel on the surface of the ground, consisting of: needle litter, dead branches, downed logs, and low growing plants.

Thin from Below: A treatment that cuts smaller understory trees to increase the distance between vegetation on the ground and the lowest branches of taller trees.

Thinning: A treatment where individual trees are cut to increase the spacing between tree tops.

Wildland Fire Management Strategy: Overall plan for managing unplanned wildfire ignitions. The strategy gives consideration to the values threatened, potential fire behavior, legal constraints and natural resource management objectives. All wildland fires would be controlled by one of three strategies:

> Direct Control: The intent is to immediately and completely extinguish a wildfire.
>
> Perimeter Control: A strategy that seeks to confine the activity of a wildfire to a specified zone. Zones are determined by threatened values and the benefits of wildfire effects.
>
> Prescription Control: The fire is considered to be controlled as long as it burns within specified geographic boundaries and predetermined burning conditions. These parameters are determined in advance and detailed in a written prescription. Fires that fall within this prescription are allowed to continue to burn.

Wildland Urban Interface (WUI): As defined by the HFRA, Title I, Section 101, (16), the term ‘‘wildland urban interface’’ means:

> (A) an area within or adjacent to an at-risk community that is identified in recommendations to the Secretary in a community wildfire protection plan; or
>
> (B) in the case of any area for which a community wildfire protection plan is not in effect:
>
> > (i) an area extending ½ mile from the boundary of an at-risk community;
> >
> > (ii) an area within 1 and 1/2 miles of the boundary of an at-risk community, including any land that:

(I) has a sustained steep slope that creates the potential for wildfire behavior endangering the at-risk community;

(II) has a geographic feature that aids in creating an effective fire break, such as a road or ridge top; or

(III) is in condition class 3, as documented by the Secretary in the project-specific environmental analysis; and

(iii) an area that is adjacent to an evacuation route for an at-risk community that the Secretary determines, in cooperation with the at-risk community, requires hazardous fuel reduction to provide safer evacuation from the at-risk community.

Purpose and Need for Action

The purpose of this project is to reduce hazardous fuels on National Forest lands that may contribute to the increased spread and intensity of wildfires. These wildfires could impact private and National Forest lands in the vicinity of Glen Haven, Colorado. After the 2000 wildfire season, a national list of communities in the vicinity of federal land considered at-risk from wildfire was developed. The risk factors evaluated included: 1) fire behavior potential (e.g., steep slopes, dense fuels); 2) values at risk (homes, businesses, municipal watersheds, scenic byways); and, 3) infrastructure (steep narrow roads, lack of fire hydrants, little or no surface water). Within and adjacent to the Glen Haven Project Area, Drake, Glen Haven, Estes Park, Glen Comfort and Waltonia have been identified as 'at-risk communities' and have been listed in the Federal Register Notice dated January 4, 2001.

In December 2003, the Healthy Forests Restoration Act was signed into law. This legislation authorizes fuel reduction treatments on National Forest System (NFS), Bureau of Land Management (BLM) and Tribal lands to reduce the threat of wildfire to those communities determined to be at-risk. This act further defines 'at-risk communities' as "… homes and other structures with basic infrastructure and services". In addition to the communities mentioned above, there are an estimated 8,000 acres of private land that fit this definition within the project area including the Retreat and Cedar Park subdivisions.

This project responds to part of the purpose for HFRA (Section 2) to:

1) Reduce wildfire risk to communities, municipal water supplies, and other at-risk federal land through a collaborative process of planning, prioritizing, and implementing hazardous fuel reduction projects.
2) Enhance efforts to protect watersheds and address threats to forest and rangeland health, including catastrophic fire, across the landscape.
3) Protect, restore, and enhance forest ecosystem components to improve biological diversity.

The Glen Haven Project Area contains a large area of interface between public and private landowners. Many residents of these areas are aware of the potential for wildfire and the effects it can have to their property and daily life. Past fires across the Front Range of Colorado have clearly underscored the need for collaboration between property owners and associations and State and County agencies to create areas of defensible space around homes and other improvements on private land. From this collaboration, the communities of Estes Park and Glen Haven have developed Community Wildfire Protection Plans (CWPP). In addition to the specific recommendations in these plans, the Larimer County Coordinating Group (a group of local, state, and federal representatives) meet on a regular basis to coordinate the priority of hazardous fuel reduction projects on National Forest land within Larimer County.

Vegetation in the area is susceptible to wildfire events, especially crown fire. During the last century, a buildup of forest fuels and changes in the composition of the forest have occurred. The accumulation of dead and down fuels and the number of small diameter

trees has increased. The arrangement of these fuels provides a pathway for fire to move from the ground to the crowns of larger trees (see cover photo). Under these conditions, even wildland fire ignitions under average weather conditions have the potential to become fast-moving and destructive crown fires.

This unnatural buildup and arrangement of fuels has occurred in part from almost 100 years of active wildfire suppression. Prior to this active wildfire suppression, naturally caused fires periodically burned at low and moderate intensities removing some dead fuels and reducing the number of small trees. In the Glen Haven Project Area, where human development has occurred, fire size has been kept artificially small because of potential threats from wildfire to this development. As the population along Colorado's Front Range increases, more homes are being built in forested areas creating a larger and more complex wildland-urban interface. Wildfire suppression will continue to be active because of the increased threats to life and property.

This overcrowding of trees also reduces the health and vigor of individual trees making them more susceptible to disease and insect attack. Past insect epidemics combined with the lack of wildfire has caused increased fuel loadings that may lead to more severe wildfire behavior. The increase in small diameter conifer trees has also encroached into aspen stands, limiting the amount of biological diversity. Maintaining healthy stands of aspen provides effective forage and habitat for the large elk herds that gather in the vicinity of Estes Park. In addition to providing diverse wildlife habitat, aspen stands are also more resistant to wildfire.

In order to address these conditions and meet purposes of the HFRA, the following needs were identified as goals for the project area:

- There is a need to apply appropriate vegetative treatments to maintain or improve watershed and forest health, reduce hazardous fuels and modify wildfire behavior in the forested areas of the project area. Treatments need to be applied in a manner and location that complement defensible space efforts on private land and/or protect other values at risk. In addition, these treatments are needed to maintain or restore ecosystem composition and structure that would reduce the risk of uncharacteristic wildfire that would be expected to occur within the current climatic period.
- There is a need to increase the amount and vigor of aspen stands across the project area. Aspen stands are generally areas of greater moisture that can reduce the intensity of wildfires. Areas of lower intensity can allow wildfire suppression efforts to be more effective. These stands also provide habitat for a variety of wildlife and add to the biodiversity of the project area.

Proposed Action

In order to address the need to apply appropriate vegetative treatments to maintain or improve watershed and forest health, reduce hazardous fuels and modify wildfire behavior in the vicinity of Glen Haven, the Canyon Lakes Ranger District proposes to

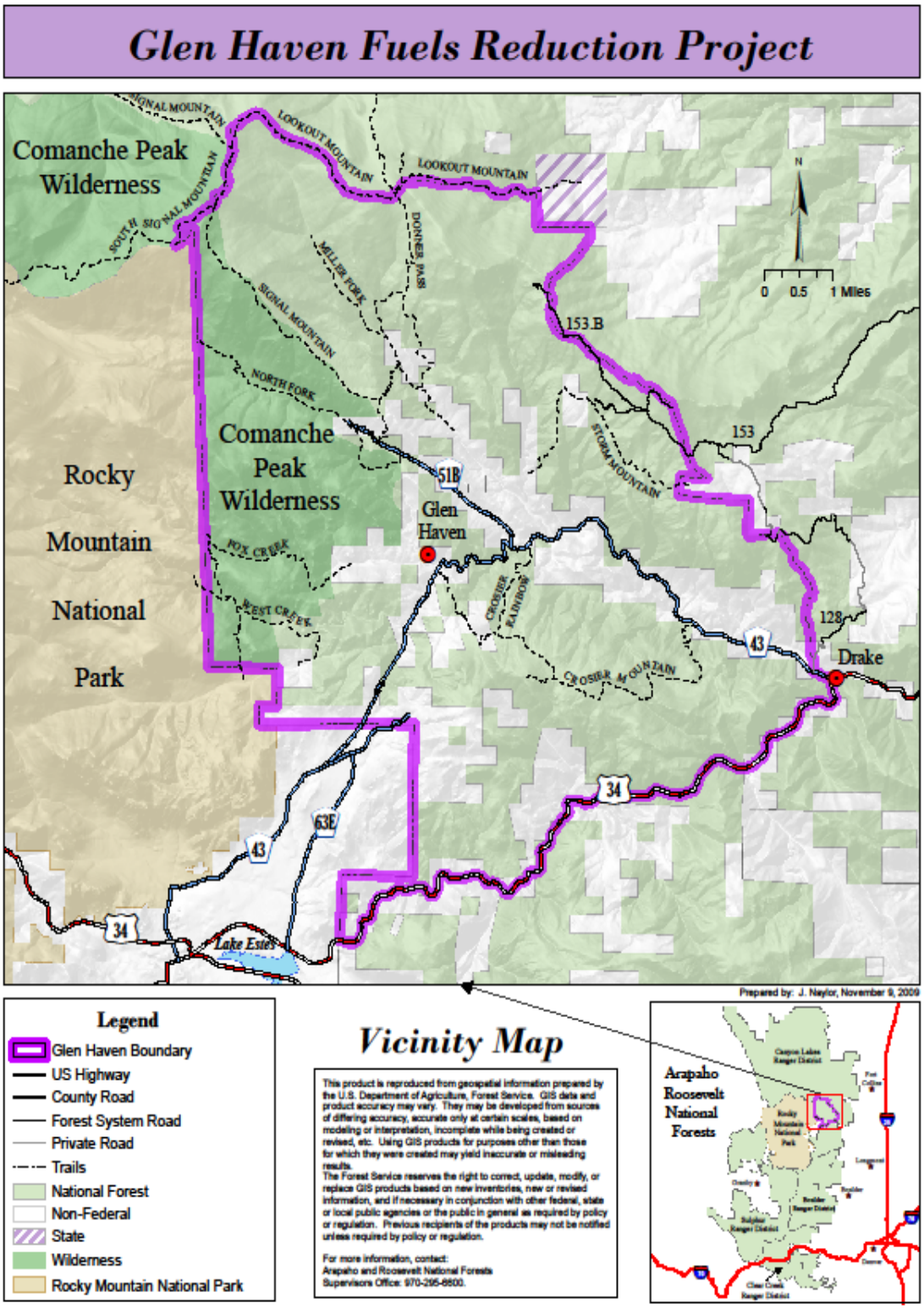
implement hazardous fuel reduction treatments on National Forest lands. The proposed project area boundary encompasses approximately 37,450 acres. Of that total, approximately 29,000 acres are NFS lands. The remaining acres are private or state lands intermixed throughout the project area. These parcels range in size from one to two acre residential lots in the subdivided areas to over 200 acres in the more remote locations.

With cooperation from the Colorado State Forest Service, Larimer County, and Rocky Mountain National Park, many of these property owners are beginning to, or continuing to create areas of defensible space around homes and other improvements on private land. Also within the project area are segments of electrical transmission and distribution lines managed by Estes Park Light and Power. This infrastructure is considered a 'value at risk' from wildfire and hazardous fuel reduction treatments would be implemented adjacent to these lines where possible to reduce the potential for interruption of service.

Public comment and collaboration, as well as input from U.S. Forest Service resource specialists, is used to develop and refine the Glen Haven proposal. Prior to development of this proposed action, maps and ground surveys of the project area were used to identify conditions that may limit or preclude fuel reduction treatments. Examples of these limiting factors would be soils with severe erosion hazards, threatened or endangered species habitat, or riparian areas. The proposed treatment unit boundaries were either located around these areas, or, specific restrictions on the types of treatments (generically called 'project design criteria') were established to minimize or avoid impacts. After considering all of these factors, approximately 5,400 acres have been proposed for treatment.

To implement the goals and objectives of this project, the Forest Service proposes to use three types of treatments on National Forest land within the Glen Haven Project Area. The first type of treatment (proposed for approximately 4,300 acres) would include cutting primarily smaller diameter conifer trees while leaving healthier and more fire resistant larger trees. Secondly, broadcast prescribed fire would be used on approximately 250 acres to accomplish the same goal of reducing the amount of flammable fuels. Lastly, Unit 6 contains pure stands of aspen overstory that are slowly being encroached on by conifer trees. To maintain the size and vigor of an estimated 210 acres of aspen stands, individual conifer trees would be cut by hand crews with chainsaws. A detailed description of the Proposed Action is included in Chapter 2 – Description of Alternatives.

Map 1. Vicinity Map



Public Involvement

The HFRA encourages meaningful public participation early in the planning stages of hazardous fuel reduction projects. Working in collaboration with adjacent communities, interested individuals, and State and local governments is essential to setting priorities and designing effective treatment areas. As a means of informing property owners and gathering specific local input, a public meeting was held in Glen Haven on October 8, 2008. A letter announcing the meeting was mailed to landowners adjacent to the project area and an article was published in the *Estes Park Trail Gazette*. Approximately 50 people attended and were informed about the proposed action and given an opportunity to ask questions.

In addition to the public meeting, a specific mailing list focusing on adjacent subdivisions and individual property owners was developed. On September 23, 2008, individual letters requesting comments on the proposal were sent to approximately 270 recipients (a copy of the scoping letter and the mailing list are available in the project record). This letter was also posted on the Forest's website. Throughout the summer and fall, the Forest Service provided news releases for the project and articles appeared in the *Fort Collins Coloradoan* and the *Loveland Connection*.

The proposal was listed in the Forest's Schedule of Proposed Actions beginning in July, 2008. This document is available on the National Forest website and is monitored by individuals and organizations interested in management of National Forest lands. From these combined outreach efforts, nine comments were received. Using these comments from the public and other agencies, the Forest Service developed issues to address and incorporated public input as part of project design.

Issues

The Forest Service uses an interdisciplinary process to separate issues brought up during scoping into groups of significant and non-significant issues. Significant or relevant issues are defined as those directly or indirectly caused from implementing the proposed action and cannot be addressed through mitigation or project design. Non-significant issues are identified as those that are: 1.) outside the scope of the proposed action; 2.) already decided by law, regulation, Forest Plan, or other higher level decision; 3.) irrelevant to the decision to be made; or, 4.) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations require this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…" However, at the discretion of the Responsible Official, some non-significant issues may be considered as part of project design for the proposed action.

Following is a summary of the comments received during scoping. Similar issues are grouped below followed by a determination of their relevance in developing alternatives

to implementing the project. The comment is italicized with the Forest Service response shown below.

Location of Fuel Reduction Treatment Areas

…..several proposed treatment units, such as most of unit 6 and the proposed Crosier Mountain burn, are more than one mile away from any private property. It is questionable if treating such areas would provide protection for homes, especially if such areas are uphill from the private land.

Unit 6 is proposed for aspen enhancement. This type of treatment involves cutting conifer trees less than 14 inches in diameter (10 inches for spruce) that are encroaching on pure stands of aspen (see Chapter 2 for detailed description of proposed action). When conifers become established in aspen stands, they typically over top and can eventually replace aspen. Aspen stands are naturally more resistant to fire spread than conifer stands. Maintaining aspen in this location near the top of Storm Mountain can reduce the potential of fire spread to private property located east of the project area.

The broadcast prescribed fire unit (Unit 18) is located adjacent to the Crosier Mountain prescribed fire completed in 1998. Prescribed fire in this location would extend the area of reduced fuel hazard along the Crosier Mountain ridge. Ridge tops are areas where fire behavior typically changes and are often used in fire suppression strategies. Implementation of both of these units would accomplish objectives stated in the purpose and need for the project.

Fuel Reduction Treatments within Inventoried Roadless Areas

A recent district court decision in the 10th Circuit invalidating the 2001 Roadless Area Conservation Rule directly conflicts with a 2006 decision from a district court in the ninth circuit reinstating the 2001 Rule. Also, a draft roadless rule for Colorado has been issued.

We recommend the Forest Service assume that the most restrictive rule, the 2001 Rule, is still in effect, and design any project to comply with it. That would protect the Forest Service legally and do the most to ensure proper protection of roadless characteristics.

Decisions authorizing projects involving cutting of timber in inventoried roadless areas on National Forest lands will be reviewed by the Secretary of Agriculture to ensure they comply with court decisions that are in effect at the time.

Proposed thinning would probably not comply with the 2001 Roadless Rule. [Specifically] …. the only exception to the prohibition on logging in roadless areas that is likely applicable here is logging small diameter material to restore ecosystem characteristics and structure, and to reduce the threat of uncharacteristic wildfire.

The elevation range of land within the Comanche Adjacent G RA is 8,200 to 11,200 feet; for the Crosier Mountain RA, it is 7,000 to 9,250 feet. Forest Plan FEIS Appendix C. This means that the majority of the acreage in both areas is above the elevation likely to have been primarily influenced by frequent, low intensity fires. In other words, hot, stand replacing fires were characteristic over most of the ponderosa pine stands in these roadless areas. This would be even more true of any lodgepole pine stands, which are affected primarily by hot, stand-replacing fires, often over sizable areas. Therefore, logging in almost any part of the Comanche Adjacent G RA and in most of the Crosier Mountain RA would not be permitted under the 2001 Roadless Rule.

--limit treatments in roadless areas to locations no more than about one-quarter mile from homes, unless steep forested slopes are below these homes, in which case treatment up to one-half mile from the affected homes may be warranted.

Elevation is not the only factor influencing fire behavior. Aspect, slope, the amount and arrangement of fuel loading, and condition class (fire return interval) also determine fire severity. The units in the proposed action are located in the vicinity of private property and are designed to reduce potential of crown fire initiation and increase the effectiveness of defensible space treatments around private infrastructure within the wildland urban interface. The majority of the treatment areas are in ponderosa pine stands or stands with a mix of Douglas fir and ponderosa. Pure lodgepole pine stands are only proposed for treatment if they are immediately adjacent to private property or within the unit proposed for broadcast prescribed fire.

In the areas proposed for treatment in roadless areas, no commercial timber harvest would take place. Thinning primarily smaller diameter trees would be completed by hand crews with chainsaws.

Absolutely NO roads in roadless areas! And very few, if any, new roads elsewhere.

No new permanent or temporary road construction would be required to implement the proposed action.

Effects on Wildlife

Stands with large trees must especially be retained, as they provide cover for big game species, and habitat for a variety of other species. Snags must be retained to provide habitat for cavity-nesting species, including flammulated owl. Some down dead material should be retained to conserve habitat for small mammals and provide material for decomposition into new soil.

Any logging in these roadless areas must retain wildlife habitat, be conducted to minimize impacts to wildlife, concentrate on the areas closest to homes, and retain large trees.

Thinning primarily smaller diameter trees is the activity proposed for all but two of the treatment areas. The emphasis would be cutting trees that contribute to ladder fuels. These are generally smaller diameter trees with green branches growing close to the ground. Individual standing dead trees are not considered ladder fuels and are not included in the cutting prescription. In addition, down and dead material greater than eight inches in diameter would be left in place (see Chapter 2, Proposed Action). Forest Plan standards for snag retention and down woody debris will be met or exceeded.

Under the project, shrubs might be cut to reduce ladder fuels, but it is important to retain some shrubs that provide food for black bears.

Within the thinning units, shrubs would not be cut. Only in the prescribed fire unit would the shrub component be affected.

In addition to deer, elk, black bear, and bighorn sheep, the Forest Service should survey for Abert's squirrel, pygmy nuthatch and flammulated owl, species that use mature ponderosa pine stands for habitat. Pygmy nuthatch is a management indicator species for the Arapaho-Roosevelt National Forest. Goshawk nests should be detected and avoided.

--make sure treatments are implemented only during periods when wildlife such as deer, elk, black bear and bighorn sheep are generally not present, or where it can be demonstrated that wildlife would not suffer adverse impacts from the activities.

Surveys for the presence of specific wildlife species and their habitat are conducted as part of the analysis of the effects to wildlife. The Wildlife section in Chapter 3 identifies the species included in the analysis and the effects of the proposed action.

Protection of Soils

…removing too many trees of any size could subject steep slopes to erosion, as there would be fewer trees to hold the soil in place and less protection from raindrop splash, especially if ground vegetation was sparse or absent.

Primarily smaller diameter trees will be cut. In areas where the majority of the trees are smaller diameter, a spacing requirement would be used to avoid cutting all trees in a certain area. As an additional safeguard to prevent soil movement, down and dead material greater than eight inches in diameter would be left in place.

Also, cut material should not be piled or burned on steep slopes. Burning on steep slopes increases the risk of a fire escaping, as fire is known to burn uphill faster than it does downhill or across flat ground, due to the fact that fire preheats flammable material above it on a slope.

Piles are burned when there is adequate snow cover or moisture on the ground to inhibit fire spread. Piles are also located at least eight feet from any residual tree (see Chapter1, Fire and Fuels Project Design Criteria).

…piling and burning cut material, especially larger diameter material is not a good practice, as the fires generate high temperatures and have a long residence time. This kills …soil microorganisms and volatilizes soil nutrients. It would be much better to broadcast burn, i.e., not pile material, if such fires can be safely implemented.

…piles should be limited to hand piles and be no more than about 100 square feet in size and no more than about 4 feet high. Piled material should be no more than about three inches in diameter to minimize long, hot fires.

Soils underneath burned areas should be broken up with hand tools to reduce the adverse effects from the fires. This is particularly important if larger diameter material (greater than about three inches) is piled and burned and if larger piles (taller than about six feet) are burned.

To facilitate clean and effective pile burning, the minimum pile size is eight feet in diameter and eight feet high. Piles constructed by hand generally do not exceed this size. Material greater than eight inches in diameter is not piled. If piles are constructed by machine, design criteria are in place to avoid excessive soil compaction or displacement caused by the creation of the piles.

Where chipping is done, there must be strict limitations on depth and coverage of chips.

Design criteria are specified to limit depth and coverage of chips and masticated material.

Mountain Pine Beetle

…conifers will be removed from aspen stands in the northeast portion of the project area. If the conifers here are pine, they should be retained. If killed by MPB, pine snags will make valuable wildlife habitat. In the future, they will fall down and may fuel a fire that would regenerate the aspen stands.

Conifers greater than 14 inches in diameter (10 inches for spruce) will not be cut in Unit 6 (aspen enhancement treatment). These larger diameter standing trees would provide wildlife habitat in the event they are killed by mountain pine beetle.

…the smallest trees are the most likely to survive an MPB attack. However, it is precisely these trees that would be targeted under the project. That might leave few live pine trees in treatment areas, the very trees needed to form future mature stands as the existing overstory dies.

…any treatments must favor retention of tree species not susceptible to MPB, including, but not limited to, aspen and Douglas-fir where present.

However, as I understand it, the beetles attack conifers greater than six inches in diameter; this means that the plan to thin these trees under ten inches is apparently the

wrong strategy. Thinning pines over six inches would appear to be the best approach given the approaching pine beetle damage.

In ponderosa pine and mixed conifer stands, reducing the number of trees per acre provides some resistance to the remaining trees from mountain pine beetle infestation. The overstory trees have the benefit of reduced competition for limited soil nutrients, water and sunlight. Lower stand densities also improve conditions for regeneration which would be important if losses of the ponderosa pine overstory are severe. In areas where all the trees are six inches or less, trees will be thinned to a specified spacing, improving their potential to survive future insect epidemics.

It is also important to consider that these treatments are occurring over a relatively small but strategic portion of the total project area. There are many thousands of acres where smaller diameter trees would not be cut.

Noxious Weeds

…prior to any treatment, there should be surveys for noxious weeds. Any populations found should be eradicated. Areas treated should be monitored for at least two years after treatment is complete in each respective area, especially if weeds were present before treatment.

Design criteria will address monitoring and treatment of new noxious weed infestations as a result of hazardous fuel reduction treatments (see Chapter 1, Botany Project Design Criteria).

Scenery

Large piles of cut material might not allow the project area to meet this SIO after implementation.

Burn piles would likely average eight feet in diameter by eight feet high. Depending on weather conditions, these piles would be burned within one or two years. Any effect on specific scenic objectives for the project area would be considered short term (see Chapter 3, Scenery).

Recreation

I'm concerned that the access, cutting and visual results will degrade the trails in this area. How will you protect these trails and ensure visitors a quality recreational experience (most people like quiet, mature, intact forests

Cutting specifications require that any cut material be removed from roads and trails. The majority of the slash created from the cutting operations would be piled and burned and after a few years would not be as noticeable. During cutting operations, chainsaw noise will be evident; however, this effect would also be considered temporary.

Recreational experiences would be degraded more from severe wildfires than from the proposed treatments.

Opportunities for Public Comment

Given the possible impacts to roadless area characteristics, the Forest Service must prepare an environmental assessment or environmental impact statement to describe the effects of the project, and to propose mitigation measures to reduce impact and evaluate the likely success of those measures in doing so.

Note that under federal caselaw, an EIS is required if there are "substantial questions whether a project may have a significant effect." LaFlamme v. Federal Energy Regulatory Comm'n, 852 F.2d 389, 397 (9th Cir. 1988). An EIS can be avoided only if the federal action will have "no significant impact' on the environment. 40 C.F.R. 1501.4(e).

It is very important that the public be able to comment on the proposed project and its possible impacts, especially since roadless areas are present. Thus the NEPA document for the proposed project must be distributed for public comment prior to approval of any project.

Individuals and organizations interested in the Glen Haven Fuels Reduction Project have an opportunity to comment on the proposed action during the scoping period. The effects of the proposed action are disclosed in an Environmental Assessment (EA) authorized under the Healthy Forests Restoration Act of 2003 (HFRA). After the EA is published and before the decision is made, there is another opportunity to respond to the proposed action and the analysis during the 30-day objection period.

Prescribed Fire

Why treat a mountain summit area with fire? A wildfire there has no place to go but up – and out!

Areas adjacent to the west side of the prescribed fire unit have extremely high fuel loads. The strategy for treating the top of the mountain is to help prevent a wildfire from spotting over the ridge and toward private property. The trail system along the prescribed burn is a popular place during the summer months creating potential for human fire starts. The prescribed burn ties into a broadcast burn completed in 1998 to the east. The proposed burn would increase the area treated between National Forest and private property near the communities of Glen Haven and the Retreat Subdivision.

Will any areas have views of the forest destroyed by this burn. Will any areas be clear cut?

The 250 acre prescribed burn unit located near the top of Crosier Mountain would be burned under weather and fuel moisture conditions that would not cause complete

mortality in the overstory. (Specific limits on the amount of acceptable mortality are included in Chapter 2 – Project Design.) Individual trees or groups of trees would be burned and would be visible especially while brown needles are present. Once the needles drop, the burned trees would be less noticeable. The proposed action does not include any clearcutting.

Miscellaneous

How will you close and obliterate roads and paths you create? Monitor and provide enforcement for illegal and motorized uses.

No new permanent or temporary roads are proposed for this project. If 'paths' or travelways are created during implementation, they would be covered with slash, fenced, or otherwise made impassable to motorized vehicles (see Chapter 2, Recreation Design Criteria).

Please don't overchip, leave debris, damage remaining trees or leave trash and flagging. Closely supervise contractors.

Standard design features limiting the depth and area covered with chips would be specified in any contract that included chipping an as option. All work awarded to private contractors would be monitored by Forest Service inspectors and contract administrators.

The national public is not responsible for the risk assumed by private parties in building in areas prone to wildfires.

Private parties building in risk prone areas should assume the major portion of the cost of fire suppression to their property.

The Healthy Forest Restoration Act of 2003 provided clear direction from Congress that federal land management agencies reduce hazardous fuels on federal lands within the wildland-urban interface.

CHAPTER 2 DESCRIPTION OF ALTERNATIVES

Alternatives Considered but Not Analyzed in Detail

An alternative to not treat in Inventoried Roadless Areas was considered by the Forest Service. During the initial analysis, it was determined the northern one fourth of the project area contained a high percentage of pure lodgepole pine stands. Effective fuel reduction treatments in these stands typically require mechanized equipment because of the larger area and larger volume of material to be treated. This type of ground based equipment would require construction of some temporary road for access. Based on a preliminary evaluation, it was determined fuel reduction treatments could not take place without altering the area's roadless characteristics and no further analysis was considered.

The remaining portions of the roadless areas are within wildland urban interface zones identified in Community Wildfire Protection Plans (CWPP) for Glen Haven, Estes Park and Cedar Park. These areas are also made up of primarily ponderosa pine stands and are relatively close to existing roads (see map titled Roadless and Treatment Areas). Effective fuel reduction treatments in these types of stands can be implemented by hand crews and do not require product removal. Analysis of these areas indicated that approximately 2,500 acres in roadless was in need of and available for some type of fuel reduction treatment. Based on the number of acres, it was determined an alternative that did not consider treatment in roadless could not meet the purpose and need and therefore, was not brought forward for full analysis.

Alternatives Analyzed in Detail

Alternative 1 - No Action

Under the No Action Alternative, current management actions, such as road and trail maintenance, would continue within the project area. No hazardous fuel reduction treatments to complement efforts on private lands would be implemented. No action would be accomplished to meet the identified purpose and need of the project. Because the project area contains a high percentage of private land, immediate fire suppression activities on even low severity fires would continue and fuel hazard condition would likely continue to increase. The desired conditions for the Glen Haven Project Area intended by the Healthy Forest Restoration Act and described in the Forest Plan, would not be pursued.

The No Action Alternative serves as a baseline for comparing the effects of the action alternative on the environment. Analysis of this alternative complies with regulations listed at 40 CFR 1502.14(d) requiring analysis of a no action alternative to be included in the Environmental Assessment.

Alternative 2 – Proposed Action

The Canyon Lakes Ranger District of the Arapaho and Roosevelt National Forests proposes to implement hazardous fuel reduction treatments on National Forest lands in the vicinity of Glen Haven, Colorado. The project area is generally located north of the Big Thompson River and south of Storm Mountain. Other geographic features within the project area include Crosier Mountain and the North Fork of the Big Thompson River. The Glen Haven Project Area boundary encompasses an estimated 37,500 acres. Of that total, approximately 29,100 acres are National Forest System lands. The remaining 8,400 acres of private land are intermixed throughout the project area. These private parcels range in size from less than one acre near Glen Haven to over 160 acres in more remote locations.

The Glen Haven Project Area contains numerous full time residences and summer cabins. As a means of reducing the threat from wildfire, many of these property owners have completed, or are in the process of completing, defensible space around these structures. To increase the effectiveness of these fuel reduction efforts and reduce the potential for destructive wildfires affecting private lands, the U.S. Forest Service proposes to treat up to an estimated 5,380 acres of National Forest land within the Glen Haven Project Area. Proposed treatments would emphasize thinning primarily smaller diameter conifer trees growing underneath larger, more mature trees. In some cases, the healthier tree may have a smaller diameter. In all cases, trees larger than 12 inches in diameter would not be cut.

The cut material (referred to as slash) would primarily be piled and burned at a later date when snow cover or moisture conditions would inhibit fire spread. A portion of the area could be treated with mechanized equipment. If this occurs, the slash would be chipped or masticated to a specified depth. The method of slash treatment would be determined by the amount of material cut, its proximity to private land and other improvements, and topographical features such as slope and aspect. In some areas, existing down and dead material would also be treated in a similar manner. To be treated, this dead material must be sound and eight inches in diameter or less.

This work would be accomplished by private contractors and/or Forest Service employees. Generally, the option of using mechanized equipment or hand crews with chainsaws to complete the treatments would be considered. However, some areas, such as units within inventoried roadless areas or on steep or rocky ground, would be limited to treatment by hand crews only. Removal of some forest products such as firewood would be considered where appropriate. Forest products would not be considered for removal from any of the inventoried roadless areas.

Two other types of treatments are also being proposed. Broadcast prescribed fire is planned for a 250 acre unit near the summit of Crosier Mountain. The objectives for this type of treatment are similar to thinning treatments described above. Low to moderate intensity surface fires would thin some of the younger trees, prune lower branches, and consume flashy fine fuels such as ground juniper and small diameter dead and down material that could contribute to fire spread in the event of a wildfire.

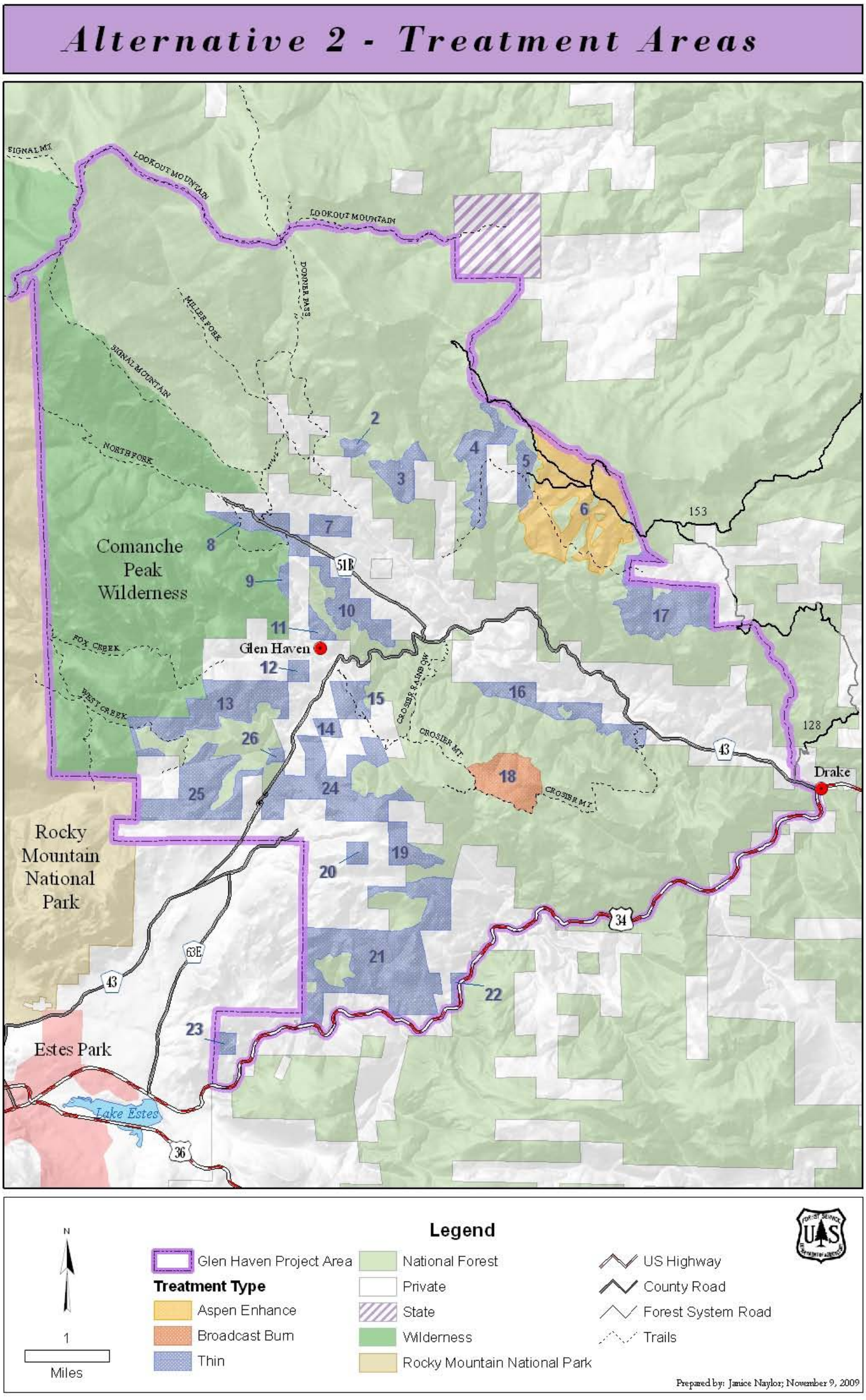
The Glen Haven Project Area also contains stands of pure aspen. Over time, conifer trees begin to encroach on and can eventually over top aspen stands, essentially out competing aspen for sunlight. This project proposes to cut the conifer trees that are growing within these stands of pure aspen. Trees would be felled by hand and the branches cut from the bole and scattered.

The following table lists the unit number, the possible treatments, and the number of acres available for treatment within each unit.

Table 1. Proposed Treatment

Unit Number	Vegetative Treatments	Slash Treatments	Treatment Accomplishment	Approximate Acres
2	Thin	Pile and Burn and/or Lop and Scatter	Hand Crews	36
3	Thin	Pile and Burn and/or Lop and Scatter	Hand Crews	132
4	Thin	Pile and Burn and/or Lop and Scatter	Hand Crews	228
5	Thin	Pile and Burn and/or Lop and Scatter and/or chip or masticate	Hand Crews and/or Mechanized	76
6	Aspen Enhancement	Lop and Scatter	Hand Crews	790 **
7	Thin	Pile and Burn and/or Lop and Scatter	Hand Crews	77
8	Thin	Pile and Burn and/or Lop and Scatter and/or chip or masticate	Hand Crews and/or Mechanized	146
9	Thin	Pile and Burn and/or Lop and Scatter	Hand Crews	26
10	Thin	Pile and Burn and/or Lop and Scatter and/or chip or masticate	Hand Crews and/or Mechanized	216
11	Thin	Pile and Burn and/or Lop and Scatter and/or chip or masticate	Hand Crews and/or Mechanized	44
12	Thin	Pile and Burn and/or Lop and Scatter	Hand Crews	39
13	Thin	Pile and Burn and/or Lop and Scatter and/or chip or masticate	Hand Crews and/or Mechanized	421
14	Thin	Pile and Burn and/or Lop and Scatter	Hand Crews	38
15	Thin	Pile and Burn and/or Lop and Scatter	Hand Crews	109
16	Thin	Pile and Burn and/or Lop and Scatter and/or chip or masticate	Hand Crews and/or Mechanized	231
17	Thin	Pile and Burn and/or Lop and Scatter and/or chip or masticate	Hand Crews and/or Mechanized	399
18	Broadcast Prescribed Fire	(Areas thinned prior to broadcast burn could be piled and burned)	Hand Crews	253
19	Thin	Pile and Burn and/or Lop and Scatter	Hand Crews	113
20	Thin	Pile and Burn and/or Lop and Scatter and/or chip or masticate	Hand Crews and/or Mechanized	41
21	Thin	Pile and Burn and/or Lop and Scatter	Hand Crews	967
22	Thin	Pile and Burn and/or Lop and Scatter	Hand Crews	33
23	Thin	Pile and Burn and/or Lop and Scatter	Hand Crews	40
24	Thin	Pile and Burn and/or Lop and Scatter and/or chip or masticate	Hand Crews and/or Mechanized	505
25	Thin	Pile and Burn and/or Lop and Scatter and/or chip or masticate	Hand Crews and/or Mechanized	402
26	Thin	Pile and Burn and/or Lop and Scatter	Hand Crews	19
Total Estimated Acres = 5,381 ****** An estimated 210 net acres would be treated within this unit.				

Map 2. Alternative 2 - Proposed Action.



Project Design

In response to public comments and collaboration on the proposal and from analysis by the Forest Service, project design features were developed to minimize the potential impacts the action alternative may cause. Experience has shown these project design features to be effective in other projects. If an action alternative is selected, the following measures would be included in project design and implementation.

Soil, Hydrology, Fisheries

Mechanized Treatment Units

- A no treatment buffer of 100 feet, or to the edge of riparian vegetation, whichever is greater, would be established around perennial and intermittent streams.

- For ephemeral streams, equipment would be excluded from the stream channel, except to cross at designated points.

- Wetlands, fens, and wet meadows may occur within or adjacent to treatment units. These features may not be mapped and may only be discovered during unit layout. A no treatment buffer of 100 feet or to the edge of riparian vegetation, whichever is greater, shall be established around the wetland, fen or wet meadow.

- Mechanized treatment would be completed by a tracked masticator or chipper. The material would be chipped or masticated and left on site. No slash piles would be created where mastication or chipping occurs.

- No ground-based mechanized equipment would be operated on slopes greater than 40%.

- Operate heavy equipment only when soil moisture is below the plastic limit, or protected by at least one foot of packed snow or two inches of frozen soil. Soil moisture exceeds the plastic limit if the soil can be rolled into three millimeter threads without breaking or crumbling.

- Retain effective ground cover (live and dead plant cover and woody material) according to the appropriate slope gradient ranges in a unit as follows:

Slope Gradient Range	Thinning
	(% ground cover to retain)
0-15%	30
15-25%	30
25-40%	40
40-75%	No mechanized treatment
>75%	No mechanized treatment

Manual Treatment Units

- Tree cutting can occur to the edge of the stream bank for perennial, intermittent and ephemeral streams. No riparian vegetation will be cut.

- Wetlands, fens, and wet meadows may occur within or adjacent to treatment units. These features may not be mapped and may only be discovered during unit layout. No tree cutting would occur within wetlands, fens or wet meadows.

- Burn piles would be located at least 50 feet from perennial streams (unless thinning occurs in Preble's habitat; see design criteria for Wildlife), wetlands, fens, and wet meadows. Ditches and canal outflow channels are considered perennial streams if they carry water outside of runoff season or storm events and/or they support riparian vegetation.

- Burn piles would be located 50 feet or outside the inner gorge, whichever is less, for intermittent and ephemeral streams.

- Lopped and scattered slash created from treatment activities would be removed from the stream channel of perennial, intermittent and ephemeral streams.

- During winter operations, maintain roads as needed to keep the road surface drained during thaws and break-ups. Perform snow removal in such a manner that protects the road and other adjacent resources. Do not use riparian areas, wetlands or streams for snow storage or disposal. Remove snow berms where they result in accumulation or concentration of snowmelt runoff on the road or erodible fill slopes. Install snow berms where such placement will preclude concentration of snowmelt runoff and will serve to rapidly dissipate melt water.

- Retain effective ground cover to prevent accelerated on-site soil loss and sediment delivery to streams according to the appropriate slope gradient ranges in a unit as follows:

Slope Gradient Range	Thinning
	(% ground cover to retain)
0-15%	30
15-25%	30
25-40%	40
40-60%	50
>60%	No treatment over 60%

- Restore ground cover, if necessary, using certified native plants as practicable to meet re-vegetation objectives. Avoid persistent or invasive exotic plants.

- Where chipping or masticated materials are planned, depth should not exceed three inches for chips or 6-12 inches for chunks, and neither should cover more than 40% of an area for any given acre.

Prescribed Fire Unit and Pile Burning

- Rehabilitate constructed fire lines by installing water bars, raking topsoil back over the line, covering with slash or other mulch materials, or seeding, if recommended by the botanist, to help prevent weed/non-native invasion.

- Conduct prescribed fire and pile burns to minimize the residence time on the soil while meeting the burn objectives. This is usually done when the soil and duff are moist (not wet).

- Schedule burning when the soil moisture conditions will minimize heat conductivity into the soils.

- Where pile burning of slash is planned, it is critical to burn under conditions where complete consumption of organic materials is not expected.

Scenery

- Landscape Architect would be involved in review of the layout of Units 7, 8, 10, 14, 15, 22, 24, 25 and 26.

- Flush cut stumps to a maximum height of six inches at the highest point. Where objects (such as rocks) may prevent flush-cutting, the stem would be cut as close as safely possible to the ground.

- Prescribed burning operations shall occur in advance of growing season whenever possible.

Fire, Fuels, Air

- Slash would be piled and burned in all units except for Unit 6; slash in this unit would be lopped and/or scattered.

- Minimum pile size, hand or machine created, shall be no less than eight feet high by eight feet in diameter.

- Maximum conical pile size, hand or machine created, shall be no greater than 20 feet in diameter by 12 feet high.

- Maximum windrow size, hand or machine created, shall be no greater than 100 feet long by six feet high by six feet wide *OR* 35 feet long by 10 feet high by 10 feet wide.

- Existing and/or created slash material up to eight inches in diameter and sound shall be piled (See exception for Preble's mouse habitat in Wildlife section).

- Piles shall be compact and constructed by laying existing and/or created slash material in a manner as to eliminate large air spaces within the piles.

- Piles shall be located at least 35 feet from any private property boundary and at least eight feet from reserve trees.

- In hand piling operations, any created or existing slash that must be moved more than 100 feet to meet minimum required pile size shall be lopped and scattered.

- Lopped and scattered material would not exceed 24 inches in height from the ground.

- Pre-treatment of fuels (limbing, thinning, piling and burning) may occur within the broadcast burn area, prior to ignition, to help ensure fire does not escape the intended boundary.

- Understory mortality of up to 75% would be the target for the burn unit. Overstory mortality of up to 35% would be acceptable but not targeted.

- Suppression action must be taken once fires become 50 acres on north slopes and 150 acres on south slopes within the secondary burn area.

- Obtain a smoke permit from the State of Colorado Air Pollution Control Division prior to doing any prescribed burning, including pile burning.

- Perform burning operations when smoke dispersion is favorable as required by the smoke permit.

- Notify any stakeholders, media, and smoke sensitive individuals prior to burning, by signs and/or phone calls/emails as required by the smoke permit.

Heritage

- A Class II (sample) Cultural Resource Inventory would be completed on all thinning, aspen enhancement, and prescribed burn units, in consultation with the Colorado State Historic Preservation Office (SHPO) prior to project implementation. Implementation would not begin until the SHPO has concurred with a determination of *no historic properties affected* or *no historic properties adversely affected*.

- If specialized tree cutting machinery (not including chainsaws) is used to implement thinning treatments, then all National Register of Historic Places (NRHP) eligible or unevaluated sites within the units proposed for such treatments would be flagged on the ground for avoidance during implementation. No thinning, pile burning, or other slash treatments would occur within these sites, unless determined to be appropriate by the Project Archaeologist.

- All NRHP eligible or unevaluated sites located within prescribed burn units (including the secondary burn area) would be marked on the ground by the Project Archaeologist. The Project Archaeologist and fire staff would design protection measures to remove the sites from the burn's Area of Potential Effects. These protection measures would take into consideration the site type, environmental setting, and anticipated burn conditions. These protections may include, but are not limited to: fuel breaks, no treatment buffers, wrapping, foaming, wetting, black line, fire line (machine or hand dug), and raking.

- All potentially ground-disturbing fire lines and all road improvement, construction or deconstruction, or designated ATV or vehicle routes/ways would be intensively (Class III) surveyed for cultural resources prior to project implementation; any NRHP-eligible cultural resources would be avoided by project design.

- Previously undiscovered sites encountered during the course of project activities would be avoided until they can be evaluated by an archaeologist. If affected properties are discovered after project activities are completed, the Forest would document any damage and consult with SHPO and Council pursuant to 800.13(b).

Recreation

- In the Inventoried Roadless Areas - no roads will be constructed. Hand crews with chainsaws will be used instead of mechanized equipment. Cut trees will be flush-cut as close to the ground as possible (six inches or less of stump remaining above the ground). Where objects (such as rocks) may prevent flush-cutting, the stem should be cut as close as safely possible to the ground.

- Recreation infrastructure components shall be protected from damage from all treatment activities.

- Treatment units that already have off-road impacts and/or the potential for new and increased off-road vehicular use impacts are generally in areas that have a moderate or low slope angle (35% or less), and enough usable terrain to use the vehicle (four-wheel drive or all-terrain vehicle). These areas would be protected from further encroachment of motorized vehicles by creating a buffer zone of no treatment between the road open for motorized travel and the treatment area, or by installing fencing or other barriers. Buffer zones should be wide enough

(minimum 100 feet from edge of road) to discourage attempts at creating new routes. These areas would be identified with input from recreation staff and unit layout personnel prior to final unit boundary designation.

- Treatment units that have direct Forest Service road access for motorized public use could impact fall hunters. Design mitigations include timing project implementation to avoid the fall big game seasons on the weekends and/or posting signs notifying hunters of treatment activities.

- Treatment units that abut designated Wilderness will ensure, through use of GPS units (resource grade accuracy at a minimum) that unit boundaries are not within designated wilderness.

Lands and Minerals

- Hand pile construction would not take place within 100 feet of any utility pole nor within 25 feet of any overhead utility lines. Machine piles shall be 150 feet from utility poles and overhead lines.

- All Public Land Survey System monuments and associated witness trees shall be protected from damage during tree cutting and prescribed fire operations.

Range

- Delineate all improvement locations on treatment area maps and protect them from damage from tree cutting and prescribed fire operations. If damaged, provide funds to repair or replace. As determined by the Range Specialist, fence extensions may be required in areas where dense trees that currently limit livestock movement are removed by treatment.

- Coordinate operations with grazing permittee before the grazing season to make necessary modifications to allotment use.

Botany

- If populations of the federally threatened Colorado butterfly plant or Ute ladies'-tresses orchid are found, protect them from any adverse impacts from project activities. A Forest Service botanist will define exclusions and/or other protection measures, if any are needed in addition to existing project design criteria.

- If yellow lady's-slipper is discovered prior to or during implementation, it will be protected from project impacts. A Forest Service botanist will define excluded areas and/or other measures needed to protect occurrences, if any are discovered.

- Any Forest Service Sensitive species other than yellow lady's-slipper, or other local plant species of concern identified in the botany specialist report, found within treatment units prior to or during implementation, may be flagged and excluded from treatment to remove or reduce adverse impacts to occurrences. If needed, a Forest Service botanist will define this excluded area prior to or during project implementation.

- Based on maps in the Botany Report, exclude from treatment the following areas delineated on the ground by a Forest Service botanist prior to project implementation.
    - Unit 6, small populations of two orchid species – fairy slipper *(Calypso bulbosa)* and yellow coralroot *(Corallorhiza trifida)*
    - Units 8, 11, 12, 21 and 24, areas of Rocky Mountain cinquefoil (*Potentilla rupincola*).
    - Unit 17, two drainages near northeast corner of unit, with moist aspen, rock outcrops, and multiple rare plant occurrences, and north-south riparian habitat near center of unit
    - Unit 19, area with two fairy slipper orchid *(Calypso bulbosa)* populations in northern part of unit
    - Unit 25, Colorado blue spruce *(Picea pungens)* in northern part of unit; wood lily *(Lilium philadelphicum)* and wild sarsaparilla *(Aralia nudicaulis)* in drainage at northeast edge of unit

- In the Unit 18 secondary burn area, because cheatgrass was found in the rare montane grasslands rare plant community occurrence, consult with a Forest Service botanist or botanical representative prior to preparation of a burn plan to determine measures to protect the occurrence.

- If previously undetected seeps or springs are located within a treatment unit, buffer these features and their associated small drainageways by 100 feet from the edge of the feature in mechanized treatment areas, and by 50 feet from the edge of the feature in manual treatment areas. These buffers may be adjusted in consultation with a Forest Service botanist.

- Where riparian vegetation is present adjacent to ephemeral streams, exclude equipment from the riparian areas, except if designated crossings are necessary. Do not cut riparian vegetation if manual treatment will occur in these areas.

- Place burn piles at least 50 feet outside of riparian habitat and at least 50 feet from the edge of seeps, springs, and their associated drainage ways.

- Minimize impacts to aspen stands, including stringers along streams, that are dominated or co-dominated by quaking aspen, by doing the following:
    - No piling and burning in aspen stands
    - No ATV use in aspen stands.
    - No mechanized equipment use in aspen stands.

- Consult a Forest Service botanist for site rehabilitation plantings and seed mixes to maximize use of native plants and minimize the risk of nonnative species invasion. Site rehabilitation may include revegetation and/or mulching, depending on site conditions.

- Consult with a Forest Service botanist regarding seed testing if revegetation will occur.

- Comply with Forest Service Rocky Mountain Region Order NO. 02-2005-01 requiring use of certified weed-free hay, straw, or mulch in all Forest Service activities

- To minimize risk of noxious weed introduction and spread, require all equipment used off road for this project (not including service trucks or other vehicles that remain on roadways) to be clean, i.e., free of mud, dirt, plant parts, seeds, or other debris that could contain or hold seeds, prior to entering the project area. Equipment will be considered free of soil and other debris when a visual inspection does not disclose such material. Disassembly of equipment components or specialized tools is not required.

- Avoid and/or treat known noxious weed infestations, based on occurrence information found in the Botany Report, GPS locations from botany surveys, and consultation with the District weed coordinator. If additional infestations are found prior to or during implementation work, avoid and/or treat in consultation with District weed coordinator.

- Inspect project areas at highest risk for noxious weed infestation and/or spread at least once during the first three growing seasons after ground-disturbing operations, and determine treatment and further monitoring needs based on the results.

Wildlife

- Leave all existing snags greater than six inches DBH within thinning units that do not pose a safety hazard as determined by the Contract Administrator or Contractor.
- In prescribed burn Unit 18, minimize loss of existing larger snags (e.g. 12 inches and greater DBH) and minimize overstory aspen mortality.

- In units where slash is piled, leave two piles per acre for wildlife.
- Retain a minimum of 50 linear feet per acre of downed woody material, distributed randomly across an acre at a minimum diameter of five inches or greater. If five inch material is not available, leave the largest diameter possible. Length of the material should be 8 feet or greater.
- For portions of Units 9, 12, 13, 15, 16, 21, and 22 along perennial and intermittent stream channels identified by the wildlife biologist that may provide potential Preble's mouse habitat, only chainsaw thinning would be allowed within 100 meters (328 feet) of each side of the stream, and tracked or wheeled machinery would not be allowed within this 100-meter (328 feet) buffer.
- For these same portions of Units 9, 12, 13, 15, 16, 21, and 22, burn piles would not be located within 100 feet of the edge of the riparian zone, and burn piles within the 100-meter Preble's habitat zone would be burned only from November 1 through April 30.
- Within 100 feet of riparian vegetation along the above-identified stream channels, retain all existing downed woody material with a minimum of five inches or greater diameter. New slash from the thinning may be piled, burned, lopped, and/or scattered.
- As identified by the wildlife biologist, remove smaller diameter conifers up to 14 inches DBH to maintain and enhance meadow areas and aspen stands. Englemann and blue spruce trees up to 10 inches DBH may be cut.
- During December 1 through March 31, unit treatment activities may occur in only one of the following groups of units at any one time (i.e. work cannot occur in two groups simultaneously) in order to reduce potential disturbance to wintering elk and deer in the project area. If treatment activities are completed within a group during this time period, work may then occur in another group. Waiver or modification of this project design criterion may be allowed after consultation with the wildlife biologist.
    - Group 1 – Units 2, 3, 4, 5, 6, and 17
    - Group 2 – Units 14, 15, 16, 18, 19, 20, 21, 23, and 24
    - Group 3 – 7, 8, 9, 10, 11, 12, 13, 25, and 26
- If raptor nesting activity (e.g. nesting behavior, nest sites, or fledglings) is detected within treatment units or areas potentially impacted by proposed project activities prior to or during implementation, a Forest Service wildlife biologist would be contacted as soon as possible to ensure Forest Plan guidelines for raptor protection are met.
- If a federally listed or Forest Service sensitive wildlife species is identified within treatment units or areas potentially impacted by proposed project activities prior to or during implementation, a Forest Service wildlife biologist will be contacted as soon as possible to ensure Forest Plan guidelines are met.

Monitoring

Soil Resource

Monitor implementation and effectiveness of design criteria by visiting the project area at least once a year during implementation.

A Forest Service soil scientist would monitor post-treatment areas to ensure Forest Plan Standard 19 that states: “Manage land treatments to limit the sum of severely burned and detrimentally compacted, puddled, and displaced land to no more than 15 percent of any land unit” would be met. Monitoring to determine areas of detrimental disturbance may be conducted by transecting and making observations within representative units or by more rigorous methods outlined in *Guidelines for Sampling Some Physical Conditions of Surface Soils (Howes, 1983).* The recommended timeframe for initial monitoring is after fuels treatments are complete but prior to contract close-out to determine if rehabilitation needs are necessary.

Also monitor treatment units two years following treatment for compliance with soil quality standards. Detrimental soil impacts occur when minimum effective ground cover or organic matter requirements are not met, soil porosity decreases by more than 10 percent, soil is displaced by more than one meter, or if soil is severely burned.

Air Resource

Take photographs of the smoke column during burning operations to verify smoke dispersion, if necessary.

Check the receptors for smoke pooling near those areas, if necessary.

CHAPTER 3 ENVIRONMENTAL CONSEQUENCES

This section discloses the physical, biological, and social environments of the affected project area and the potential changes to those environments due to implementation of the alternatives.

Physical

Soil, Hydrology and Fisheries

Affected Environment

The project area is located in Larimer County, Colorado and includes portions of five different watersheds (see Table 1), with the majority of the project located in three of the five watersheds.

Table 1. Watersheds within Glen Haven Project Area

Watershed (WS) Name	WS-HUC6* Number	WS ACRES	Acres within Project Area	% of WS to be treated	% of Project area in WS
Big Thompson River-Glacier Creek to North Fork	101900060218	31,819	1,356	4	25
Devils Gulch	101900060402	15,774	1,091	7	20
Headwaters North Fork Big Thompson River	101900060404	16,431	173	1	3
Miller Fork	101900060408	8,937	390	4	7
North Fork Big Thompson River-Devils Gulch to Mouth	101900060410	13,365	2,370	18	44

*HUC6 number is the watersheds Hydrologic Unit Code, 6th level. The HUC system is used nationally to code watersheds from largest to smallest.

The project area includes private and State owned property interspersed throughout National Forest lands that are covered in many areas with dense vegetation overlaying steep and mountainous terrain. Rocks identified from surveys during the 2008 field season include granitic rocks, schist, biotitic gneiss, migmatite, and felsic and hornblendic gneisses. Of these, granitic rocks and schist are least resistant to weathering and are considered subject to erosion.

Topography within the project boundary ranges from floodplains to canyons and rocklands. Overall the terrain in the Glen Haven vicinity is steep; however, mapping inventories indicate an estimated 24% of the 5,380 acres proposed for treatments have slopes over 40%. Specific project design measures, such as limiting equipment operation to slopes of 40% or less, would be prescribed to minimize impacts from management activities (see Chapter 2, Project Design for the complete list).

Watersheds
Between 14 and 85 percent of the individual project area watersheds are non-National Forest lands (see Table 2). Non-National Forest lands include private as well as National Park lands. Private lands are generally more highly developed than National Forest System or National Park lands (i.e. residential and commercial developments, and agricultural use). The Forest Service has considerably less information on specific land use and watershed conditions for private lands than on adjacent Forest Service lands. Road densities resulting from residential and commercial developments on private lands are generally higher than on NFS lands. Expansion of these impervious structures (roads, driveways, etc.) increases erosion due to an increase in both the rate and volume of precipitate runoff. Unpaved roads and heavily compacted areas (i.e. livestock dominated areas and hiking trails) are also a source of erosion.

A Watershed Condition Assessment was conducted for the 1997 Forest Plan Revision to examine watershed sensitivity and disturbances along with stream channel conditions. The watersheds were rated either Class I--Functional, Class 2--At-Risk, or Class III--Non-functional. Within the project area, the two composite Big Thompson watersheds were classified as Class II—At-risk. This classification is due primarily to a relatively high percentage of roads and buildings on private land. The other watersheds were all rated Class I—Functional.

Table 2. Watershed ownership and watershed condition class

Watershed (WS) Name	WS HUC6 #	WS Acres	Percent Non-Forest Service	Watershed Condition Class*
Big Thompson River-Glacier Creek To North Fork	101900060218	31,819	65%	2
Devil's Gulch	101900060402	15,774	85%	1
Headwaters North Fork Big Thompson River	101900060404	16,431	64%	1
Miller Fork	101900060408	8,937	14%	1
North Fork Big Thompson River-Devils Gulch To Mouth	101900060410	13,365	31%	2

*from the 1997 Forest Plan—based on the 1997 Forest Plan watershed layer

Water Quality
The State of Colorado Water Quality Control Commission has designated the streams within the analysis area as Cold Water Aquatic Life Class 1, Recreation Class 1, Agriculture, and Domestic Water Supply. This indicates that the waters should be: capable of sustaining a wide variety of cold-water biota, including sensitive biota; suitable for direct contact recreational activities; suitable for direct agricultural irrigation; and, suitable for potable water supplies following standard treatment (Colorado DPHE, 2006). No streams within or adjacent to the project area are listed on the State 303(d) or Monitoring and Evaluation lists as impaired streams.

Hydrology
Stream flow patterns in the project area are typical of those found in snow-dominated watersheds along the Front Range of Colorado. The annual average precipitation in the Glen Haven area is approximately 15 inches with July being the wettest month of the year. Hydrologic stream flow increases in April or May as snow begins to melt. Peak flows typically occur in May or June at the higher elevation ranges in the project area. Flow declines through the summer and fall. Low, stable base flow occurs through late fall and winter, until snow begins to melt again the following spring. Throughout the project area, stream channels are predominantly pool-riffle with some low gradient, meandering, depositional channels in wetlands and meadows. Riparian wetlands and isolated forested wetlands were identified throughout the project area.

In the past, minor amounts of vegetation management have occurred in different portions of the project area watersheds. The most persistent impact to Forest Service lands from management is from road drainage and sedimentation accumulating at stream crossings. However, much of the project area is inaccessible by roads.

Aquatic Ecosystems
Aquatic ecosystems are subjected to varying levels of hydrologic flow and sediment fluxes, depending on the type of disturbance that occurs and vegetation within the area. Aquatic ecosystems in ponderosa pine historically have been subjected to infrequent, but intense floods and high sediment delivery yields following wildfire. Wildfire in ponderosa pine ecosystems typically burn at low or moderate severity. High severity fires increase hydrologic flow, leading to more erosion and sediment flow than with low and moderate severity fires. Where fire suppression has allowed ponderosa pine stands to become denser, fires may result in stand replacing burns. Human uses such as roads, human habitation, and recreation have introduced sources of chronic, lower level watershed disturbance and sedimentation into portions of the project area.

The Glen Haven Project area has several perennial streams within its boundary, including West Creek, Fox Creek, North Fork Big Thompson and the Big Thompson River. West Creek was surveyed for stream health and aquatic species presence/absence during the 2008 field season. Based on the data collected in 2008, the parameters considered for stream health (bank stability, pool frequency, and width/depth ratio) are all within the accepted range for streams in this area.

During the 2008 survey of West Creek, brown and rainbow trout were found. There is a small population of greenback cutthroat trout upstream in West Creek within Rocky Mountain National Park but no cutthroat were found in the project area.

Soils
Units proposed for treatment are 14% of the total acreage in the project boundary (37,500 acres) or 5,350 acres and are most easily classified for soils into three separate slope gradient categories (0-40%, 40-60%, and those greater than 60%), identified using ARCMAP and a digital elevation model (DEM).

Table 3. Acres displayed by DEM slope breaks determined using ARC GIS

ARCMAP GIS Slope Separation Using DEM					**Grand Total**
Slope Gradient Breaks		DEM Slope 0-40%	DEM Slope 40-60%	DEM Slope > 60%	
Grand Total		4084	1081	185	5350
% of Total		76%	20%	3%	

Soils with a gradient range less than 40% tend to be more subject to compaction, generally because of their ability to hold water and accessibility by wildlife, humans, or machinery. Within the category of 0-40% slopes, are soils on lower gradients (less than 25%) which have a deep soil profile (>100cm) and the presence of clays. These soils are especially susceptible to compaction, especially when exposed to precipitation, either in the form of rain or snow.

Soils more susceptible to erosion are those with slope gradients over 40%. Mitigations are included in this report to reduce erosion potential on these slopes. These soils are primarily residuum based (formed in-place) or are colluvium derived (movement related) soils. Common to each of the steeper slopes, are a moderate to high runoff potential.

Soil erosion is not expected from rock outcrops and rocklands or from referenced soil series unless valley bottom areas are flooded during an extreme precipitive event (i.e. 100 year flood). The majority of areas observed and walked during field visits in 2008 (without impacts from wildfire) all had stable soils with ground cover and vegetation sufficient to prevent erosion.

Alternative 1 – No Action
Direct and Indirect Effects

No efforts through Forest Service managed activities to reduce hazardous fuels would occur with Alternative 1. Selection of this alternative could have both beneficial and adverse consequences for watershed resources. The main benefit of the No Action Alternative is avoidance of any impacts expected from management activities proposed in Alternative 2. Adverse effects to watersheds include risks associated with not minimizing fuels that could increase the chances of severe wildfire.

Impacts to water quality following wildfire (both directly and indirectly related to soil quality) include compaction, puddling, and displacement, or erosion of surface soils when soil stabilizing roots are removed (as in high intensity and high severity wildfires).

Incidental compaction and puddling are expected when wildfire travels through an area. Impacts could include compaction via debris flows from steep areas (>45%) (predicted to occur 5-15 years following wildfire (Holden and Hoffman 2005)), and from anthropogenic attempts to remove or manage debris. Puddling is expected to occur in the

form of hydrophobicity following a wildfire when temperatures to soils exceed 176 degrees Celsius, or from displaced materials.

Displacement is expected following a wildfire with subsequent effects possible to fisheries, hydrology and soils (e.g., reduced water holding capacity of soil via hydrophobicity; considerable or complete loss of ground cover; increased runoff due to an increased amount of exposed surfaces (with loss of soil stabilizing root structures and death of soil microorganisms that contribute toward soil aggregation); and eroding sediment traveling to streams or along roads. Duration of displaced materials is expected to be permanent, unless relocated with equipment. Soil mixing is expected which will lower soil productivity. Organics and microorganisms eliminated by wildfire in an area are expected to return within five years.

Organic matter is expected to be reduced during and following wildfire. Fire intensity to surface soils exceeding 176 degrees Celsius is expected when a wildfire occurs because of resins and volatile oils contained in many drought tolerant plants (e.g. juniper, ponderosa pine, and lodgepole pine), especially if burned during drought conditions. Effects, highly correlated to burn severity, include short-term to long-term loss of ground cover (duff, litter, coarse wood, herbaceous plants, and desiccation of root systems), and canopy cover (herbaceous plants, shrubs, and trees). Additionally, organisms crucial for the nutrient cycling process and re-establishment of shallow rooted vegetation in disturbed areas are expected to be temporarily removed by soil displacement or from death, when soil temperatures reach between 50 to 121 degrees Celsius. Combustion will occur to both organisms and vegetation when soil temperatures reach between 220 and 460 degrees Celsius. If soil temperatures exceed 460 degrees Celsius, other impacts will include chemical and nutrient changes (both additions and deletions).

The length of time needed for recovery from impacts listed above would depend upon the fire intensity, remaining mosaic live vegetation pattern, area burned, residual post-fire surface soil organic matter, soil erosion, and the length of time needed for ground cover reestablishment. Research suggests a period of at least 20 years is needed for recovery when soils are sterilized by extreme temperatures (>460 degrees Celsius). Erosion following a wildfire is 10 times greater than typically occurs on untreated soils (Odion and Davis 2000).

Without wildfire, existing trends toward both recovery and degradation on the landscape would continue, resulting from current use and natural conditions. Under this scenario, organic matter would continue to accumulate on the landscape. Due to low precipitation in the area (long periods between precipitation events), decomposition of organic materials will be slow. Soil productivity is not expected to be reduced where canopy cover is present and decomposing organic matter exists. Direct and indirect impacts to fisheries, hydrology, and soil resources are expected to be less than Alternative 2.

Cumulative Effects

Effects to hydrology, fish and soils initiated naturally by grazing livestock and recreational use (including travel on existing roads and trails) would continue. Streams

within the project area would continue to receive sediment loading of fine material from substrate generated by human and livestock travel from project area roads. Aquatic habitat and fish populations within the project area would continue to remain relatively stable. Self sustaining populations of management indicator species (brook and brown trout) would persist in areas where they currently exist.

Except for roads, watersheds have largely recovered from past management activities. Tree mortality (primarily from insect infestation) within the immediate and foreseeable future (1-15 years) is expected to increase in the project area, and will subsequently increase the probability for high intensity and high severity crown wildfire(s). Adverse impacts from wildfires as stated above can be expected for fisheries, hydrology, and soil resources.

Alternative 2 – Proposed Action
Direct and Indirect Effects

Fish, hydrology and soil resource concerns with respect to wetlands and riparian areas are primarily based on potential impacts from management activities. This includes the potential for sediment eroding into streams and lakes (thus disrupting the aquatic environment), and compaction of wet soils with subsequent impacts possible to the hydrologic flow regime. Areas of particular concern exist along and immediately outside of perennial and intermittent drainages. Changes to aquatic habitat and area fisheries, hydrology and soils would be expected to be negligible with application of Watershed Conservation practices and design criteria recommended for watershed protection. Brook and brown trout populations are expected to remain stable with the implementation of Alternative 2.

Under Alternative 2, fuels reduction would be accomplished on 5,380 acres. The proposed treatments include thinning, pile burning, and prescribed fire. The main access to the proposed units would be from existing roads and trails. The following tables show how the fuels treatment areas would be distributed across the project area watersheds, and where the treatment types and steeper slopes are by unit.

Table 4. Alternative 2 Proposed Treatments by Watershed

HUC_NAME	HUC6	HUC ACRES	Acres Recommended for Treatment	Percent of watershed being treated
Big Thompson River-Glacier Creek To North Fork	101900060218	31,819	1,356	4
West Creek	101900060402	15,774	1,091	7
Headwaters North Fork Big Thompson River	101900060404	16,431	173	1
Miller Fork	101900060408	8,937	390	4
North Fork Big Thompson River-Devils Gulch To Mouth	101900060410	13,365	2,370	18
			5,380	4

Table 5. Alternative 2 Proposed Units and Recommended Treatments Using Slope Breaks Determined Through ARCMAP Identification of Digital Elevation Map

		ARCMAP GIS Slope Separation Using DEM				
Slope Gradient Breaks	**Treatment * H M P**	DEM Slope 0-40%	DEM Slope 40-60%	DEM Slope > 60%	**Grand Total**	**% of Total**
Unit #						
2	H	30	6		**36**	1%
3	H	117	14	0.06	**131**	2%
4	H	200	27		**227**	4%
5	HM	57	18	0.77	**76**	1%
6	H	662	117	9.78	**789**	15%
7	H	47	29	1.08	**77**	1%
8	HM	82	24	18.00	**124**	2%
9	H	13	8	4.00	**25**	0%
10	HM	107	93	16.00	**216**	4%
11	HM	28	15	0.80	**44**	1%
12	H	26	10	3.00	**39**	1%
13	HM	324	81	15.00	**420**	8%
14	H	33	4	0.41	**37**	1%
15	H	95	12	1.52	**109**	2%
16	HM	172	55	4.00	**231**	4%
17	HM	347	49	2.35	**398**	7%
18	H P	218	34	1.13	**253**	5%
19	H	86	24	2.89	**113**	2%
20	HM	33	8		**41**	1%
21	H	714	210	42.00	**966**	18%
22	H	22	6	5.00	**33**	1%
23	H	25	14	0.87	**40**	1%
24	HM	347	111	47.00	**505**	9%
25	HM	285	108	9.00	**402**	8%
26	H	14	3.5	0.81	**18**	0%
Grand Total		**4084**	**1081**	**185**	**5350**	100%
% of Total		76%	20%	3%	1	

* (H) Hand thin, (M) Mechanical thin, (P) Prescribed burn

Vegetation management in the form of thinning has the potential to impact streams and aquatic habitats. Potential adverse impacts include increases in erosion and sedimentation, compaction, and vegetation loss in and near wetlands and riparian areas. Typically it is not tree cutting that directly produces the adverse impacts, but rather burn piles necessary to treat the slash as well as mechanized equipment if used for treatment.

Units with slope gradients less than 40% may be treated with mechanized equipment, such as tracked masticators, chippers, or tree shears. Mechanical vegetation management

can increase soil compaction and ground disturbance, and increase the risk of erosion and sedimentation. Under normal conditions on-site impacts to soils are more likely to occur than to streams because most units are located on upland sites away from stream channels. Thinning activities resulting from mechanized equipment would not be expected to have a measurable effect to streams, wetlands, or riparian areas with implementation of recommended design criteria. Monitoring will be used to ensure the appropriate implementation and effectiveness of conservation measures.

Hand treatment units are proposed on all areas with slope gradients between 40-60%, in addition to some areas with gradients less than 60%. Hand treatment units should have minimal watershed impacts because foot traffic typically does not create sufficient ground disturbance to create the adverse impacts described above. No treatments are proposed on areas with slope gradients greater than 60%.

For Unit 6, the proposed treatment is aspen enhancement. Conifer trees would be cut by hand crews with chainsaws and the limbs of the cut trees would be scattered. Because there is not a continuous conifer tree cover, the amount of slash would be minimal and there would be no need to pile and burn this material. Effects to the soil resource from this type of treatment would be negligible.

No new permanent or temporary roads or skid trails are proposed for this project. Access to the project area would be from existing roads and trails causing a short term increase in motorized traffic during project implementation. No increased soil and water impacts are expected from this use; however, protection measures for unintended impacts created during implementation are included in the design criteria.

Pile burning is proposed to treat heavy accumulations of slash. Established piles are generally burned in the winter after slash has lost most of its moisture content. Burning piles can remove ground cover and create bare soil patches if all organics are reduced to ash. Burn piles typically result in a mosaic pattern, which acts as a buffer, with burned patches separated from unburned areas making it unlikely that erosion from burn piles would reach stream channels. With specific protection measures provided in the design criteria, burn piles are not expected to adversely impact stream channels.

Where broadcast prescribed fire is proposed (Unit 18), vegetative recovery is expected to be rapid, with erosion rates typically dropping to pre-fire levels within one to two years. Hydrologic recovery after fuel treatments also tends to be more rapid than after wildfire or where high severity fires occur because a smaller proportion of the forest canopy would be removed (Robichaud et al., 2006). By using project design features prescribed in Chapter 2, no significant impacts to the soil and water resource are expected.

Cumulative Effects

Cumulative watershed effects include past and present vegetation management (timber harvest, fuels treatment, and prescribed fire), and concern for erosion from roads resulting from increased travel as a result of proposed treatments. Treatments proposed

in this project would be expected to reduce fire severity and intensity created by wildfire, thereby potentially reducing adverse impacts to the watersheds.

However, climate change predictions suggest an increase in wildfires within the next 25 years. The prediction is based on modeling that forecasts increased temperatures and lower precipitation that will come in more extreme events. Cumulatively under both Alternatives 1 and 2, if predictions are accurate, this could result in:

- a decrease in groundwater levels, and base flow in streams and rivers over the long-term,
- riparian habitats (fisheries, wildlife, and wetlands) being altered or removed,
- higher evapotranspiration rates in months with increased heat and precipitation,
- a drop in soil moisture levels,
- changes to species that cannot adapt to climate changes (migrating or not surviving),
- invasives, exotics, or type-conversion to grasses (i.e. cheatgrass), and
- soil quality may be altered and productivity may be reduced.

In the absence of wildfire, the cumulative effects to watershed resources from fuels treatment are expected to be largely undetectable. Removing trees would increase hydrologic flow potential as existing vegetation needs for water are reduced. However, because the project area vegetation, including ponderosa pine, is water limited, any water that is made available through thinning would increase supplies for remaining trees and other vegetation and is not expected to increase streamflow.

Tree mortality from mountain pine beetle infestation, currently considered in an epidemic state in areas of Colorado, is occurring along the Front Range. Within the next five years it is predicted (Pankratz and Denver Post 2008) that the mountain pine beetle infestation will escalate in Larimer County to an epidemic proportion; therefore, it is reasonable to expect further increases in tree mortality within the Glen Haven Project Area over the next five years. Using custom fire models, Page and Wesley (2007) predict that forests with an epidemic infestation will experience an increased rate of fire spread and have a greater potential for high severity crown fires than those in an endemic infestation. This prediction assumes that dead needles now on trees will fall to the forest floor in the near future and that trees infected by the mountain pine beetle will be drier due to less moisture content. Wildfires occurring under this scenario are expected to generate both high intensity and high severity burn conditions, and are subsequently expected to adversely impact fisheries, hydrology, and soil resources.

Air

Affected Environment

The Glen Haven Project Area falls within the Front Range Airshed. This airshed includes the majority of the Roosevelt National Forest on the Canyon Lakes Ranger District and ranges in elevation from 5,000 to 14,000 feet. The prevailing winds are generally from west to east and southwest to northeast, with a component of diurnal heating that can bring air back upslope in midday. This airshed has existing air quality impacts and the potential for increases due to air pollutants such as sulfur dioxides, nitrogen oxides, ozone, and particulate matter (PM). There are five Air Quality Related Values (AQRVs) identified, within the Front Range Airshed, as having the potential to be impacted by human-caused air pollution. These five AQRVs are soil, water quality, flora, fauna, and visibility. Air pollutants come from many sources including prescribed fires, wildfires, oil and gas development, mining, and motorized use on both paved and unpaved roads.

Particulate matter, or PM, is the term used for particles found in the air, including dust, dirt, soot, smoke, and liquid droplets. Particles can be suspended in the air for long periods of time. Some particles are large or dark enough to be seen as soot or smoke. Others are so small that individually they can only be detected with an electron microscope.

Particulate matter (PM) is the term for particles found in the air, including dust, dirt, soot, smoke, and liquid droplets. Some particles are large or dark enough to be seen as soot or smoke. Others can only be detected with an electron microscope. Particulate matter is classified by size of the particles into two categories: PM10 (less than 10 microns in diameter); and PM 2.5 (less than 2.5 microns in diameter).

Data about pollution is available by County rather than by Airshed, therefore Larimer County is shown in the following table. Larimer County does not collect and record data on PM 2.5, therefore only PM 10 data is shown. Particulate Matter is listed because it is of primary concern to the Environmental Protection Agency and proposed project activities can increase particulates. The County's primary sources of particulate pollutants are construction and road dust. The following table is from the year 2006 and is the most up to date from the Colorado Air Pollution Control Division.

Table 6. Sources of Particulate Matter in Larimer County (2006)

SOURCE	PM10 (tons per year)	PM10 (% of total)
Agriculture	1,172	8.78
Aircraft	5	0.04
Biogenic	0	0
Commercial Cooking	110	0.82

Construction	6,462	48.44
Forest and Prescribed Fire	104	0.78
Fuel Combustion	2	0.02
Highway Vehicles	122	0.91
Non-Road	165	1.24
O&G area	1	0.01
Railroads	2	0.01
Road Dust	3,731	27.97
Solvent Utilization	0	0
Stationary Sources	1,055	7.91
Structure Fires	3	0.02
Surface Coating	0	0
Wood burning	407	3.05
TOTAL	**13,341**	**100**

The National Ambient Air Quality Standards (NAAQS), in any 24-hour period, for PM2.5 is 35 micrograms per cubic meter ($\mu g/m^3$) and PM10 is 150 $\mu g/m^3$. The visibility standard range, under the Ambient Air Quality Standards for the State of Colorado, is 32 miles. These two parameters are used by the Air Pollution Control Division (APCD) to determine the permitting of prescribed fires in the state. If these parameters are exceeded, the APCD would not grant permission to prescribe burn on a given day. Planned Forest Service broadcast burning projects in Larimer County over the next five years may contribute up to an estimated 2,648.6 tons of PM10 in the next five years. However, on average the Forest Service may add up to an estimated 529.7 tons of PM10 in any given year, or about 4.2% of the County's annual total.

Table 7. Total Estimated Maximum Particulate Matter Release from Planned Broadcast Prescribed Fire on the Canyon Lakes Ranger District over the Next Five Years Within the Front Range Airshed

Project Proposal	PM10 Max. tons per year	PM2.5 Max. tons per year
Cache la Poudre (north slopes – aerial ignition)	119.2	100.7
Cache la Poudre (south slopes – aerial ignition)	60.4	51.2
Cache la Poudre (hand ignition)	7.9	6.7
Sheep Creek 2 (hand ignition)	*144.4*[1]	*122.4*
Sheep Creek 2 (aerial ignition)	*641*[1]	*543*
Pawnee	*1.0*[1]	*0.9*
Pingree Hill	*200.8*[1]	*170.2*

Estes Valley	*28.9*[(1)]	*24.5*
Stringtown West	*2.3*[(1)]	*1.9*
Lonetree	*75.9*[(1)]	*64.3*
Red Feather	*1,366.8*[(1)]	*1,157.9*
TOTAL Maximum	**2,648.6 tons**[(2)]	**2,243.7 tons**[(2)]

Notes:

1. Numbers shown in italics are estimates biased toward showing the maximum emissions possible in one year. Numbers not in italics are taken from approved smoke permit applications.
2. The total maximum tons, shows how much emissions would be produced if all acres across all the projects were burned in one year. However, it is virtually impossible to burn all the above projects in any one year. Actual emissions would depend heavily on the number of acres burned for each project per year. Given uncertainty about timing of burns, this estimate should be used for any one year between 2009 and 2014.

The APCD no longer requires the Forest Service to run smoke models for any prescribed burn projects, including pile burns. For any proposed prescribed burn project, the Forest Service is required to give APCD some general information regarding the burn including the location of the burn, proposed burn date(s), distance (in miles) to the closest occupied residence, smoke sensitive receptors (including nearest community, subdivision, and Class I airsheds within 25 miles of the proposed burn), and minimum elevation of the burn. Additional information is needed for broadcast burns including brief description of the fuels, fuel category (meaning the potential to create smoke impacts), dominant fuel model, ignition method (hand vs. aerial), site fuel load, and method used to estimate the fuel loading. For pile burning, the following additional information is needed, 1000 hour fuels as a percent of the volume, brief description of the fuels, average cubic foot volume of the piles, pile dimensions, and construction method. The number of piles allowed to be burned depends on the average size of the piles and distance from an occupied residence. Broadcast burning acreage allowed depends on the smoke fuel category and distance to an occupied residence.

The Front Range Airshed is primarily within an attainment or maintenance area. The Fort Collins urban area is in attainment/maintenance for carbon monoxide and in non-attainment for 8-hour ozone. The communities of Glen Haven and Estes Park, Rocky Mountain National Park (Class I Airshed), Highway 34, and all other residences within and adjacent to the project area are considered smoke receptors or have smoke concerns.

Alternative 1 – No Action
Direct and Indirect Effects

Under the No Action Alternative, no prescribed fire or mechanical treatments would take place within the project area to increase the amount of particulate matter. There would still be dust created from motorized use on existing roads and smoke created from wildfires and from prescribed fire on non-federal land.

There will continue to be vehicles traveling along the paved and unpaved roadways which will also continue to contribute to the particulate matter for the Front Range Airshed.

Alternative 2 – Proposed Action
Direct and Indirect Effects

The direct and indirect effects of the proposed action on air quality would be an increase in dust from thinning operations performed within the units. If not masticated or chipped, the slash from all cutting units would be piled and burned, also affecting the air quality. The APCD has limited the size of the piles that can be burned at any one time. The APCD used the Smoke Impact Spreadsheet (SIS) to generate the emission production for different sized piles ranging from less than 300 cubic feet to 10,000 cubic feet. More piles can be burned if they are smaller in size. The larger the piles, the more restrictive the APCD is regarding number of piles burned in a day. All pile burning activities would follow these regulations; therefore, air quality standards would not be exceeded.

Using the SIS model, the APCD also regulates the number of acres of broadcast burning allowed in any given day. By following the guidelines set forth by the APCD, the Forest Service would not exceed air quality standards for broadcast burning.

Cumulative Effects of No Action and Proposed Action

Other fuel reduction projects with prescribed fire components are being implemented on National Forest land within the Front Range Airshed (see Table 7). These projects would contribute to the total particulate matter for Larimer County but would not exceed the NAAQS. Fuel reduction activities, including pile burning, would continue to occur on private land in the vicinity of the Glen Haven Project Area. Contributions from these additional projects would be considered by the State APCD when issuing smoke permits for prescribed burning activities.

There will continue to be vehicles traveling along the paved and unpaved roadways which will also continue to contribute to the particulate matter for the Front Range Airshed.

Fire and Fuels

Affected Environment

The Glen Haven Fuels Reduction Project Area is located north of US Highway 34, south of Larimer County Road 27 and is bordered on the west by Rocky Mountain National Park. It encompasses the Glen Haven community as well as several other subdivisions. Other values at risk within the project area include infrastructure such as utility lines and portions of watersheds that provide municipal drinking water supplies.

Fuel hazard is used as one of the measures for determining potential for extreme wildfire behavior. Factors used to determine fuel hazard are the primary vegetation type (tree species, shrub, grass, etc.), percent canopy cover, and the presence of ladder fuels (see Glossary for definition). These factors are then used to assign a fuel hazard rating of low, moderate, high and very high.

Out of the estimated 29,000 total acres within the Glen Haven Project Area, there are approximately 4,136 acres classified as having a low fuel hazard. Low fuel hazard means that the percent of canopy closure is 0 – 10% and the absence of ladder fuels. Moderate fuel hazard covers approximately 5,948 acres of the project area and is defined by having a canopy closure of 11 – 39% with some ladder fuels. There are approximately 14,966 acres of high fuel hazard, defined as 40 - 69% canopy closure and more ladder fuels than in moderate fuel hazard. There are approximately 4,001 acres of very high fuel hazard, defined as 70+% canopy closure and ladder fuels throughout the entire stand. In general, lodgepole pine stands have a high canopy closure percentage but a low percentage of ladder fuels and therefore do not often have a very high fuel hazard.

The quantity and type of material on the ground (generally called surface fuels) can also contribute to wildfire behavior. Using the Brown's Planar Intersect method (a standardized measuring system) current fuel loading was calculated within the project area using random sampling points. A total of 245 sample points (193 points within units and 52 outside units) were used to calculate the estimated tons per acre throughout the project area. On average, there are approximately 12.35 tons per acre of down woody debris within the units. The amount of down woody debris across the project area varied from zero tons per acre to 92.59 tons per acre.

Wildland fire behavior generally occurs during three weather situations: 1.) "typical" - high fuel moistures; 2.) "intense" - large fuels less than 13% fuel moisture; and 3.) "extreme" - both low fuel moistures and high winds. Ignitions that occur in a stand with ladder fuels and downed woody debris during intense or extreme fire weather are most apt to threaten the private property surrounding the project area.

Forest Service records dating back to 1951 list a total of 365 wildfires in the vicinity of the project area. In 2000, the Bobcat Fire burned over 10,000 acres just to the east of the project area. Most fires have occurred in July, August, and September with 101 occurring in July. Human caused fires have accounted for about 38% of the total number of fires that have occurred.

Creating a condition on the landscape where fire behavior is modified to reduce the threat of a catastrophic wildfire in the direction of the values at risk is the desired condition for the Glen Haven Project Area. Reducing the surface fuel loading and increasing the spacing between tree crowns, or decreasing the canopy closure from 70% or greater to a more manageable 10 to 69%, will modify fire behavior within the project area. By decreasing the canopy closure, the fuel hazard moves from high to low or moderate in those areas across the landscape where treatment occurs.

Currently the stands within the project area are best represented by fuel models consisting of grass (GR), grass-shrub (GS) and timber litter (TL). Moderate load conifer litter (TL3) models the lodgepole pine stands; large downed logs (TL7) models areas with substantial fuel loading, mainly north facing slopes; long needle litter (TL8) models the ponderosa pine stands; and, low load, dry climate grass-shrub models some south-facing slopes. Using the fire modeling program Behave Plus 4.0, surface fire behavior was calculated for each of the above fuel models based on average weather conditions for the area and a one hour response time before suppression operations began.

Table 8. Existing Predicted Fuel Model Fire Behavior

TL3 - Lodgepole

Rate of Spread (ch/hr)	2.1
Flame Length (ft)	1.2
Critical Surface Intensity (Btu/ft/s)	163
Critical Flame Length (ft)	4.7
Fire Size (acres)	0.2
Spotting Distance (miles)	0.2 - 0.3
Scorch Height (ft)	2
Mortality (%)	50 - 75

TL7 - Heavy Fuel Load Areas

Rate of Spread (ch/hr)	3.5
Flame Length (ft)	2.3
Critical Surface Intensity (Btu/ft/s)	163
Critical Flame Length (ft)	4.7
Fire Size (acres)	0.5
Spotting Distance (miles)	0.2 - 0.3
Scorch Height (ft)	8
Mortality (%)	52 - 76

TL8 - Ponderosa

Rate of Spread (ch/hr)	9.1
Flame Length (ft)	4.4
Critical Surface Intensity (Btu/ft/s)	98
Critical Flame Length (ft)	3.7
Fire Size (acres)	3
Spotting Distance (miles)	0.2 - 0.3
Scorch Height (ft)	23
Mortality (%)	73 - 94

GS1 - Southern Exposure

Rate of Spread (ch/hr)	23.7
Flame Length (ft)	4.4
Critical Surface Intensity (Btu/ft/s)	98
Critical Flame Length (ft)	3.7
Fire Size (acres)	21
Spotting Distance (miles)	0.2 - 0.3
Scorch Height (ft)	23
Mortality (%)	75 - 95

The NEXUS program was also used for the stands within the project area to calculate the crown fire potential. This type of model predicts the type of fire, rate of spread, flame length, and amount of wind speed needed to change fire behavior from a surface fire to a crown fire. An elapsed time of one hour was used because it is a realistic time frame for any initial attack ground crews to get to a fire. Table 9 demonstrates the potential for crown fire in the fuel models present in the project area.

The types of fire that may be exhibited are surface, passive, and active crown fires. Surface fires are defined as fires that do not get into the canopy and stay on the surface only. Passive crown fire behavior occurs when individual or small groups of trees ignite, but continuous flame is not maintained in the canopy. Active crown fires are defined when the entire surface/canopy fuel complex becomes involved, but the crowning phase remains dependent on heat from the surface fuels for continued spread. They can be characterized by a solid wall of flame extending from the fuel bed surface through the top of the canopy. Torching index is defined as the wind speed at which crown fire activity

can initiate. If wind speeds are less than the torching index a surface fire is expected. Crowning index is a measurement of the wind speed necessary to sustain an active crown fire.

Table 9. Existing Predicted Crown Fire Behavior with Average Weather Conditions

TL3 - Lodgepole

Type of Fire	surface
Rate of Spread (ch/hr)	2
Flame Length (ft)	1.2
Torching Index (mi/hr)	150.4
Crowning Index (mi/hr)	20.1

TL7 - Heavy Fuel Load Areas

Type of Fire	surface
Rate of Spread (ch/hr)	3.5
Flame Length (ft)	2.3
Torching Index (mi/hr)	60.2
Crowning Index (mi/hr)	20.1

TL8 - Southern Exposure

Type of Fire	passive
Rate of Spread (ch/hr)	25.5
Flame Length (ft)	12.7
Torching Index (mi/hr)	7.3
Crowning Index (mi/hr)	14.2

GS1 - Southern Exposure

Type of Fire	passive
Rate of Spread (ch/hr)	32.2
Flame Length (ft)	11.2
Torching Index (mi/hr)	7.6
Crowning Index (mi/hr)	14.2

Alternative 1 – No Action
Direct and Indirect Effects

Under this alternative, no treatments would take place to reduce hazardous fuels and change potential wildfire behavior. The areas of moderate, high, and very high fuel hazard rating that contain heavy fuel loads and tight canopies, as discussed earlier in this section, could sustain severe wildfire behavior under average summer weather conditions. These areas would show intense wildfire behavior and areas of severe soil heating. The risk to firefighters and public safety would remain the same. Because of a high percentage of private land and other identified values at risk within and adjacent to the project area, direct suppression of wildfires would continue. Fuel hazard would remain unchanged from the current condition or gradually increase across the project area.

Alternative 2 – Proposed Action
Direct and Indirect Effects

The treatments that would occur within the project area would change the predicted fire behavior and moderate the fuel hazard rating in those treated areas. Currently the majority of project area is within the moderate and high fuel hazards. The proposed action includes thinning, aspen enhancement and broadcast burning. Thinning typically removes smaller diameter trees, also known as ladder fuels. The material from the thinning would be piled and burned to help decrease the fire hazard adjacent to private land. Under Alternative 2, an estimated 5,380 acres could be treated by thinning and approximately 250 acres would be treated by broadcast prescribed fire. The following table shows the difference of before and after treatment fire hazard values for the treatment units.

Table 10. Pre and Post Fuel Hazard Ratings

Before Treatment - Units

Fuel Hazard (Acres)			
Low	**Moderate**	**High**	**Very High**
1,114	1,229	2,074	964

After Treatment - Units

Fuel Hazard (Acres)			
Low	**Moderate**	**High**	**Very High**
1,648	2,186	1,424	123

Canopy bulk density is the main driver, along with slope, in determining what type of fire will occur. Canopy bulk density is defined as the oven dry weight of the available canopy fuel per unit of canopy volume, including the spaces between the tree crowns. Available canopy fuel is the part of the canopy that can burn in the flaming front of a crown fire. The foliage and some branch wood, which is less than 0.25 inches in diameter, are considered available canopy fuel. Canopy bulk density is expressed in pounds per cubic foot or kilograms per cubic meter, and can range from zero, where there is no canopy, to about 0.0312 lb/ft^3 (0.5 kg/m^3) in very dense stands. The estimated canopy bulk density for the existing ponderosa pine stands was 0.0070 lb/ft^3 (using the ponderosa pine initial condition) and for the lodgepole pine stands was 0.0104 lb/ft^3 (using the lodgepole pine initial condition). Expected post treatment canopy bulk densities are as follows: 0.0036 lb/ft^3 for the ponderosa pine stands (using ponderosa pine 25 percent of initial basal area) and 0.0017 lb/ft^3 for the lodgepole pine stands (using lodgepole pine 25 percent of initial basal area). These canopy bulk densities were based on a study ("Stereo Photo Guide for Estimating Canopy Fuel Characteristics in Conifer Forests") done by Joe Scott and Elizabeth Reinhardt in ponderosa pine, Douglas-fir, lodgepole pine, and mixed conifer stands in Arizona, Montana, Idaho, and California.

Using the expected changes to the factors that make up the fuel hazard rating after treatment, the Behave Plus 4.0 fuel modeling program was again used to calculate surface fire behavior for each fuel model.

Table 11. Post-Treatment Fire Behavior Modeling

TL1 - Lodgepole

Rate of Spread (ch/hr)	1.1
Flame Length (ft)	0.7
Critical Surface Intensity (Btu/ft/s)	511
Critical Flame Length (ft)	7.9
Fire Size (acres)	0
Spotting Distance (miles)	0.2 - 0.3
Scorch Height (ft)	1
Mortality (%)	50 - 75

TL3 - Lodgepole

Rate of Spread (ch/hr)	2.1
Flame Length (ft)	1.2
Critical Surface Intensity (Btu/ft/s)	511
Critical Flame Length (ft)	7.9
Fire Size (acres)	0.2
Spotting Distance (miles)	0.2 - 0.3
Scorch Height (ft)	2
Mortality (%)	50 - 75

TL8 - Ponderosa

Rate of Spread (ch/hr)	9.1
Flame Length (ft)	4.4
Critical Surface Intensity (Btu/ft/s)	511
Critical Flame Length (ft)	7.9
Fire Size (acres)	3
Spotting Distance (miles)	0.2 - 0.3

GS1 - Southern Exposure

Rate of Spread (ch/hr)	23.7
Flame Length (ft)	4.4
Critical Surface Intensity (Btu/ft/s)	511
Critical Flame Length (ft)	7.9
Fire Size (acres)	21
Spotting Distance (miles)	0.2 - 0.3

Scorch Height (ft)	23
Mortality (%)	43 - 83

Scorch Height (ft)	23
Mortality (%)	46 - 84

The proposed treatments would change the fuel models for the lodgepole pine stands within the units. These changes show a decrease in fire behavior within those stands and the large downed log (TL7) fuel model would be eliminated. The rates of spread and flame lengths predicted for post treatment fire behavior are lower than the existing stands. Another significant change is the critical surface intensity and critical flame length. The intensity and flame lengths needed for these stands to become passive or active crown fires would increase notably from 163 Btu/ft/s and 4.7 feet in the existing stands to 511 Btu/ft/s and 7.9 feet, respectively. "Used alone, thinning especially directed at the smaller and medium-sized trees, can be quite effective in reducing the conditions conducive to crown fire spread" (*Influence of Forest Structure on Wildfire Behavior and the Severity of Its Effects, An Overview, May 2003).*

To determine post treatment crown fire potential, expected fuel hazard conditions were entered into the NEXUS program.

Table 12. Post-treatment Crown Fire Potential

TL1 - Lodgepole

Type of Fire	surface
Rate of Spread (ch/hr)	1
Flame Length (ft)	0.7
Torching Index (mi/hr)	751.4
Crowning Index (mi/hr)	59.5

TL3 - Lodgepole

Type of Fire	surface
Rate of Spread (ch/hr)	2.1
Flame Length (ft)	1.2
Torching Index (mi/hr)	360.4
Crowning Index (mi/hr)	59.5

TL8 - Southern Exposure

Type of Fire	surface
Rate of Spread (ch/hr)	9.1
Flame Length (ft)	4.4
Torching Index (mi/hr)	34.6
Crowning Index (mi/hr)	34.1

GS1 - Southern Exposure

Type of Fire	surface
Rate of Spread (ch/hr)	23.7
Flame Length (ft)	4.4
Torching Index (mi/hr)	31.1
Crowning Index (mi/hr)	34.1

As Table 12 shows, especially for the TL1 and TL3 stands, the torching index is extremely high meaning that the chances of these stands demonstrating passive or active crown fires is non-existent. The other stands also demonstrate the need for higher winds to achieve the passive or active crown fire status.

Within the majority of the proposed treatment units, there is little separation between the crowns of the trees due to overcrowding and presence of ladder fuels. These ladder fuels "…essentially bridge the vertical gap between surface and crown strata. The size of this gap is critical to ignition of crown fire from a surface fire below. Canopy base height, canopy bulk density, and canopy continuity are key characteristics of forest structure that affect the initiation and propagation of crown fire." (Graham, et al 2004). The proposed treatments (both thinning and prescribed fire) would effectively remove the ladder fuels

and most surface fuels; thereby increasing the canopy base height and making less fuel available to initiate crown fire behavior.

Prescribed burning is an essential tool in reducing fire behavior across the landscape as well as reintroducing fire back into the ecosystem. "Historically, many dry forests dominated by ponderosa pine and Douglas-fir were frequently (4 to 25 years) burned by low intensity surface fires" (Graham, McCaffrey and Jain, April 2004). These fires helped to keep the amount of shrubbery and ladder fuels from becoming an increased fire hazard to the overstory. Broadcast burning in Unit 18 is a proposed treatment to help decrease the surface fuel loading.

The location of Unit 18 was based on control features surrounding the primary burn area. The Crosier Mountain trail would be an effective control feature on the west and south sides of the burn. On the north side are several areas of natural control features including rock ridges. The Crosier Mountain trail again flanks the east side as well as an area burned in the 1998 Crosier Mountain Prescribed Burn Project. Fuel models within the primary burn area can be described as TL3 and TL8.

Based on the fuel models within Unit 18 and the expected ignition conditions, smaller diameter trees, including ladder fuels and the understory within the broadcast burn unit, could expect to have up to 75% mortality. In the overstory, the expected mortality could be up to 35% and would be distributed in single trees or small patches of trees across the unit.

For safety and logistical purposes, secondary burn areas would be established surrounding the primary burn areas. These areas are located approximately 0.5 miles out from the primary burn boundary unless private property impedes this distance. Although not part of the target area, prescribed fire would be allowed to burn into these secondary burn areas as long as the weather and fuel moistures were still within the initial prescription for the primary burn. Active ignition in the secondary burn areas would not take place.

Fire suppression has achieved the goal of limiting wildfires to as small a fire as operationally possible. However, "changes in forest structure and composition over the past 60 to 100 years have increased fuel loads and made many of the ponderosa pine forests more susceptible to highly intense and highly severe fires" (Graham, McCaffrey and Jain, April 2004). "Reducing the likelihood of crown fires requires decreasing the amount, density, and continuity of surface fuels, and removing ladder fuels" (Graham, McCaffrey and Jain, April 2004). "Crown fires are dependent on the sequence of available fuels starting from the ground surface to the canopy. Crown fires are more likely to occur when sufficient surface fuels are available to ignite ladder fuels and/or the lower crowns of overstory trees" (Graham, McCaffrey and Jain, April 2004). By using a combination of thinning and broadcast burning, the overall goal of decreasing the surface and ladder fuels is achieved further reducing the potential for catastrophic crown fires.

Cumulative Effects

The cumulative effects of the no action alternative are continued buildup of surface fuel loads and an increase in ladder fuels leading to a potentially large wildfire under the right weather conditions.

It is predicted that the mountain pine beetle infestation will continue in areas east of the Continental Divide including within the project area over the next three to five years. The infestation is expected to affect all the mature lodgepole pine and eventually kill the trees. The infestation could lead to extremely volatile fuels within the project area once the needles begin to fade from green to shades of red. The lack of moisture within the red needles would allow for a fire to become a crown fire with very little wind and much lower temperatures.

It has been observed in Vanderhoof, British Columbia, Canada that there are different stages of coloring seen in the needles and boles following a beetle attack. The needles go from green to yellow/orange to red to purple and then the trees seem to look black from an aerial view and then turn grey as the small branches fall to the ground.

Typically the needles will begin to turn yellow/orange within a year of the tree being attacked. This stage is the most volatile stage because the needles still have similar chemical properties of green needles with much lower foliar moisture contents. Fire can be described as either a surface fire or crown fire with no torching observed and no warning of when the fire transitions into a running crown fire.

When the needles turn red, again the fire behavior exhibited can be described as either a surface fire or a crown fire with no transition between. The needles then turn purple at which stage torching is exhibited. Fires in this stage are typically less severe.

The black stage is when the needles have fallen off the trees but the branches are still attached to the bole of the tree. Crown fire cannot be sustained within these trees unless 30% or more of the trees surrounding the black trees have green needles. Crown fire can be initiated at that point and sustained until there is no more continuous fuel. There can be individual or group torching occurring in these stands.

The grey stage is described as when the branches have fallen off the tree and all that is left is the bole of the tree. Vanderhoof has not experienced fire within this stage yet; however, research shows that the fire risk would be reduced until the boles begin to fall down. After the needles drop but before the trees fall down, a sub forest will have begun. Regeneration in beetle killed sites would become ladder fuels or an extension of ground fuels. Once the stems fall down, a significant increase in down woody fuel coupled with the regeneration would have the potential to cause an intense fire that could be difficult to suppress with potential to cause severe impacts to soil conditions.

Cumulatively over time, the areas that would have ladder fuels removed would have to be retreated. It may take 10 years before treatment needs to reoccur. The regeneration that

would be expected to occur would need to be thinned to continue to keep those areas within a desired condition. These re-treatments may need to occur within 10 years of completion of the project depending on tree growth in that timeframe. "A single thinning treatment cannot maintain lowered wildfire risk over the long-term…" (*Recent Forest Insect Outbreaks and Fire Risk in Colorado Forests: A Brief Synthesis of Relevant Research, 2006*).

The areas treated by prescribed fire would need to be re-evaluated for maintenance burning within 15 to 25 years from its first application. This would be to help keep fire in the ecosystem and to keep the shrubbery and ladder fuels at a minimum. "Although low-intensity prescribed burns reduce fine fuels in the short-term, they also contribute to subsequent dead fuels by killing understory trees, which can result in fuel levels that exceed pre-burn levels within a decade. Therefore, repeated or staged prescribed fire or mechanical thinning treatments are essential for maintaining lower forest densities; otherwise, a one-time thinning may facilitate a dense tree establishment" (*Recent Forest Insect Outbreaks and Fire Risk in Colorado Forests: A Brief Synthesis of Relevant Research, 2006*).

The proposed treatments would help decrease the amount of fuel buildup when the Mountain Pine Beetle infestation occurs across the project area by thinning the forest and piling the created and existing down woody debris. Fire intensities would decrease due to these cumulative treatments, allowing firefighters to suppress wildfires more readily.

Biological

Silviculture

Affected Environment

There are two related environmental factors that influence ecological processes and the distribution of tree species in the Colorado Front Range: elevation and moisture availability. As elevation increases, growing seasons become shorter, temperatures are cooler and precipitation is greater. Fire and other disturbances generally become less frequent at higher elevations. Changes in vegetation composition along this gradient reflect these environmental changes.

The Glen Haven Project Area is characterized by elevations that range from 10,400 feet (Lookout Mountain) to 6,200 feet (Drake, CO). At the lower elevations where conditions are the warmest and driest, the vegetation is dominated by shrubs and gradually transitions into open ponderosa pine forest. The ponderosa pine forest typically becomes mixed with Douglas fir and aspen at higher elevations. At about 8,000 feet, ponderosa pine, Douglas fir and aspen are joined by lodgepole pine and limber pine. This species mix forms a transitional mixed conifer forest in the higher elevations of the project area. Where there is usually a persistent winter snowpack, ponderosa pine and Douglas fir are

replaced by lodgepole pine, patches of aspen and limber pine, subalpine fir and Engelmann spruce.

The slope, aspect and topographic position at low and middle elevations have a major influence on the composition of forest vegetation. Slopes that face south, west and southwest are exposed to intense sunlight and dry prevailing winds. On these warm dry slopes ponderosa pine is the dominate species. Douglas fir is found on slopes with north aspects where conditions are generally cooler and moister.

Most of the project area is located in the montane ecological zone between 6,000 and 9,000 feet elevation. A summary of the cover types and tree species in the project area is summarized in the tables below.

Table 13. Acres and Percent Cover Type on NFS Land

Cover:	Total Acres	% of Total
Tree Cover	26,000	90%
Shrub Cover	728	3%
Grass / Forb Cover	1790	5%
No Vegetation	533	2%
Total	29,051	100%

Table 14. Acres and Percent Tree Cover on NFS Land

Tree Cover:	Total Acres	% of Total Tree Cover
Rocky Mountain Juniper	301	1%
Cottonwood	4	<1%
Aspen	763	3%
Douglas Fir	668	3%
Ponderosa Pine	7,968	31%
Lodgepole Pine	12,638	48%
Spruce/Fir	3,658	14%
Total	26,000	100%

Stand structure is the distribution of tree sizes, ages and species in a given area. In the project area, stand structure has been influenced in the past by human uses, fire exclusion and possibly climate change. During the late 19th and early 20th centuries, logging removed the largest and oldest trees. Over the last 100 years as wildfire suppression became more successful, more seedlings survived than would have under a natural fire regime.

Within the project area, lodgepole pine is the most dominate tree cover type representing 48% of all tree cover; however, forested areas where ponderosa pine is dominate is of primary importance for fuel reduction activities. These are typically the stands that have a high percentage of ladder fuels. In the project area, ponderosa pine represents 31% of all tree cover. Mature ponderosa pine in the project area generally averages 12 to 16 inches in diameter at breast height (DBH) and 40 to 50 feet total height. Occasionally, larger trees greater than 20 inches DBH are found, usually in drainages where optimal

growing conditions exist. On average, site productivity (as measured by the amount of radial growth increments at DBH and total height) in the project area is generally low. For example, the typical ponderosa pine site index is 48 feet of total height after 100 years of growth.

Habitat Structure Stage (HSS) is a means of describing the condition of the stand in terms of stand age, canopy closure, and average tree size. HSS-3 represents younger stands with sapling and pole sized smaller diameter trees. HSS-4 stands are mature with trees greater than 9 inches DBH. HSS-A represents stands with a crown closure of less than 39%, HSS-B is 40 to69%, and HSS-C greater than 70%. The following table provides a summary of the ponderosa pine cover type and HSS within the project area.

Table 15. Ponderosa Pine Habitat Structure Stage

Ponderosa Pine									
		3A	3B	3C	4A	4B	4C	Summary	
		acres	acres	acres	acres	acres	acres	total acres	% of total tree cover
		996	671	0	3,490	2,811	0	7,968	31%

The ponderosa pine stands vary dramatically in stand structure. Mature stands are park-like with perhaps 50 to 120 large diameter trees per acre present and only a few smaller diameter and younger trees growing in a grass dominated under-story. Other stands are multi-storied with hundreds of trees of multiple diameters, ages, and heights present in the same stand.

Ponderosa pine seedlings require mineral soil and full sun to establish. Logging and fires create favorable opportunities for regeneration. When conditions are favorable, ponderosa pine trees will produce a large crop of seeds. As a result, groups of trees tend to establish resulting in clumps of trees of the same age. Within the project area it is common to see dense groups of trees that have resulted from a regeneration event. Low intensity surface fires would generally thin these groups killing most but not all of the young trees. In the absence of fire, most of these young trees have survived creating stands of very dense forest. Dense stands with ladder fuels have an increased chance of a crown fire potentially resulting in high mortality to the stand.

Douglas fir represents 3% of the forested acres within the project area. The Table below provides a summary of the Douglas fir cover type and HSS within the Project Area:

Table 16. Douglas Fir Habitat Structure Stage

Douglas Fir									
		3A	3B	3C	4A	4B	4C	Summary	
		acres	acres	acres	acres	acres	acres	total acres	% of total tree cover
		60	152	0	89	345	22	668	3%

Where Douglas fir and ponderosa pine co-occur in the same stand, there is a tendency for the fir to slowly, successionally replace the pine. In relatively old post fire stands, young Douglas fir are typically present whereas juveniles of the shade intolerant ponderosa pine are typically absent. This successional pattern is due primarily to the differences in shade tolerance of the two dominant species in stands that originated following a stand-replacing fire. Within the project area, these types of stands were probably less influenced by frequent surface fires. Conversely, in the upper montane zone, stand structures have been shaped by severe fires (stand replacing or partial stand replacing) occurring at intervals usually much greater than 50 years. The long intervals between fires would have allowed fuels to accumulate and develop a laddered structure favoring crown fires.

Spruce budworm causes defoliation in Douglas fir. In the 1980s, spruce budworm populations were at epidemic levels contributing to considerable mortality of mature Douglas fir trees within the project area. Spruce budworm is currently present in the project area, but populations are at endemic levels.

Lodgepole pine represents 48% of the cover type in the project area. The table below provides a summary of the lodgepole pine cover type and HSS within the project area.

Table 17. Lodgepole Pine Habitat Structure Stage

Lodgepole Pine									
		3A	**3B**	**3C**	**4A**	**4B**	**4C**	**Summary**	
		acres	**acres**	**acres**	**acres**	**acres**	**acres**	**total acres**	**% of total tree cover**
		1,303	8,684	733	149	1,128	641	12,638	48 %

Most of the lodgepole pine stands are even-aged ranging from 90 to 120 years of age. Stand structure varies dramatically from small diameter (two to three inch DBH), densely stocked “dog-hair”, to stands where the average diameter is six to nine inches DBH with 150 to 300 trees per acre. Overall, tree heights rarely exceed 40 feet except in deeper soils found in drainage bottoms. The lodgepole stands in the project area grow on dry sites and typically have sparse understories. Moisture restrictions and general absence of shade-tolerant conifers in these stands create conditions where lodgepole is self-perpetuating.

Aspen is present throughout the project area, but represents less than 3% of the forested area in pure stands or clones. The mature aspen clones have diameters of six to 10 inches at DBH with total heights of 30 to 40 feet and range in age from 80 to 100 years old. Some clones are relatively healthy with sprouting occurring along the clone edge while others that are subjected to elk browsing have very few sprouts. Throughout the project area, small groups consisting of a few trees exist in ponderosa pine and lodgepole stands. These trees are remnants of larger clones that deteriorated with the succession and competition from conifer trees.

Engelmann spruce, blue spruce, subalpine fir, alder, willow and cottonwood can be found in and near riparian areas. Limber pine is found on rocky sites. Rocky Mountain juniper is found on south aspects to about 8,500 feet. Mountain mahogany and antelope bitterbrush are the most common shrubs.

Old growth stands contain older, larger diameter trees and other structural features such as snags, down logs and gaps in the canopy layers that include patches of regeneration. The Forest Plan describes old growth management strategies as part of its analysis and identified 2,065 acres of old growth in all species within the project area. These stands were mostly excluded from the proposed treatment units except 39 acres in Unit 18. .

Dwarf mistletoe is present and scattered throughout the project area. Several locations within the ponderosa and lodgepole pine cover types have heavy concentrations of mistletoe.

Mountain pine beetle (MPB) and pine engraver beetle (Ips) are present in the project area. Ips populations are currently at endemic levels. The 2008 Forest Pest and Disease Detection Map indicate several areas within the project area where trees have been infested and killed by MPB. When compared to maps from previous surveys, it is apparent that there is an increasing MPB population. The MPB affected areas are most extensive in the lodgepole pine forest cover. The increase in MPB populations is consistent with other lodgepole pine areas of the Canyon Lakes Ranger District where the MPB populations have been officially declared at epidemic levels.

Tree windthrow is not prevalent in the project area, but may occasionally occur. Trees susceptible to windthrow grow on sites where saturated soils persist and are exposed to high winds during the spring months.

Alternative 1 – No Action
Direct and Indirect Effects

Under this alternative, vegetation management for the purpose and need of this project would not take place. Natural growth processes, insect attacks, disease outbreaks, wind events, and wildfire would be the dominant forces of change on the landscape. The aspen component would continue to diminish in some areas from conifer encroachment until a stand replacement wildfire occurs or the mature conifers are killed by MPB. Lodgepole pine stands would continue to mature gradually shifting to an older age class. Due to the generally dry site conditions in the project area, it is unlikely that the lodgepole stands would ever be replaced by subalpine fir or Engelmann spruce. The Douglas fir stands and younger stands of ponderosa pine would continue to develop into dense stands of multi-storied canopies; leaving the stands at an increased risk of intense wildfire behavior and more susceptible to insects and disease. No activities would take place to meet part of the purpose of the HFRA to improve forest health and biological diversity.

Alternative 2 – Proposed Action
Direct and Indirect Effects

Alternative 2 proposes to thin primarily smaller diameter understory trees in stands of ponderosa pine and Douglas fir while leaving the larger more fire resistant trees. Implementation of this treatment would make more water and nutrients available for the remaining trees and other vegetation. This effect would tend to make the remaining trees healthier and more resistant to insect and disease attacks. As the stands are thinned, an increase in the amount of sunlight reaching the forest floor would be expected.

Under Alternative 2, treatments could be accomplished by hand crews using chainsaws or by equipment specifically designed to cut or mulch trees (outside of inventoried roadless areas). If equipment is used, there would be some mixing of the forest litter layer with the mineral soil. If coupled with prolific seed production (the average interval between heavy cone crops of ponderosa pine is eight years) and wet conditions, seedlings could be produced. Use of machinery to complete treatments would increase potential for broken limbs and scraped bark on residual trees making them more susceptible to disease causing pathogens.

Where treatments are manually completed, slash would be piled by hand and burned at a later date. Piles would be created in openings or kept a specified distance from residual trees. Piles would be burned when there is adequate snow cover or moisture to reduce potential of fire spread from the piles. Some scorching or burning of branches of residual trees located near the piles would be expected; however, tree mortality from pile burning would be minimal.

On the treated acres, varying age and size classes of ponderosa pine stands would remain. Stand composition after thinning would favor ponderosa pine and aspen in the majority of the treatment areas. Douglas fir would be favored on northerly aspects. Residual conifers in the ponderosa pine and Douglas fir cover type would be arranged singly and in clumps with a diversity of ages, sizes and densities represented. Single story clumps of sapling and pole size trees would be thinned to a range of spacing from 16 feet to 25 feet. This provides for stocking of 75 to 125 trees per acre. Trees with the greatest live crown would be left to take advantage of growing space, available water, sunlight, and nutrients. Healthy full crowned, residual trees, less than 100 years old, would respond to thinning. The most notable response in growth of residual trees would be an increase in diameter that otherwise would occur at a slower rate in unthinned stands.

Generally, mature lodgepole pine is characterized by larger diameter trees arranged in a single story. In most mature lodgepole stands, there are very few younger trees in the understory except in gaps or openings where a sufficient amount of sunlight has allowed new trees to establish. The treatment areas proposed in Alternative 2 generally target ponderosa pine stands and not mature lodgepole.

The treatment areas may include inclusions of lodgepole pine but generally these are areas where there is a mix of tree species. The proposed thinning in stands of mixed tree

species would result in an increase in the percentage of ponderosa pine and a reduction in the number of lodgepole pine in the stand. In inclusions of pure, mature lodgepole, the proposed treatment would be limited to treating existing surface fuels (leaving < 5 tons / acre) and a light thinning in the openings to eliminate sapling and pole size trees that could be ladder fuels. The lodgepole overstory would generally not be disturbed.

The existing and expected post treatment cover types and the associated HSS within the treatment units are summarized for Alternative 2 in Table 18. Although the thinning would primarily affect the understory, a minor but measurable change to canopy closure and the HSS would occur. In ponderosa pine and Douglas fir cover types, the effects of thinning would potentially change from a high to moderate closure to a moderate to low closure. Due to an increase in available soil moisture and sunlight, a minor increase in aspen cover would be anticipated in most of the treatment areas. Although spruce and fir stands are included in the proposed treatment areas, thinning would not occur in these stands and no change to HSS would occur.

Table 18. Changes in HSS from Proposed Treatments

Existing Condition							
	3A	3B	3C	4A	4B	4C	total acres
Tree Cover	acres	acres	acres	acres	acres	acres	
Rocky Mountain Juniper	40				104		144
Cottonwood	4						4
Aspen	214	2					216
Douglas Fir	8	6		6	50		70
Ponderosa Pine	78	275		913	633		1899
Lodgepole Pine	287	1610	146	58	142		2243
Spruce/Fir	10	6			26		42
Total	641	1899	146	977	955	0	4618

Anticipated Changes Resulting from Implementation							
Rocky Mountain Juniper	40				104		144
Cottonwood	4						4
Aspen	216						216
Douglas Fir	14			37	19		70
Ponderosa Pine	353			1444	102		1899
Lodgepole Pine	822	1171	50	174	26		2243
Spruce/Fir	10	6			26		42
Total	1459	1177	50	1655	277	0	4618

	3A	3B	3C	4A	4B	4C	total acres
Tree Cover	acres	acres	acres	acres	acres	acres	
Existing Condition – All cover types	641	1899	146	977	955	0	4618
Anticipated Changes – All cover types	1459	1177	50	1655	277	0	4618

Forested stands would have increased resistance to insect attacks in the long term. In the short term, populations of *Ips* beetles could build in the piled slash potentially making isolated residual trees susceptible to insect attacks. Once the slash is burned, this threat would no longer be present. In addition, residual trees would have more available nutrients, sunlight, growing space and moisture allowing the trees to be more resistant to *Ips* beetle attacks if they occur. Mortality of residual trees from windthrow is not expected since the removal of dominant trees from the overstory would be rare. Mistletoe levels would be reduced slightly but would persist at endemic levels.

The removal of a laddered forest canopy (vertically adjacent canopy layers) in thinned Douglas fir stands would be a deterrent to spruce budworm. Thinning would impede the horizontal and vertical movement of the defoliating larval stage of the budworm.

Cumulative Effects

Fuel reduction projects conducted in and near the project area by private landowners would be expected to continue. In combination with proposed treatments on National Forest land, these efforts would generally reduce surface fuels and increase openings in canopies in localized areas.

It is anticipated that widespread MPB caused tree mortality, particularly in lodgepole pine, will continue to occur over the next several years. As the epidemic spreads, larger diameter trees will be most susceptible. If the epidemic continues to the levels seen west of the Continental Divide, smaller, pole size trees would also be attacked (Foresters reported MPB killed trees as small as 4 inch DBH in Grand County, Colorado). At the end of the infestation, it is expected the residual stands will contain a minor amount of surviving dominant and codominant trees.

The insect killed trees will eventually begin to fall and contribute to coarse woody debris. In a study completed in Southern Oregon, mountain pine beetle killed trees began to fall to the forest floor after five years, with 50% of trees falling within nine years, and 90% falling by 14 years post-attack. In the relatively dry conditions experienced in the Glen Haven Project Area, these time frames could be longer as the dead trees tend to dry quickly and caseharden.

Dense ponderosa pine forests are at greatest risk of severe losses to mountain pine beetle as the northern Front Range epidemic develops. Nevertheless, losses are likely to be patchy in nature due to a variety of differences between ponderosa pine forests and lodgepole pine forests. Ponderosa pine forests tend to be more variable in density and canopy structure, presenting the beetles with much different environmental conditions that are less attractive to dispersing beetles. Also, ponderosa pine forests do not occur in the vast, extensive landscape pattern typical of lodgepole pine.

The wildland fire management strategy for the project area per the Forest Plan requires direct control. Wildfires occurring in the future within the project area would be suppressed to protect other resource values and uses. The historic range of variation

analysis indicates that stand structure within the project area was influenced by mixed severity fires. The proposed treatment and active future fire suppression activities would reduce the chances of stand replacing crown fires from occurring. As a result, tree age and insect or pathogen induced mortality may be more of an influence on stand structure dynamics than wildfire into the future. Consequently, to maintain the desired condition of the stands, future management interventions such as controlled surface fires or thinning may be needed.

Wildlife

Section 7 of the Endangered Species Act of 1973, as amended, requires federal agencies to ensure that actions authorized, funded, or carried out by them are not likely to jeopardize the continued existence of threatened or endangered species, or result in the destruction or adverse modification of their critical habitats. In addition, the Forest Service has established direction in Forest Service Manual 2670 to include habitat management for sensitive species. This process ensures that threatened, endangered, and sensitive (TES) species receive full consideration in the decision-making process.

This section discloses the likely effects of the alternatives to federally listed species, Forest Service sensitive species, management indicator species (MIS), and other species or habitats, for example old growth and effective habitat, pertinent to this project (USDA Forest Service, 1997). A summary of the analysis for wildlife species is presented below. The complete Glen Haven Fuels Reduction Wildlife Specialist Report is incorporated by reference and is part of the project record available at the Canyon Lakes Ranger District office.

A total of 38 terrestrial species were evaluated to determine if the species or their habitat is present within the project area: six federally threatened or endangered species; 24 Forest Service sensitive species; and 10 management indicator species (including two MIS species that also are Forest Service sensitive and are not duplicated in the above total). Of this total, 22 species were carried forward for analysis, and the effects of the no action and proposed action alternatives for each species are addressed.

Table 19. Federally-listed wildlife species and Forest Service management indicator and sensitive species included in project analysis.

Threatened/ Endangered Species	Management Indicator Species	Sensitive Species			
		Mammals	Birds	Amphibians	Insects
Canada lynx Preble's meadow jumping mouse	Bighorn sheep Elk Mule deer Golden-crowned kinglet Hairy woodpecker Mountain bluebird Pygmy nuthatch Warbling vireo Wilson's warbler	Marten Wolverine Bighorn sheep Pygmy shrew Fringed myotis Townsend's big-eared bat	Northern goshawk Flammulated owl Three-toed woodpecker Lewis' woodpecker Olive-sided flycatcher	N/A	N/A

Threatened and Endangered Species
Direct and Indirect Effects

Canada lynx
Due to the low elevation and forest types within most treatments units, only the highest elevation portions of thinning Units 4, 5, and aspen enhancement Unit 6 are located within the Estes lynx analysis unit (Estes LAU). Approximately 62 and 34 acres of the Estes LAU are located within Units 4 and 5, respectively. Approximately 430 acres total are located within Unit 6; however, the treatment proposed would only cut conifers from stands of pure aspen and the net acres treated would be less. The majority of treatment Units 4 and 5 are predominately lodgepole pine with little understory, along with some aspen stands and herbaceous meadows. According to Forest remote sensing data, no spruce and fir habitat is present within Units 4, 5, or 6. The dry lodgepole pine type generally is not considered suitable lynx habitat due to the lack of understory, which provides habitat for snowshoe hare at densities that can support lynx.

Additionally, the portion of the Estes LAU that overlaps these three treatment units basically is the terminus of a narrow peninsula running along Storm Mountain ridge above 9,000 feet elevation and is surrounded by unsuitable habitat on the north, south, and east. Due to the dry lodgepole pine type and the narrow configuration of this portion of the Estes LAU, the area within and adjacent to these treatment units is not considered to provide suitable lynx habitat. No lynx critical habitat has been designated by U.S. Fish and Wildlife Service (USFWS) within the analysis area, or in Colorado, and there are no key lynx linkages within the analysis area.

A small amount of the Estes LAU overlaps units 4, 5, and 6 and the intervening area between units. However, the dry lodgepole pine forest type that is present over most of this area does not provide suitable lynx habitat. Consequently, there would be no direct or indirect effects to lynx or lynx habitat. Because no suitable habitat is present, implementation of either Alternative 1 or 2 would not have an effect on lynx. Because no designated lynx critical habitat is present within the analysis area, both Alternatives 1 and 2 would have no effect to lynx critical habitat.

Preble's meadow jumping mouse
According to USFWS data, Preble's have been detected within the analysis area on the North Fork Big Thompson River near Glen Haven, and on the Big Thompson River near Glen Comfort. Designated critical habitat for Preble's mouse, as identified by the USFWS, is not present within the analysis area. However, potential Preble's habitat may be located along streamside riparian areas in the following portions of thinning units below 7,600 feet elevation: unit 9 along the North Fork Big Thompson River; unit 12 along Fox Creek; unit 13 along West Creek; unit 15 along an intermittent channel: unit 16 along ephemeral channels that have pockets of water; unit 21 along Dark Gulch; and, unit 22 along the Big Thompson River. These perennial and intermittent stream channels have varying levels of riparian vegetation, including willow, alder, water birch, Rocky Mountain maple, and a dense herbaceous layer in places, that may provide suitable Preble's habitat.

Under Alternative 1, thinning treatments would not be implemented, and therefore no direct or indirect effects would occur in or adjacent to potential Preble's habitat along the reaches identified above. The majority of potential Preble's habitat in the treatment units consists of fairly narrow riparian corridors in drainages along streams that are primarily within forested stands. With fire exclusion over time, numerous seedling, sapling, and pole-sized conifers have become established in the riparian zone and adjacent upland slopes. Consequently, adjacent forested stands are impacting the riparian habitat by shading out riparian vegetation or encroaching on the riparian zone within the Preble's habitat which would tend to degrade the habitat over time. In the areas with conifer overstory, stands would continue to develop under relatively natural processes, with the exception of fire suppression and also livestock grazing activities within unit 16. Average tree size, stand densities, and canopy cover would increase over time until inter-tree competition caused suppression mortality, insect mortality occurred, or wildfire occurs. Because no treatment activities would be implemented with this alternative, generally little change would occur to Preble's habitat within the proposed units. Natural forest processes would continue, which would cause little change to potential Preble's habitat. Therefore, the determination for the No Action Alternative is no effect for Preble's meadow jumping mouse and its critical habitat.

Effects to potential Preble's habitat from implementing Alternative 2 – Proposed Action would be minimized by the use of project design criteria listed in Chapter 2. These practices would allow only chainsaw thinning and piling and burning of slash piles within 100 meters of potential Preble's riparian habitat. Additionally, within identified habitat, burn piles would be located at least 100 feet from riparian vegetation; therefore, Preble's mice would not be expected to utilize the burn piles as winter hibernation sites. Preble's habitat is not expected to be impacted by the fuels reduction work, and the fuels reduction work would be expected to provide some long-term protection to the Preble's habitat by reducing potential for high-intensity wildfire. The thinning also would be expected to improve riparian habitat conditions by removing encroaching conifers that are or will be competing with riparian vegetation through time.

By implementing Alternative 2 with the project design features described above for Preble's habitat, the determination is may affect, not likely to adversely affect Preble's meadow jumping mouse. Because no critical habitat is located in the analysis area, there would be no effect for Preble's critical habitat.

Forest Service Sensitive Species
Direct and Indirect Effects

American marten
Due to the primarily low-elevation forest types within and adjacent to the treatment units, potential marten habitat is limited. It is likely that only the higher portions of units 4, 5, and 6 may provide potential marten habitat, but of low-quality due to the predominately small size class of the forest and the lack of substantial understory. Approximately 282 acres of mature Douglas fir, lodgepole pine, and spruce and fir occurs within treatment

units, according to Forest data. Potentially suitable marten habitat of low quality may occur in small patches across the higher portions of units 4, 5, and 6.

Because no activities would occur under Alternative 1 and no marten habitat would be impacted, the project would have no impact for marten. Because of the low quality and limited extent of potential marten habitat within the treatment units, and the lack of a substantial change to those lodgepole pine stands that may provide suitable habitat, Alternative 2 would have no expected impact to marten.

Wolverine

Due to the primarily low-elevation forest types within and adjacent to the treatment units, as well as the presence of residential areas along the valley bottoms adjacent to treatment units, potential wolverine habitat is very limited. It is likely that only the higher portions of units 4, 5, and 6, along the Storm Mountain ridgeline, provide potential wolverine habitat, and if present, would be of low-quality due to the predominately small size class of the forest and the lack of substantial understory. Approximately 282 acres of mature Douglas fir, lodgepole pine, and spruce and fir occurs within treatment units, according to Forest inventory data. This would represent about 0.3% to 1% of an average adult male and female wolverine home range. Due to the lack of a large undisturbed area of potential habitat and the close proximity of residential areas on both sides of the Storm Mountain ridgeline, limited functionally suitable habitat occurs within units 4, 5, and 6, or elsewhere within the Glen Haven treatment units.

No activities would occur under Alternative 1 and no wolverine habitat is present within treatment units. Consequently, Alternative 1 would have no impact for wolverine. No suitable wolverine habitat is present within or adjacent to treatment units. Consequently, it was determined that Alternative 2 would have no impact for wolverine.

Rocky Mountain Bighorn sheep

According to Colorado Division of Wildlife inventory data, bighorn sheep use areas range across portions of several treatment units. The proposed thinning would be beneficial for bighorn habitat by opening up denser areas of forest vegetation and stimulating the growth of herbaceous and shrub vegetation. Additionally, the thinning would reduce seedling, sapling, and pole-sized tree cover that blocks bighorn vision and can provide hiding cover for bighorn predators (primarily mountain lion). Should sheep be in these areas during project activities, they may be temporarily displaced to adjacent habitat outside of those particular units. However, the long-term habitat benefits of thinning would far outweigh any short-term and temporary displacement of bighorn. Additionally, the treatment units are small portions of much larger winter and summer range areas that would provide sheep ample habitat availability to avoid project activities.

Because no fuels treatment activities would occur under Alternative 1, no impacts to bighorn habitat or populations would occur. Approximately 350 acres of bighorn summer range, 1,260 acres of winter range, and 250 acres of winter concentration area are within thinning units. Although the thinning treatments would improve bighorn habitat, it is possible there could be some temporary displacement of bighorn to adjacent

habitat during project activities. However, this would not be expected to cause impacts to bighorn populations. Therefore, it is expected that implementation of Alternative 2 would have no impact to bighorn sheep habitat and populations.

Pygmy shrew
An estimated two acres within Unit 4 and 73 acres within Unit 6 occur above 9,600 feet. This habitat consists of lodgepole pine forest, meadow, and a small amount of aspen. The meadow edges and small clumps of aspen within the 73 acres in Unit 6 may provide suitable pygmy shrew habitat. Potential pygmy shrew habitat is very limited and likely of low quality within treatment units 4 and 6. Additionally, habitat conditions should essentially remain unchanged because of the light thinning proposed for the 2 acres of lodgepole stands in Unit 4, and the maintenance/enhancement prescription for aspen in Unit 6. Based on the above discussion, it was determined that Alternatives 1 and 2 would have no impact to pygmy shrew habitat or populations.

Fringed myotis
Suitable habitat is present within the analysis area within the lower-elevation forests of ponderosa pine and Douglas fir. However, the majority of units are above 7,500 feet elevation placing them above the typical habitat range for fringed myotis. Because fringed myotis habitat would remain unchanged and no direct impacts from project activities would occur, Alternative 1 would have no impact to fringed myotis. Although very unlikely (because smaller trees are being targeted by the treatments under Alternative 2) direct impacts may occur if an occupied roost tree is removed. Unlikely and/or minor indirect impacts of treatments may include removal of potential roosting trees and habitat modification that leads to a short-term loss of prey species and their habitats. In the long-term, the proposed treatments would maintain and improve habitat for this species by restoring more open forest habitat conditions and hastening development of old-growth forest conditions. For fringed myotis, implementation of Alternative 2 may impact individuals, but is not likely to result in a loss of viability within the planning area (for this analysis, the planning area is considered to be the Forest), nor cause a trend towards federal listing.

Townsend's big-eared bat
No caves or abandoned mines that can provide primary critical roosting habitat are known to exist within treatment units. The conifer stands of ponderosa pine, mixed Douglas fir/ponderosa, and lodgepole pine and the riparian areas along the perennial and intermittent streams do provide potential foraging habitat. Because Townsend's habitat would remain unchanged and no direct impacts from project activities would occur, Alternative 1 would have no impact to Townsend's big-eared bat. Under Alternative 2, the proposed thinning treatments would treat primarily understory trees, and leave most of the mature overstory trees for potential roosting and foraging habitat. There are no known roosts, hibernacula, or maternity sites within the project area, so there would be little chance for direct effects to these habitat features from project activities. Treatments would have a long-term positive effect due to maintaining and restoring the open forest conditions of the ponderosa pine and mixed Douglas fir/ponderosa stands in the treatment units, which also would reduce the risk of a stand-replacing wildfire. For the Townsend's

big-eared bat, Alternative 2 may impact individuals, but is not likely to result in a loss of viability within the planning area, nor cause a trend towards federal listing.

Northern goshawk
Within proposed treatment units, 851 acres of conifer forest are considered in the mature stage. Large contiguous stands with the larger trees and higher canopy cover needed for suitable goshawk nesting habitat are limited in the analysis area within the vicinity of treatment units, and generally occur in small patches. Initial surveys indicate habitat conditions to support goshawk nesting in the treatment units are not present. Additionally, because no treatment activities would occur under Alternative 1, there would be no chance for direct effects to goshawks or potential goshawk habitat, if any should be present in the analysis area. Based on these conditions, Alternative 1 would have no impact on northern goshawk.

Under Alternative 2, surveys have not located any goshawk nests in or immediately adjacent to the project area or treatment units. Forest stands in the project units and project area may provide marginally suitable goshawk nesting and foraging habitat. The proposed thinning treatments would remove primarily smaller diameter trees while leaving a residual stand of larger dominant trees. Although the treatments would initially result in a reduction of canopy cover, in the long term these treatments should improve conditions for goshawk habitat by hastening development of mature and old growth forest stands that may provide goshawk habitat, as well as maintaining the limited areas of existing large tree structure. Based on the above discussion, Alternative 2 would have no impact to the northern goshawk.

Flammulated owl
Mature ponderosa pine and mixed Douglas fir/ponderosa pine forest can be found on approximately 9,181 acres within the analysis area and 1,602 acres within treatment units. Densities of larger snags, for nesting, are variable in the project area. However, given the detections in or adjacent to treatment units, suitable habitat appears to be relatively abundant and widespread. Because no treatment would occur, no direct or indirect effects to flammulated owl would occur under Alternative 1. Therefore, implementation of Alternative 1 would have no impact to flammulated owl.

The proposed thinning treatments are intended to maintain and enhance stand conditions by removing primarily smaller diameter trees while leaving a residual stand of larger dominant trees. These stands are expected to continue to provide nesting, roosting, and foraging habitat for flammulated owls. Foraging habitat should be improved by thinning the denser stands of young conifer and by the expected increase in herbaceous and shrub vegetation that occurs after the forest floor is opened up to more sunlight. Additionally, the risk of stand-replacing wildfire and consequent loss of habitat would be reduced by the fuel reduction treatments. For all treatments, direct impacts may occur if an occupied nest tree is removed during the nesting season. Unlikely and/or minor indirect impacts of treatments include removal of potential nesting and roosting trees, and habitat modification that leads to a short-term reduction of prey species and their habitats. All treatments are expected to maintain or enhance conditions preferred by flammulated owls

by reducing stand density in younger dense stands, by maintaining the mature overstory trees, and by hastening development of mature and old-growth stand conditions by reducing stem densities. Habitat conditions in the prescribed burn unit are expected to be improved over the long term for the same reasons. Additionally, herbaceous vegetation should be stimulated and increased by consumption of the duff layer, and fire-killed shrubs will come back over time through re-sprouting or from seed. Based on the above discussion, it was determined that implementation of Alternative 2 may impact individuals, but is not likely to result in a loss of viability within the planning area, nor cause a trend towards federal listing.

American three-toed woodpecker
Suitable habitat for three-toed woodpecker is present within the analysis area and treatment units in mature and old-growth lodgepole pine and spruce and fir stands, and to a lesser degree in the ponderosa pine and Douglas fir stands. Approximately 4,981 acres of mature lodgepole and spruce and fir stands are present within the analysis area, and 226 acres within treatment units. Densities of larger snags, for nesting, are variable in the project area. Little potential habitat is likely present in the treatment units. No direct or indirect effects would occur with the No Action Alternative. Therefore, Alternative 1 would have no impact to three-toed woodpecker.

The proposed thinning and prescribed burn treatments are designed primarily to remove young smaller trees, while retaining the majority of larger overstory trees in ponderosa pine and Douglas fir stands. The thinning prescription in lodgepole basically would retain the existing overstory, and no treatment would occur in the limited acres of spruce and fir. This would improve woodpecker habitat conditions by maintaining or hastening stand development toward mature and old-growth forest conditions, which provide preferred woodpecker habitat. Design criteria that maintain snags in both thinning and burn units are included in the project, so potential nest tree habitat would be maintained. Three-toed woodpeckers may be temporarily displaced or disrupted during treatment activities, and nest trees or potential nest trees may be felled, but these impacts would be temporary and limited in scope. Any impacts from Alternative 2 are expected to be short-term with long-term benefits overall. Based on the above discussion, implementation of Alternative 2 may impact individuals, but is not likely to result in a loss of viability within the planning area, nor cause a trend towards federal listing.

Lewis' woodpecker
Mature ponderosa pine can provide the open conditions these birds prefer and an estimated 4,147 acres exist in the project area with 1,546 acres in treatment units. However, most of the pine stands in the project area or the treatment units are too dense to provide suitable Lewis' woodpecker habitat, and also lack open grassland habitat for foraging. Additionally, most of the project area is above elevations that may be used by this species. It is likely that portions of units 16 and 21 may provide suitable Lewis' woodpecker habitat due to both their low elevation and presence of open grassland habitat mixed with ponderosa pine habitat. No direct or indirect effects would occur with the No Action Alternative; therefore, Alternative 1 would have no impact to Lewis' woodpecker.

The thinning and prescribed burn treatments are intended to enhance stand conditions for ponderosa pine by removing smaller diameter trees, while leaving a residual stand of larger dominant trees. Treatments are expected to help develop open mature stand characteristics in younger stands by promoting increased tree growth, thus providing potential long-term benefits to Lewis' woodpecker. Most of the pine stands in the project area currently are too dense to provide suitable Lewis' woodpecker habitat, but the treatments may open some stands up enough to promote suitable habitat, and currently suitable stands with larger trees would be maintained or restored by the treatments. Direct impacts may occur if an occupied nest tree is removed during the breeding season. Nest trees commonly are snags, and snags are not targeted for removal unless they pose a direct safety hazard. Any impacts from Alternative 2 are expected to be short-term with long-term benefits overall. Given the proposed prescriptions and their enhancement of open habitats and existing mature stands, implementation of Alternative 2 may impact individuals, but is not likely to result in a loss of viability within the planning area, nor cause a trend towards federal listing.

Olive-sided flycatcher

Potential habitat is present in the project area in the 14,181 acres of mature conifer and aspen stands, and 1,932 acres within proposed treatment units. However, most of the treatment units lack high-quality flycatcher habitat because of the dominance by low-elevation forest types (ponderosa pine-dominated stands) and lack of large trees, existing old-growth forest habitat, and large snags. Because no treatment would occur under Alternative 1, there would be no chance for direct or indirect effects to birds or suitable habitat that may be present in treatment units.

The thinning and prescribed burn treatments would remove smaller trees and ladder fuels, while leaving stands of larger dominant trees. Fuel reduction treatments would raise average canopy height, increase average tree diameter, and reduce canopy cover in denser stands. By reducing stem densities, stands would develop into mature and old-growth conditions more quickly than without the treatments, thereby improving or providing potential olive-sided flycatcher habitat. Thinning and prescribed burn treatments primarily remove small trees and ladder fuels while leaving a residual stand of larger dominant trees. The resulting conditions would promote stand succession into (or enhancement of) a mature stage. Therefore, Alternative 2 may adversely impact individuals, but is not likely to result in a loss of viability within the planning area, nor cause a trend towards federal listing.

Management Indicator Species (MIS)
Direct and Indirect Effects

Because treatment activities would not occur under the No Action Alternative, there would be no impacts to habitat and habitat conditions would remain the same for all MIS species. Consequently, it was determined the effects of implementing this alternative would have a neutral influence on all MIS species habitat, and changes to MIS populations at the planning unit scale are not expected. Therefore, Alternative 1 is not discussed below by individual species. Following is a summary of potential impacts to

MIS and their habitats for the Proposed Action - Alternative 2. The community or communities represented by each MIS is in parentheses after the species name.

Elk and mule deer (young to mature forest structural stages and openings within/adjacent to forest)

The proposed treatments of thinning and prescribed fire are expected to improve forage conditions for elk and deer because they should stimulate and rejuvenate herbaceous and shrub species growth in the more open forest conditions created by the treatments and by consumption of duff in the burn unit. Vegetative hiding cover within treatment units may be reduced in the short-term by the reduction in seedling, sapling and pole-sized trees. However, cover still would be provided in areas outside of treatment units, and by topography. The 253 acres proposed for prescribed burning are likely to improve forage conditions for elk and deer as new grasses, forbs, and shrubs would populate the burned area over time. Grasses and forbs in particular would respond rapidly in a few years, while shrubs should come back over a somewhat longer period of time (approximately five to 15 years).

All of the treatment units occur within elk winter range habitat, and most of the treatment acres overlap winter concentration areas or severe winter range. There are no delineated production areas or summer range within or adjacent to units, but there could be some elk calving that occurs within the area. For mule deer, the entire project area is within deer summer range, and winter range overlaps virtually all treatment units except the highest-elevation portions of units 4 and 6. Project activities taking place from December 1 through March 31 could cause temporary displacement of elk or deer wintering in the immediate area. Project activities taking place from May 15 to June 15 could cause temporary displacement of cow elk using the area during calving season. However, such displacement would be temporary and localized because fuels reduction activities would be localized in scope at any one time (i.e. not all units would have simultaneous treatment implementation). A project design criterion is included that limits the potential disturbance of project activities (i.e. pile burning) to certain groups of units during the wintering season for elk and deer. Additionally, winter range habitat is available around the units and project area for potentially displaced elk and deer to utilize.

Slash created from the treatments would be disposed of by pile and burn, chipping, or mastication. These disposal methods are not expected to negatively influence elk and deer. They may temporarily leave the area while treatment occurs, but are expected to return once operations are completed.

Overall, the proposed treatments of Alternative 2 are expected to create favorable changes to elk and deer habitat primarily by creating openings and reducing stand canopy cover, which should result in an increase of grasses, shrubs, and forbs over existing conditions. These improved forage conditions should maintain healthy local populations. An overall beneficial influence is expected locally at the project level, but changes to elk and deer populations or trends at the planning unit level are not expected from the proposed project.

Golden-crowned kinglet (interior forest)
Because of the existing habitat types, it is unlikely that golden-crowned kinglets occur in the project area. However, proposed treatments would not reduce or adversely impact the interior forest areas in treatment units. The prescribed burn would be conducted to reduce primarily understory vegetation while leaving mature dominant trees. The burn also will help maintain interior forest habitat by reducing the risk of a stand-replacing wildfire, which could result in total habitat loss. Should this species occur, it may be disrupted for the short-term while fuels reduction activities are occurring. An overall neutral influence is expected locally, and changes at the planning unit level are not expected from the proposed project.

Hairy woodpecker (snag component of young to mature forest structural stages)
The proposed thinning and prescribed burn treatments are designed primarily to remove young smaller trees, while retaining the majority of larger overstory trees. This would improve woodpecker habitat conditions by maintaining or hastening stand development toward mature and old-growth forest conditions, which provide preferred woodpecker habitat. Additionally, the fuels reduction treatments would reduce the risk of habitat loss from potential stand-replacing wildfire. Design criteria that maintain snags in both thinning and burn units are included in the project, so potential nest tree habitat would be maintained. Snags are not to be cut in thinning units unless they pose a safety hazard. Within hand ignition portions of prescribed burn units, the loss of larger snags would be minimized by drip-torch lighting patterns. Additionally, new snags would be created within prescribed burn units.

Hairy woodpeckers may be temporarily displaced or disrupted during treatment activities, but these impacts would be temporary. Consequently, Alternative 2 is expected to have a neutral influence on hairy woodpecker habitat, and no changes to this species' populations at the planning unit level are expected.

Mountain bluebird (openings within and adjacent to forest)
Mountain bluebirds utilize open habitats and open forest adjacent to openings. Thinning treatments are intended to enhance stand conditions, particularly in the ponderosa pine and Douglas fir types, by removing smaller diameter trees while leaving a residual stand of larger dominant trees. These stands are expected to maintain and provide potential nesting habitat for mountain bluebirds because treatments would open the understory and leave mature trees standing. Foraging habitat may be improved by the expected increase in herbaceous and shrub vegetation that typically occurs when stands are opened up to increased sunlight.

Snag densities in the project area are expected to increase over time. Design criteria that maintain snags in both thinning and burn units are included in the project, so potential nest tree habitat would be maintained. Snags are not to be cut in thinning units unless they pose a safety hazard. Within hand-ignition portions of prescribed burn units, the loss of larger snags would be minimized by drip-torch lighting patterns. Additionally, new snags would be created within the prescribed burn unit.

The prescribed fire treatment would result in a mosaic of stand conditions designed to minimize the potential for a sustained crown fire. The intent is to run a low to moderate-intensity fire through the unit to reduce stem densities primarily in the understory, while retaining the majority of mature trees. Grasses are expected to increase in the growing seasons following the burn. Because the mountain bluebird relies on open habitats, edges, and dead trees, the prescribed fire is likely to benefit mountain bluebird habitat.

Direct impacts may occur if an occupied nest tree is removed during the breeding season. Nest cavities commonly are in snags, but snags are not targeted for removal in thinning units. Unlikely and/or minor indirect impacts of treatments include removal of potential nesting trees. Any impacts are expected to be short-term, with long-term benefits overall. As discussed above, the proposed project may have temporary impacts on mountain bluebird but would not affect population trends at the local or planning unit level; an overall favorable influence is expected.

Pygmy nuthatch (existing and potential old-growth forest)
The proposed treatments are designed to maintain the large majority of mature overstory trees and reduce the risk of stand-replacement wildfire by thinning primarily the younger trees through mechanical and prescribed fire treatment. Consequently, the proposed treatments would be beneficial and are consistent with managing these stands toward old-growth conditions, as well as for other stands that are not identified as old-growth retention or development stands by the Forest Plan. The thinning treatments are expected to improve ponderosa pine and mixed Douglas fir/ponderosa stand conditions by removing smaller diameter trees, while leaving a residual stand of larger dominant trees. Partial removal of the understory also helps to reduce the risk of stand-replacing wildfire (by changing potential fire behavior), and would help move the stand towards mature and old-growth forest conditions more quickly by reducing inter-tree competition for resources (water and nutrients). Pygmy nuthatches typically forage in the crowns of ponderosa pine and with the proposed thinning treatments, crowns are left intact.

Pygmy nuthatches may be temporarily displaced by project activities during operations (short term), but are expected to return once activities are complete. Direct impacts include the potential loss of nest trees during the prescribed burn, and the removal of potential nest trees. However, this is expected to be minimal or unlikely because treatments are designed to remove primarily the smaller trees, snags would not be cut in thinning units, and the loss of larger would be minimized within the burn unit by drip-torch lighting patterns. Short-term displacement may occur while fuel reduction activities take place, but there is a benefit to moving stands towards old-growth conditions and reducing the risk of damaging wildfires. Although some old-growth ponderosa pine trees exist within treatment units, the majority of these trees and the larger mature trees would remain after treatment. A favorable influence is expected locally at the project level, but population changes at the planning unit level are not likely.

Warbling vireo (aspen)
Proposed treatments, specifically in aspen stands within Unit 6, would remove the smaller encroaching conifers. This is intended to maintain and improve aspen habitat conditions by reducing conifer competition and potential overtopping of the aspen over time by conifers. Additionally, thinning and prescribed fire treatments in ponderosa pine stands adjacent to aspen stands or willow would be expected to improve vireo habitat by opening up these stands and reducing competition, shade, and encroachment into the aspen and willow habitat. For the prescribed burn unit, a project design criterion (i.e. adjustment to drip-torch lighting patterns to minimize overstory aspen mortality) is included to protect the few small (about 0.1 acres or less) aspen stands present. Existing habitat (primarily aspen) within the treatment units is expected to continue to provide potential nesting and foraging habitat for warbling vireos after treatments and over the long-term.

For all activities, warbling vireos may be temporarily displaced while treatments are occurring, but once operations are complete, they are expected to return and utilize the area. An overall favorable influence is expected locally, but changes to populations at the planning unit level are not expected.

Wilson's warbler (montane riparian areas and wetlands)
Potential Wilson's warbler habitat (riparian shrubs) would not be directly impacted or treated. Much of the riparian shrub habitat is excluded from treatment units, and riparian vegetation along streams within units would be buffered by at least 100 feet from mechanical equipment entry. There is no suitable riparian shrub habitat in the prescribed burn unit. Existing habitat within the treatment units is expected to continue to provide potential nesting and foraging habitat for this species after treatments and over the long-term. An overall neutral influence is expected locally and no population changes at the planning unit level are expected.

Cumulative Effects of Alternatives for TES Species, Forest Service Sensitive, and Management Indicator Species

Cumulative effects may occur from a proposed action when the effects from that action are combined with impacts from past, present, and reasonably foreseeable future actions, whether those actions are federal or non-federal. The Glen Haven Fuels Reduction Project Area (37,459 acres in size) serves as the analysis area for this cumulative effects evaluation.

Primary past and present activities within the analysis area that can have appreciable impacts on habitat include: 1.) residential/subdivision development and home construction on private lands primarily along the main roadways along the valley bottoms, including associated infrastructure (roads, power lines, etc.); 2.) livestock grazing on the Dunraven allotment, which includes National Forest and intermixed private lands along the North Fork Big Thompson valley bottom in approximately the eastern half of the analysis area; 3.) the Crosier Mountain prescribed fire implemented in 1998 that covered approximately 1,000 acres on the south side of Crosier Mountain; 4.)

small commercial and private firewood sales that removed Douglas fir mortality caused by a spruce budworm outbreak that occurred in the early 1980's; and, 5.) wildfire suppression activities. Additionally, minor amounts of forest products such as sawlogs, post and poles, and firewood have been removed from the Glen Haven vicinity for at least the last 100 years. This material primarily was removed by ranchers and homesteaders. Commercial timber harvest has not been prevalent. Fuel reduction treatment has occurred on some private lands.

Recreational use of the analysis area includes: trails from the Dunraven trailhead that run west up into the wilderness and Rocky Mountain National Park, and the three trailheads and trail system on Crosier Mountain. Habitat and disturbance impacts from the developed trailheads are limited to their footprint, which are inconsequential relative to the size of the treatment units and analysis area. Impacts from the trails would be limited to temporary disturbance from users, and habitat impacts are minimal due to the very limited footprint of trails.

Mountain pine beetle activity, particularly in lodgepole pine, is increasing in and adjacent to the Glen Haven Project Area.

Residential development on private lands is expected to continue, but would be confined primarily to the immediate valley bottoms on or near the main roads, due to steep slopes and because NFS lands are prevalent on upper slopes and higher elevations. Private lands comprise 22% of the total project area. However, the large majority of this acreage would not likely be developed for homes due to steep slopes or ownership patterns, and therefore would continue to provide habitat with little permanent human disturbance, which generally provides habitat conditions with limited and infrequent disturbance.

Forest Service permitted livestock grazing is likely to continue on the Dunraven Allotment within the analysis area, and this allotment only overlaps unit 16.

The reasonably foreseeable future activities proposed or planned within the analysis area include fuel reduction activities on private land, continuation of livestock grazing, continuing use of trailhead and trail facilities, and future private land residential development.

There is no potential for an alternative to contribute to appreciable cumulative impacts for a species when the determination is "no effect" for threatened and endangered species, and when the determination is "no impact" for Forest Service sensitive species. Because no effects or impacts are expected for any federally-listed threatened or endangered species or Forest Service sensitive species (TES) from Alternative 1, there is no potential for cumulative impacts to occur from selection of this alternative. Similarly, for Alternative 2, no further cumulative effects discussion is necessary for the following species: Canada lynx and lynx critical habitat, marten, wolverine, bighorn sheep, pygmy shrew, and, northern goshawk. Discussion for Preble's mouse, flammulated owl, three-toed woodpecker, Lewis' woodpecker, olive-sided flycatcher, fringed myotis, and Townsend's big-eared bat follows below.

Preble's Meadow Jumping Mouse

Of the activities noted above, residential development on private lands and grazing on the Dunraven Allotment have the greatest potential to cause measurable impacts to Preble's habitat. A field review of the small intermittent streams within the Dunraven allotment, which also includes private lands along the North Fork Big Thompson River, indicates moderate to heavy grazing impacts are occurring. Most of these impacts are on reaches on private land within the allotment. These intermittent streams likely provide marginal quality habitat for Preble's due to the limited amount of water present and lack of denser riparian vegetation (both herbaceous and shrub) that is more typical of higher quality Preble's habitat. Moderate to heavy grazing impacts also appear to be occurring on reaches of private land along the North Fork Big Thompson River within the allotment. The Dunraven Allotment is currently being analyzed for permit reauthorization with 4 other allotments under the Thompson Area Grazing Allotments Environmental Assessment (EA). Under the proposed action, riparian and Preble's habitat conditions in the Dunraven Allotment are expected to be improved. This would occur from implementation of grazing design criteria, and adaptive management options if necessary, developed to improve riparian habitat conditions.

Appreciable impacts to potential Preble's habitat from the proposed action would not occur in the riparian habitat and adjacent upland habitat zone, and the proposed thinning treatments are expected to have long-term beneficial impacts. The large majority of potential Preble's habitat along stream reaches in the treatment units, as well as outside of units, is not within grazing allotments and riparian habitat conditions along these reaches generally are good. The exception is streams within the Dunraven Allotment, and habitat conditions are expected to improve under the proposed action of the Thompson Allotments Permit Reauthorization EA. Because of this expected improvement, and the lack of appreciable habitat impacts and the expected long-term beneficial impacts of the proposed action, implementation of Alternative 2 is not expected to lead to or contribute to appreciable cumulative effects for Preble's meadow jumping mouse. Designated critical habitat for Preble's mouse is not located within or adjacent to the analysis area. Therefore, there is no potential for the proposed action to lead to or contribute to cumulative impacts for Preble's critical habitat.

Flammulated owl, Three-toed woodpecker, Lewis' woodpecker, Olive-sided flycatcher, Fringed myotis, Townsend's big-eared bat

With regard to these Forest Service sensitive species, current vegetation community composition should be retained and mature and old-growth forest habitat would be retained and increased over time. For these six species, the proposed fuels reduction treatments should lead to improved habitat conditions over time by maintaining and developing more rapidly (than without thinning/burning activities) mature and old-growth forest habitat conditions. This is particularly true for flammulated owl and fringed myotis, which would benefit from mature and old-growth ponderosa pine-dominated forest habitat for potential nesting and roosting habitat. This also is true for three-toed woodpecker, olive-sided flycatcher, and Lewis' woodpecker, but to a lesser degree, because there is limited acreage of preferred habitat types for these three species

within the proposed treatment units. The proposed action is not expected to lead to or contribute to appreciable cumulative effects for these species.

Discussion of Other Forest Plan Habitat Attributes

Old Growth: The Forest Plan identifies types of existing old growth forest or old-growth development stand allocations within the analysis area that are adjacent to or overlap proposed treatment units. An estimated 39 acres are located within unit 18. The predominant forest cover type is ponderosa pine with small inclusions of Douglas fir and lodgepole pine. Unit 17 contains approximately 234 acres of area designated as old growth retention and development. Most of this acreage is within stands dominated by a mix of lodgepole pine, ponderosa pine, and Douglas fir. Forest Plan direction for these stand allocations in lodgepole pine or ponderosa pine types is to manage vegetation to achieve a mix needed for wildlife habitat and to reduce fuel loading. Prescribed fire or thinning treatments that maintain or encourage their development towards old-growth forest conditions is allowable.

The proposed treatments are intended to retain a large majority of mature overstory trees and reduce the risk of stand-replacement wildfire by thinning out primarily the smaller or younger trees through mechanical and prescribed fire treatment. Thinning in lodgepole pine would be very light, and primarily would remove mainly surface fuels. No trees greater than 12 inches DBH would be cut. Consequently, the proposed treatments are consistent with Forest Plan direction for managing these stands toward old-growth conditions and maintaining existing ponderosa pine and Douglas fir old-growth stands (Forest Plan, p. 32, Guidelines # 121 and 122). With likelihood that mountain pine beetles, which are now spreading across primarily lodgepole pine stands at higher elevations to the west, will be moving into this area in the near future, reducing stand densities may help such stands, or at least a percentage of the trees, to withstand a mountain pine beetle event. This may be particularly helpful in the ponderosa pine stands.

Habitat Effectiveness: Effective habitat is considered to be mostly undisturbed habitat which is buffered from regularly used motorized and non-motorized roads and trails (Forest Plan 1997). All proposed treatment units are located within the Crosier Mountain Geographic Area. From the Forest Plan, habitat effectiveness is at 72% for the Crosier Mountain Geographic Area. Because new road construction or reconstruction is not proposed with this project, habitat effectiveness levels will not be reduced from existing conditions. As funding is obtained, existing unauthorized roads or "ways" could be decommissioned once project activities are completed. Consequently, habitat effectiveness may be improved somewhat, although most if not all of the unauthorized roads in the project area likely receive little public use and currently do not exceed the threshold for habitat effectiveness (11 or more disturbance events per week).

Interior Forest
Interior forests are considered to be contiguous areas of relatively dense and large trees that are buffered from the temperature, light, and humidity differences of sizeable

openings in the forest, and from human disturbance along regularly used roads and trails (Forest Plan 1997). An estimated 94 acres are located within thinning unit 17, and approximately 31 acres located in prescribed burn unit 18. The proposed thinning in Unit 17, would be light and would retain interior forest conditions of the stand. The proposed prescribed burn is designed to maintain interior forest conditions, as it will be a low to moderate-intensity fire and the forest canopy generally would remain intact, with some relatively small areas of overstory kill, which are not expected to exceed a few acres. Low-intensity, mixed severity, and small patches of crown fire are consistent with Forest Plan direction for prescribed fire use in the Crosier Mountain Geographic Area. Also, the prescribed burn is intended to reduce the potential risk of a future wildfire that could burn with stand-replacing intensity across a larger area.

Aspen

From Forest Service remote sensing data, aspen occurs on 763 acres on NFS lands within the project area, and 216 of those acres fall within proposed treatment units. Aspen would not be cut as part of the mechanical or hand treatments within units proposed for thinning. However, young conifers may be cut out of aspen stands either during project implementation or as funding is obtained for aspen habitat maintenance. In particular, the identified treatment for Unit 6 is aspen enhancement. This unit is primarily lodgepole pine, with inclusions of stands of pure aspen. Where conifers are encroaching on the aspen stands, conifers up to 14 inches dbh (up to 10 inches for spruce) may be felled. This would benefit aspen stands by reducing conifer encroachment and competition within the aspen. Very small aspen clones are present within the prescribed burn unit 18 (e.g. less than 0.1 acres). The prescribed burn would be conducted so that active drip-torch lighting would not occur within these clones. Without active drip-torch lighting within aspen stands, it is expected that the majority of overstory aspen trees would not be killed by prescribed burning operations.

Riparian/Wetlands

Perennial streams within or adjacent to treatment units include reaches of Fox Creek, Cow Creek, West Creek, North Fork Big Thompson River, and the Big Thompson River. There are several intermittent and ephemeral streams located within units. Willow and other riparian shrubs occur along the perennial and wetter intermittent stream channels. There are no ponds located within or adjacent to treatment units. Project design criteria incorporate buffers and protections around all riparian areas for mechanical treatments, slash piling and burning, and broadcast prescribed burning. Hand thinning by chainsaw to remove or reduce young conifers (particularly Rocky Mountain juniper, ponderosa pine, and Douglas fir) from within the riparian buffers is expected to improve riparian habitat conditions by removing encroaching conifers that are currently or eventually would shade out and compete for resources with riparian vegetation. Removing these encroaching conifers also likely would reduce the burn intensity if a wildfire were to run through these riparian drainages in the future. Consequently, riparian habitat would be protected and not adversely impacted by the proposed project activities.

Snags and Downed Woody Debris
The Forest Plan requires that snags and down woody debris be retained and recruited on all treatment projects. As stated in project design, all snags that do not pose a safety hazard would be retained; therefore, implementation of the project would not reduce existing snag levels within thinning units. For hand-ignition portions of the prescribed burn unit, loss of larger snags would be minimized by drip-torch lighting patterns. Although some snags may be toppled and burned in the prescribed burn unit, the prescribed burning also would create new snags, and snag levels are expected to remain above the Forest Plan minimum guidelines.

Forest Plan standards for down woody debris (DWD) require a minimum of 50 linear feet per acre of randomly distributed DWD with a minimum diameter of 5 inches and a minimum length of eight feet. If material greater than 5 inches is not available, leave the largest possible material. Project design features state that material greater than 8 inches in diameter would not be piled. In addition, two slash piles per acre would be left as cover for wildlife as directed in the project design criteria.

Botany

Affected Environment

This section of the EA discloses the effects of the alternatives on three categories of plant species and their habitats: federally-listed Proposed, Threatened, or Endangered plant species; Forest Service Region 2 Sensitive plant species for the Arapaho and Roosevelt National Forests (the Forest); and plant species and communities of local concern on the Forest. Also included is an assessment of the existing condition of noxious weeds in the project area and a determination of the effects project activities may have on future noxious weed populations. There are no plant Management Indicator Species (MIS) on the Forest; therefore there will be no discussion of MIS in this analysis.

Pre-field reviews were conducted during 2008 using Colorado Natural Heritage Program data (CNHP 2008) to determine known presence of Proposed, Threatened, Endangered, and Sensitive (PTES) plant species and other species and plant communities of local concern within the Glen Haven Project Area. Species of local concern include plants that are tracked on a Forest or Ranger District level, because of suspected rarity or importance to biodiversity, previous inclusion on the Region 2 Sensitive List, or because of insufficient information about the species. Pre-field reviews were also conducted to identify known natural communities and Potential Conservation Areas of Biodiversity Significance (PCAs), tracked by the Colorado Natural Heritage Program (CNHP 2008).

The occurrence of habitat was identified through existing vegetation inventory, aerial photography, and general field review. Detailed habitat maps for each species are not available. There are no previously documented occurrences of PTES or rare plant species in the project area (CNHP 2008). There are three CNHP PCAs recorded within the Glen Haven Project Area, all of which occur partly on NFS lands. Of these three PCA's, one

protects a plant community occurrence that falls within the secondary burn area for Unit 18.

During 2008 field surveys, multiple occurrences of *Potentilla rupincola*, *Potentilla effusa*, and possible hybrids of these two species were found. No other undocumented occurrences of PTES species were identified within the project area. Two species of local concern were found: three occurrences of forked spleenwort (*Asplenium septentrionale*); and six occurrences of mountain polypod (*Polypodium saximontanum*) were detected within granitic rock outcrops in open ponderosa pine forest throughout the project area. Moister, mixed conifer forests were found to support two occurrences of fairy slipper orchid (*Calypso bulbosa*), a species which is of biodiversity importance but is not rare on the Forest.

Table 20 . Rare and Region 2 Sensitive plant species found during project surveys

Common name, Scientific Name	Status	Units where found
Grass fern, *Asplenium septentrionale*	Rare	6, 17, 21
Rock cinquefoil x straggling cinquefoil, *Potentilla rupincola x P. effusa*	Sensitive (*P. rupincola)*	8, 11, 12, 13 (nearby, not in unit), 21, 24
Rocky Mountain polypody, *Polypodium saximontanum*	Rare	4, 8, 17, 18, 21, 24

Forest Service botany personnel did not encounter any additional PCAs during surveys, aside from those already tracked by CNHP. No other plant species or communities of local concern were identified within the project area during 2008 surveys. Some areas were not surveyed or may need additional surveys. Future survey needs are identified in Chapter 2, Project Design Criteria for Botany.

The Forest received the Threatened and Endangered species list dated February 2009 from the U.S. Fish and Wildlife Service's Colorado Field Office. The complete list for the State of Colorado (by county) can be found in the District files. Species listed in the table below are known or suspected to occur on the Forest. No further analysis is needed for Threatened, Endangered, or Proposed species that are not known or suspected to occur in the project area, and for which no suitable habitat is present, unless indirect or cumulative effects may result (as in downstream water depletions). The following table documents the rationale for excluding a species. The species noted as excluded on the table below will not be discussed further in this document.

Table 21. Federally Listed Plant Species that may occur on the Forest or may be affected by projects on the Forest

Common Name	Scientific Name	Status	Species Excluded	Reason for Exclusion
*** ▲ Ψ Colorado butterfly plant**	***Gaura neomexicana* ssp. *coloradensis***	**Threatened**	**No**	
* ▲ Western prairie fringed orchid	*Platanthera praeclara*	Threatened	Yes	No known or suspected plants or suitable habitat in project area or Federal Action Area/ No water depletions
*** ▲ Ute ladies'-**	***Spiranthes diluvialis***	**Threatened**	**No**	

Common Name	Scientific Name	Status	Species Excluded	Reason for Exclusion
tresses				
** Penland alpine fen mustard	*Eutrema penlandii*	Threatened	Yes	No known or suspected plants or suitable habitat in project area or Federal Action Area
■ Ψ Osterhout milkvetch	*Astragalus osterhoutii*	Endangered	Yes	No known or suspected plants or suitable habitat in project area or Federal Action Area
■ Penland beardtongue	*Penstemon penlandii*	Endangered	Yes	No known or suspected plants or suitable habitat in project area or Federal Action Area
** North Park phacelia	*Phacelia formosula*	Endangered	Yes	No known or suspected plants or suitable habitat in project area or Federal Action Area

Note:

▲ water depletions in the South Platte River watershed may affect these species

Ψ these species are suspected to occur but unconfirmed on the Arapaho/Roosevelt National Forest

* The Federal Action Area for Colorado butterfly plant, Westerm prairie fringed orchid, Ute ladies'-tresses orchid for this analysis is the project area. This project does not involve water depletions.

■ The Federal Action Area for this analysis for the Osterhout milkvetch and Penland beardtongue is the project area. These species are endemic to western Colorado, therefore they are excluded from further consideration in this analysis.

** The Federal Action Area for North Park phacelia and Penland alpine fen mustard is the project area. North Park phacelia is found in Jackson and Larimer counties, but suitable habitat is not present in the project area. Penland alpine fen mustard is endemic to the Mosquito Range of central Colorado and occurs in alpine habitat which is not present in the project area. Therefore, these two species have been excluded from further consideration in this analysis.

The following list includes current Region 2 Forest Service sensitive species found within or suspected on the Forest. The species noted as excluded in the table below will not be discussed further in this document. Some species are excluded from analysis due to elevation. While habitat for some plants on this list may be within the overall project area, it may not occur within a specific treatment area.

Table 22 . Region 2 Forest Service Sensitive Plant Species for the Forest

Common Name	Scientific Name	**Species Excluded**	Reason for Exclusion
Ψ Sea pink	*Armeria maritima* var. *siberica*	Yes	No known or suspected plants or suitable habitat in project area
☼ Dwarf milkweed	*Asclepias uncialis*	Yes	No known or suspected plants or suitable habitat in project area
Ψ Park milkvetch	***Astragalus leptaleus***	**No**	
☼ Prairie moonwort	*Botrychium campestre*	Yes	No known or suspected plants or suitable habitat in project area
Fork-leaved moonwort	***Botrychium* tax. nov. "furcatum"**	**No**	
Ψ Slender moonwort	***Botrychium lineare***	**No**	
Lesser panicled sedge	***Carex diandra***	**No**	
Livid sedge	*Carex livida*	Yes	No known or suspected plants or suitable habitat in project area
☼ Sandhill goosefoot	*Chenopodium cycloides*	Yes	No known or suspected plants or suitable habitat in project area
Yellow lady's-slipper	***Cypripedium calceolus* spp. *parviflorum***	**No**	
Clawless draba	*Draba exunguiculata*	Yes	No known or suspected plants or suitable

Common Name	Scientific Name	**Species Excluded**	Reason for Exclusion
			habitat in project area
Gray's peak whitlow-grass	*Draba grayana*	Yes	No known or suspected plants or suitable habitat in project area
Roundleaf sundew	*Drosera rotundifolia*	Yes	No known or suspected plants or suitable habitat in project area
Dropleaf buckwheat	*Eriogonum exilifolium*	Yes	No known or suspected plants or suitable habitat in project area
Slender cottongrass	***Eriophorum gracile***	**No**	
Hall's fescue	*Festuca hallii*	Yes	No known or suspected plants or suitable habitat in project area
Ψ Weber's scarlet-gilia	*Ipomopsis aggregata* ssp. *weberi*	Yes	No known or suspected plants or suitable habitat in project area
Simple kobresia	*Kobresia simpliciuscula*	Yes	No known or suspected plants or suitable habitat in project area
Colorado Tansy-aster	***Machaeranthera coloradoensis***	**No**	
Ψ Adder's-mouth	***Malaxis brachypoda***	**No**	
Budding monkeyflower	***Mimulus gemmiparus***	**No**	
Kotzebue's grass of Parnassus	*Parnassia kotzebuei*	Yes	No known or suspected plants or suitable habitat in project area
Ψ Harrington beardtongue	*Penstemon harringtonii*	Yes	No known or suspected plants or suitable habitat in project area
Rocky Mountain cinquefoil	***Potentilla rupincola***	**No**	
Tundra buttercup	*Ranunculus karelinii*	Yes	No known or suspected plants or suitable habitat in project area
Dwarf raspberry	***Rubus arcticus* ssp. *acaulis***	**No**	
Silver willow	*Salix candida*	Yes	No known or suspected plants or suitable habitat in project area.
Ψ Autumn willow	***Salix serissima***	**No**	
Sphagnum (peat moss)	***Sphagnum angustifolium***	**No**	
Lesser badderwort	***Utricularia minor***	**No**	
Ψ Selkirk's violet	***Viola selkirkii***	**No**	

Note: Ψ These species are suspected to occur but unconfirmed on the Arapaho/Roosevelt National Forest.
☼ These species are suspected to occur but unconfirmed on the Pawnee National Grassland.

Region 2 Sensitive plant species analyzed in this document have been grouped according to similar habitat requirements and analyzed collectively for potential effects associated with the No Action and Proposed Action alternatives. Separate species descriptions and environmental baselines are provided for each individual species within a group. The effects discussions are consolidated, because effects to individual species within a group are anticipated to be similar in nature. Region 2 Sensitive species that may be affected by the No Action and Proposed Action alternatives are grouped below:

Group 1: Species occupying rock outcrops

- Colorado tansyaster (*Machaeranthera coloradoensis*)
- Rock cinquefoil (*Potentilla rupincola*)

Group 2: Species occupying riparian areas, stream banks, springs, and seeps (and occasionally fens)

- Park milkvetch (*Astragalus leptaleus*)
- Slender cottongrass *(Eriophorum gracile)*

- White adder's-mouth (*Malaxis brachypoda*)
- Budding monkeyflower (*Mimulus gemmiparus*)
- Dwarf raspberry (*Rubus arcticus* ssp. *acaulis*)
- Autumn willow (*Salix serissima*)
- Lesser bladderwort *(Utricularia minor)*
- Selkirk violet (*Viola selkirkii*)

Group 3: Species occupying fens

- Lesser-panicled sedge (*Carex diandra*)
- Sphagnum (peat moss) *(Spahgnum angustifolium)*

Group 4: Species occupying aspen groves, conifer forests and meadows

- Fork-leaved moonwort (*Botrychium furcatum*)
- Slender moonwort (*Botrychium lineare*)
- Yellow lady's-slipper (*Cypripedium calceolus* ssp. *parviflorum)*

Other species of local concern that occur or may occur in the project area are: *Aletes humilis*, (formerly Sensitive), any *Botrychium* species, *Cornus canadense* , *Cypripedium fasciculatum* (formerly Sensitive), *Goodyera repens, Lilium philadelphicum, Listera convallarioides, Listera borealis, Lycopodium annotinum, Petasites sagittatus, Pyrola picta*, and any fern species, including *Asplenium septentrionale, Cysopteris montana, Polypodium saximontanum,* and *Pellaea atropurpurea*.

Land uses and natural events within and adjacent to the project area have included: subdivision development and home construction on private land; cattle grazing; recreation activity; vegetation management on private lands; wildfire; prescribed fire; fire suppression; spruce budworm outbreaks; utility corridor construction; and road construction and maintenance. These historic and recent uses, and natural events, have resulted in ground disturbance, vegetation removal, soil displacement and compaction, hydrological alteration, and modification of the overstory and understory vegetation structure. These impacts have enabled the establishment and spread of several noxious weeds, which are defined as alien, introduced, or exotic undesirable plant species that are adventive, aggressive, and overly competitive with more desirable species (USDA Forest Service 2001).

Noxious weed surveys were conducted by the District Botanist and seasonal botany crews as part of the project botanical resources inventory. Based on 2008 surveys, weeds are documented in units 3, 6, 7, 8, 9, 10, 11, 13, 15, 17, 20, 21, and 23. Abundance and extent of invasive infestations range from a few plants to large patches to individuals scattered over a large area, depending on species, location, site disturbance, and plant growth habit. Noxious weeds known to exist in or near the project area include: Dalmatian toadflax *(Linaria dalmatica),* Canada thistle *(Cirsium arvense),* musk thistle *(Carduus nutans),* cheatgrass *(Bromus tectorum),* and common mullein *(Verbascum thapsus)*. Dalmatian toadflax, Canada thistle, and musk thistle are Colorado List B species, meaning that state weed management plans have been or will be developed to stop the spread of these species. Cheatgrass and common mullein are Colorado List C

species, for which the state will provide resources to local governing bodies that choose to require management of these species.

Dalmatian toadflax, found in units 21 and 23, is a priority species for treatment on the Forest. Treatment of Canada and musk thistle depends on the specific locations and available resources. Common mullein is widespread and not a priority for treatment. Smooth brome, not a Colorado designated noxious weed but which can be invasive, was encountered in one unit, and is not a priority for treatment. Noxious weed occurrences found in Units 7, 8, 9, 10, 11, and 13 are higher priorities for treatment and prevention of spread due to their proximity to the Comanche Peak Wilderness area.

Alternative 1 – No Action
Direct and Indirect Effects

Threatened Plant Species

No occurrences of Ute ladies'-tresses orchid or Colorado butterfly plant are known in the project area, and occurrence in the project area is unlikely due to limited areas that could contain suitable habitat Implementation of the No Action alternative would result in no direct or indirect impacts from project activities because activities would not occur.

Implementation of the No Action Alternative could result in continued accumulation of hazardous fuels within the project area, increasing the potential for high-intensity, high-severity wildfire. Wildfire could potentially burn with high severity in densely vegetated areas, and there is the potential for high tree mortality associated with crown fire and overstory removal. If present in adjacent areas, individual plant species could be injured or destroyed from burning, falling trees, and loss or degradation of habitat through change in light and hydrological regimes associated with removal of overstory vegetation. Fire would be expected to decrease in intensity and severity (or become extinguished) in open, wet, inundated areas where this species could occur. During extreme drought conditions, wetter areas that could support this species may burn with higher intensity and severity. Indirect effects of a wildfire on these species, if present, could include reduced water quality due to sediment loading and ash deposition into watercourses and riparian areas, and increased susceptibility to noxious weed invasion. In the absence of wildfire, none of the above-described potential effects would occur.

Although the No Action Alternative could increase the potential for a high-intensity, high-severity wildfire, the likelihood of a wildfire occurring is uncertain and unpredictable. Based on this and the low likelihood of the species occurring in the project area, effects under this alternative to Ute ladies'-tresses orchid and Colorado butterfly plant are extremely unlikely to occur and therefore considered discountable. Based on the above discussion, it is determined that Alternative 1 may affect, but is not likely to adversely affect Ute ladies'-tresses orchid or Colorado butterfly plant.

Alternative 2 – Proposed Action
Direct and Indirect Effects

Potential habitat for these species in the project area is limited by elevation and relative scarcity of perennial water and suitable wet meadows in treatment units; however habitat that could support these species may occur in several treatment units. Wet meadows would be avoided and buffered by 100 feet for mechanical treatment and avoided during manual treatments. Surveys will be conducted in all potential habitat prior to project implementation, and if any plants are found, project design criteria provide for avoiding impacts during project activities.

Reasonably foreseeable future activities occurring on non-federal lands in the vicinity of the project area include residential development, motorized and non-motorized recreation, cattle grazing, road building and maintenance, utility infrastructure development, insect activity, increases in invasive plants, and fuel reduction.

Because effects for Alternative 1 are considered to be discountable based on the above analysis, this project is not expected to make a measurable contribution to positive or negative cumulative effects. Because Alternative 2 will not affect Ute ladies'-tresses or Colorado butterfly plant or their habitat, the Proposed Action is not expected to contribute to cumulative effects for this species.

Based on the above discussion, it is determined that Alternative 2 will have no effect to Ute ladies'-tresses orchid or Colorado butterfly plant.

Alternative 1 – No Action
Direct and Indirect Effects

Group 1 – Species Occupying Rock Outcrops

Implementation of the No Action Alternative would result in no direct or indirect impacts from project activities because activities would not occur.

Colorado tansyaster was not found in the project area; however, suitable habitat was observed. The hybrid between rock cinquefoil and straggling cinquefoil occurs in units 8, 11, 12, 13 (nearby, not in unit), 21, and 24. Occurrences of either or both species could be present but undetected in the project area.

Implementation of the No Action Alternative could result in continued accumulation of hazardous fuels within the project area, increasing the potential for high-intensity, high-severity wildfire. In the event of wildfire, individuals of rock cinquefoil, the hybrid between rock cinquefoil and straggling cinquefoil, and Colorado tansyaster could be directly affected by flames burning plants, potentially resulting in mortality in areas with heavy fuel loading. Plants could also be injured by low-intensity flames passing between areas of heavier fuels. These species often occur in areas of sparse vegetation cover, where fire intensity and severity are not expected to be high. For this reason, the possible direct effects of a wildfire on the species are not anticipated to affect the long-term

viability of the species, even though individuals may be injured or destroyed by flames. Indirect effects of a severe wildfire could include soil erosion and increased susceptibility to noxious weed invasion, which could lead to habitat alteration, competition for resources, and ultimately, species displacement. Such effects of noxious weed invasion have been observed at a rock cinquefoil site elsewhere on the Canyon Lakes Ranger District (Ward 2005).

Although the No Action Alternative might increase the potential for a high-intensity, high-severity wildfire, the reality of a wildfire occurring is uncertain and unpredictable. There is the potential for altered light regimes in some areas through increased canopy density over time. Indirect effects if wildfire did not occur could include degradation of habitat through increased canopy cover in some areas, and increased risk of insect attack, but this is not expected to be of a magnitude sufficient to affect the long-term viability of the species in this group.

Group 2 – Species Occupying Riparian Areas, Stream Banks, Springs, and Seeps (and Occasionally Fens)

Implementation of the No Action Alternative would result in no direct or indirect impacts from project activities because activities would not occur.

No Group 2 species (park milkvetch, slender cottongrass, white adder's-mouth, budding monkeyflower, dwarf raspberry, autumn willow, lesser bladderwort, and Selkirk's violet) are known to occur in the project area. It is possible, however, that any of them could occur but have been missed during surveys.

Implementation of the No Action Alternative could result in an increased potential for a high-intensity, high-severity wildfire within the project area, due to continued accumulation of hazardous fuel loads. Heavy fuel loading currently is present within some areas that provide suitable habitat for Group 2 species. Wildfire could potentially burn with high severity through those drainages. There is the potential for high conifer tree mortality associated with crown fire. Severe wildfire could kill or injure Group 2 individuals, if they are present, through burning of plants, crushing by falling trees, and loss or degradation of habitat through changes in light and hydrological regimes associated with removal of overstory vegetation. Loss of aboveground parts of plants due to felled trees or burning would likely have a negligible impact on park milkvetch, if present, because the species appears to spread vegetatively once established (USDA 2002a). Wildfire could have a beneficial effect on autumn willow, if present, by promoting vigorous re-sprouting after fire, as seen in several other willow species (Barro et al. 1989). The remaining Group 2 species, except for budding monkeyflower, are perennial and may re-grow if above-ground parts are crushed but below-ground parts remain intact.

The magnitude of wildfire effects would be expected to be lower in areas of suitable habitat for Group 2 species than in adjacent uplands, because hydrological conditions tend to lessen fire severity. Indirect effects of wildfire on Group 2 species, if present, may include increased sediment loading into watercourses and riparian areas, erosion,

soil degradation through nutrient loss and hydrophobicity in areas of high-intensity fire, and noxious weed invasion in disturbed areas. Although there is potential for effects to occur associated with wildfire under the No Action Alternative, direct and indirect effects would not likely be of a magnitude sufficient to result in an adverse impact to the long-term viability of Group 2 species if present. Wildfire intensity within suitable habitat would be expected to minimally impact individuals of Group 2 species that may be present. For these reasons, the No Action Alternative (if wildfire occurred) would not be expected to threaten the viability of Group 2 species in the project area.

Although the No Action Alternative could increase the potential for a high-intensity, high-severity wildfire, the reality of a wildfire occurring is uncertain and unpredictable. If wildfire did not occur, fuel loading would continue to increase over the long term in adjacent mixed-conifer stands and insect invasion would continue to pose a risk to upland overstory vegetation. Fuel buildup and insect attack is generally less of an issue in habitat suitable for Group 2 species. The No Action Alternative, if wildfire did not occur, could result in continued conifer encroachment into wet/mesic aspen stands and riparian areas, which provide suitable habitat for Group 2 species. Modifications in light regime are possible through increased tree density and canopy cover as fuels in adjacent mixed-conifer forest accumulate. Over long periods of time, these changes could result in habitat degradation, especially if mesic sites dry out and habitat is lost. Under continuing mesic to wet conditions, conifers are not likely to establish to such an extent that the viability of Group 2 species would be threatened. For these reasons, implementation of the No Action Alternative, if wildfire did not occur, would not be expected to compromise the viability of Group 2 species on the Planning Area.

Group 3 – Species Occupying Fens

Implementation of the No Action Alternative would result in no direct or indirect impacts from project activities because activities would not occur.

No Group 3 species (lesser-panicled sedge and sphagnum) were found during botany surveys of the project area. It is possible that either of these species could occur but have been missed during surveys. Habitat for sphagnum was observed in one treatment unit during 2008 surveys. It is likely that lesser-panicled sedge is absent from the project area, but since it may occur in a range of habitats, it is possible that it is present.

Implementation of the No Action Alternative could result in continued accumulation of hazardous fuels within the project area, increasing the potential for high-intensity, high-severity wildfire. Wildfire could potentially burn with high severity in densely vegetated areas, and there is the potential for high tree mortality associated with crown fire and overstory removal. If present, sphagnum or lesser-panicled sedge individuals could be injured or destroyed through burning of plants, falling trees crushing plants, and loss or degradation of habitat through change in light and hydrological regimes associated with removal of overstory vegetation. These effects would likely have a negligible impact on populations, however, because fire would be expected to decrease in intensity and severity (or become extinguished) in wet, inundated areas. However, during extreme

drought conditions, peat or other organic substrates in fens and other wetlands may ignite and burn for long periods of time, damaging species and habitat.

Indirect effects of a wildfire on Group 3 species, if present, could include reduced water quality due to sediment loading and ash deposition into watercourses and riparian areas, and increased susceptibility to noxious weed invasion. Although there is potential for effects to occur associated with wildfire under the No Action Alternative, there is a low likelihood that Group 3 species are present within the project area because there are few potential areas of suitable habitat.

Based on the above discussion, direct and indirect effects would not likely be of a magnitude sufficient to result in an adverse impact to the long-term viability of any Group 3 species.

In the absence of wildfire, the current condition of suitable habitat for Group 3 species is expected to be maintained, and no impacts to these species are anticipated. Although fuel loading would continue to increase in mixed-conifer stands and insect invasion would continue to pose a risk to upland overstory vegetation, suitable habitat for Group 3 species would not be expected to be affected, because ponds and marsh/fen-like inclusions within riparian areas and conifer forest would not support the heavy fuel loading expected in adjacent mixed-conifer forest. Modifications in light regime are possible through increased tree density and canopy cover as fuels in adjacent mixed-conifer forest accumulate; however these effects would not be of a magnitude sufficient to impact the long-term viability of Group 3 species in the project area.

Group 4 – Species Occupying Aspen Groves, Conifer Forests, and Meadows

Implementation of the No Action Alternative would result in no direct or indirect impacts from project activities because activities would not occur.

No Group 4 species (fork-leaved moonwort, slender moonwort, and yellow lady's-slipper) were found during botany surveys of the project area; however, it is possible that plants were missed during surveys. Due to their diminutive size and ephemeral nature, moonworts could have been missed during surveys. Yellow lady's-slipper could also have been missed due to survey timing or low detectability of plants because above-ground parts do not appear every year and most known occurrences are reported to have fewer than 10 individuals (Mergen 2006).

If wildfire occurs, individual moonworts or yellow lady's-slipper, if present, could be directly affected by flames burning above-ground plant parts. In areas of heavy fuel loading where high-severity fire would be expected, mycorrhizae and other below-ground parts could be damaged or killed by hot temperatures penetrating the soil, potentially resulting in mortality of the entire above- and below-ground plant structures. Although loss of above-ground parts is not detrimental to individual moonwort plants, loss of below-ground structures generally results in complete loss of the plant. Loss of below-ground parts of yellow lady's-slipper is detrimental since it is also dependent on mycorrhizae. In more open-canopied areas where moonworts typically occur, fire

severity would be expected to be low, due to relative lack of fuels. Above-ground parts could be injured by low-intensity flames passing through an area, while below-ground structures could remain intact. In aspen stands and other moist areas where yellow lady's-slipper is more commonly found, fire severity would be expected to be low; however the species also occurs in less moist habitats with greater potential for higher fire severity.

Indirect effects of the No Action Alternative, if wildfire were to occur, may include soil erosion and vulnerability to noxious weed invasion. The possibility of wildfire under the No Action Alternative could affect individuals of Group 4 species, but this possibility is not considered to be of a magnitude sufficient to affect the long-term viability of the three Group 4 species in the project area. Wildfire could potentially have a long-term beneficial effect on moonworts, if present, through the creation of additional suitable habitat.

In the absence of wildfire, conifer encroachment into aspen stands and fuel loading in conifer forests would be expected to increase in the long term. Increased tree density within suitable habitat for Group 4 species could cause alteration of light, hydrological and soil regimes, degrading habitat and potential occurrences over time. The effects of this are considered inconsequential for moonworts in the foreseeable future, because the areas of suitable habitat within the project area are naturally relatively open, and it is unlikely that fuel loading would occur to a level where occurrences of moonworts, if present, would be shaded by adjacent fuels to the extent that viability of the species within the project area would be compromised. Also, it is assumed that fuels would not continue to accumulate in all areas of suitable habitat indefinitely, given resource limitations, competition between species, and soil and moisture conditions that would restrict heavy fuel loading in certain areas of suitable habitat – for example, very wet aspen stands with hydric soils that restrict conifer tree establishment. Depending on frequency and intensity, wildfire may have beneficial or detrimental impacts, or a combination, to yellow lady's-slipper and its habitat (Mergen 2006).

Insect invasion within conifer forest could also affect suitable habitat for Group 4 species by resulting in higher tree mortality and ultimate crushing of plants due to weakened, dead trees falling into occupied habitat. Although impacts to Group 4 plants are possible if these species are found to occur within the project area, it is unlikely that habitat alteration under the No Action Alternative (if wildfire did not occur) would be of a magnitude sufficient to compromise the viability of any of these species within the planning area or across their range in the foreseeable future.

Alternative 2 – Proposed Action
Direct and Indirect Effects

Alternative 2 proposes treatments that would emphasize thinning primarily smaller-diameter conifer trees. Riparian areas, wetlands, fens, wet meadows, seeps, and springs would be excluded from mechanical fuels treatment, and all of these except riparian areas would also be excluded from manual treatment. Where riparian areas would be treated

manually, riparian vegetation will not be cut. Design criteria incorporated into the Proposed Action (refer to Chapter 2 of the EA) require that any impacts to occurrences of the Sensitive species yellow lady's-slipper be avoided. Design criteria also require excluding areas of known or discovered populations of other Sensitive species, if determined necessary by a Forest Service botanist.

Group 1 – Species Occupying Rock Outcrops

Colorado tansyaster was not found in the project area; however suitable habitat was observed. The hybrid between rock cinquefoil and straggling cinquefoil occurs in units 8, 11, 12, 13 (nearby, not in unit), 21, and 24. Occurrences of either or both species could be present but undetected. Implementation of project design criteria would avoid or minimize losses of individuals in most cases. Most of the areas of concentration of the *Potentilla* hybrid plants would be flagged in the field and avoided during project implementation. However, not all individual plants may be included in the treatment exclusions, so some plants would most likely be damaged by trampling, crushing by moving felled trees, or pile burning.

Pile burn sites for slash disposal could have direct effects to individuals, where present, by burning plants if piles are placed on or within flame length of occurrences. Indirect negative effects associated with thinning, burning, and slash disposal may include changes in light regime through overstory removal and thinning, habitat degradation associated with soil compaction and displacement (from vehicles and personnel), and increased susceptibility to noxious weed invasion as a result of ground disturbance and native vegetation removal. No occurrences of the species were found in Unit 18 which is proposed for broadcast prescribed burning; however, the large surrounding secondary burn area in this unit was not surveyed, and populations could occur.

Although direct and indirect effects to Group 1 species are possible as a result of the Proposed Action, potential project impacts would likely be limited to a few individuals. Therefore, potential impacts from Alternative 2 are not considered of a sufficient magnitude to threaten the viability of these species in the project area in the short or long term.

Fuels treatment activities throughout the project area could be indirectly beneficial to known or discovered occurrences and habitat for Group 1 species by reducing the risk of high-intensity, high-severity wildfire that could spread into occupied or suitable habitat and adversely impact individuals or populations.

Group 2 – Species Occupying Riparian Areas, Stream Banks, Springs, and Seeps (and Occasionally Fens)

No occurrences of Group 2 species were found during botany surveys. Possible direct and indirect effects are discussed here for Group 2 species that may be found during future surveys or may have been missed during surveys.

Under the Proposed Action, all riparian areas, fens, wetlands, wet meadows, seeps, and springs would be excluded from mechanical fuels treatment and also buffered, which would mean limited potential for direct impacts to areas of potentially suitable habitat for Group 2 species. Limited impacts may occur due to tree felling into these areas.

Impacts to Group 2 species individuals or suitable habitat from hand treatment activities are possible. Fens, wetlands, wet meadows, seeps, and springs are excluded from manual treatment; however manual treatments (tree cutting) may occur in riparian areas. Proposed fuel reduction treatments could involve incidental adverse impacts to Group 2 plants, if present, through crushing by falling trees or trampling by implementation personnel. Dragging of slash through habitat could also damage plant individuals. Indirect effects of thinning activities could include modification of light and moisture regimes associated with removal or reduction of canopy cover, habitat degradation involving soil disturbance and associated native vegetation removal, and increased risk of noxious weed invasion and native plant displacement in disturbed areas. Although these impacts are possible, it is likely that only a few individuals within an undetected occurrence would be affected, and no threat to viability of the eight Group 2 species in the project area is anticipated.

Fuel treatment activities in upland vegetation, including manual and mechanical treatment, could be indirectly beneficial to Group 2 species, if present, by reducing the risk of high-intensity, high-severity wildfire that could spread into suitable habitat and have a potentially adverse impact on species individuals or populations. Upland treatments, however, could also encourage the spread of noxious weeds potentially affecting habitat.

Group 3 – Species Occupying Fens

No Group 3 species (lesser-panicled sedge and sphagnum) were found during botany surveys of the project area, and no fens were observed. It is possible that either of these species, or fen habitats, could occur but have been missed during surveys. Habitat for sphagnum was observed in one treatment unit during 2008 surveys. It is likely that lesser-panicled sedge is absent from the project area, but since it may occur in a range of habitats, it is possible that it is present.

Under the Proposed Action, all riparian areas, fens, wetlands, wet meadows, seeps, and springs would be excluded from mechanical fuels treatment and also buffered, which would limit potential for direct impacts to areas of potentially suitable habitat for Group 3 species. Limited impacts may occur in the unlikely event a tree is felled into these features.

Impacts to Group 3 species individuals or suitable habitat from hand treatment activities are possible. Fens, wetlands, wet meadows, seeps, and springs are excluded from manual treatment; however manual treatments may occur in riparian areas. Group 3 species not detected during botany surveys could be crushed by trees falling from adjacent thinning units or trampled by implementation personnel. Dragging of slash through habitat could

also damage plant individuals and habitat. Indirect effects of thinning activities could include modification of light and moisture regimes associated with removal or reduction in canopy cover, habitat degradation involving hydrological alteration, erosion and compaction, and increased risk of noxious weed invasion. Although these impacts are possible, there is a low likelihood that they would occur. In addition, there is a low potential for the two plants in Group 3 to occur, and if they are present, only a few individuals within an undetected occurrence would be expected to be affected. Therefore, no threat to Group 3 species viability in the project area is expected as a result of treatment activities.

Fuel treatment activities in upland vegetation could be indirectly beneficial to Group 3 species, if present, by reducing the risk of high-intensity, high-severity wildfire that could spread into suitable habitat and have a potentially adverse impact on species individuals or populations.

Group 4 – Species Occupying Aspen Groves, Conifer Forests, and Meadows

No Group 4 species (fork-leaved moonwort, slender moonwort, and yellow lady's-slipper) were found during botany surveys of the project area. It is possible that plants were missed during surveys. Due to their diminutive size and ephemeral nature, moonworts could have been missed during surveys. Yellow lady's-slipper could also have been missed due to survey timing or low detectability of plants because above-ground parts do not appear every year and most known occurrences are reported to have fewer than 10 individuals (Mergen 2006).

In areas proposed for thinning, plants of the three Group 4 species, if present, may be impacted by alteration of light regimes through overstory removal, crushing of individuals by felled trees, trampling of plants by personnel or equipment, and hydrological or soil disturbance. Mechanical treatment may cause indirect effects including downstream sediment loading, erosion, and alteration of hydrology. Design Criteria incorporated into the Proposed Action provide for minimizing soil displacement and other disturbance, which would also minimize impacts to above- and belowground moonwort and orchid structures that may be present. Based on the Proposed Action, including Design Criteria, and survey efforts, these effects are not considered of a sufficient magnitude to negatively affect Group 4 species viability because they would be incidental and localized in nature.

It is possible that moonworts, if present, could be adversely affected by ground disturbance during treatment, but there could be a long-term beneficial effect (several decades after disturbance, depending on site conditions), through the creation of additional suitable habitat. Several occurrences of slender moonwort have been observed at sites where ground disturbance has historically occurred, despite a possible loss of individuals at the time of disturbance (Popovich 2004).

Proposed pile burning to dispose of slash could damage mycorrhizae and other below-ground moonwort and orchid parts through soil sterilization associated with high

temperatures penetrating the soil surface. Above-ground parts could also be burned within pile sites. Given the habitat variability of moonworts, suitable and potentially occupied habitat for the species could be directly impacted by pile burning, but given the low likelihood that the species occurs and the probability that only a few individuals would be incidentally impacted, no threats to long-term viability are expected. Yellow lady's-slipper habitat is also variable; however the most common habitats on the Forest are aspen stands, and in Region 2 the species is more common in areas with moist to saturated soils. Design criteria provide for minimizing impacts to these areas, including avoiding piling in them. Based on these factors, potential impacts to yellow lady's-slipper are not expected to threaten long-term viability.

Potential effects to moonworts and yellow lady's-slipper, if present, from the distribution of chipped and masticated slash material could include crushing or smothering of aboveground parts as mats of processed slash are distributed. However, it is probable that only a few undetected aboveground individuals would be impacted by chipped and masticated material, given the lack of known occurrences of Group 4 species in the project area. Project design includes direction for avoiding wet areas and aspen stands when distributing chipped and masticated material, and distributing these materials in discontinuous and shallow mats to minimize impacts to soil and native vegetation. Due to the lack of known occurrences and the potential for a small number of individuals to be impacted by these activities, the potential effects of slash disposal under the Proposed Action are not anticipated to be of a magnitude sufficient to impact long-term viability of Group 4 species.

Under the Proposed Action, aspen enhancement activities may occur within treatment units, primarily in about 210 acres of Unit 6. This would involve conifer removal within and along the perimeter of aspen stands to promote proliferation of the stand and reduce long term conifer encroachment. Aspen stands may support occurrences of slender moonwort and yellow lady's-slipper. Aspen enhancement activities could potentially impact undetected occurrences of these species by felled conifers crushing plants within the aspen stand and foot trampling by implementation personnel. Project design provides for manual treatment only within aspen stands, lopping and scattering of slash (no piling and burning), and minimizing impacts from ATV use.

Fuel treatment activities in upland vegetation could be indirectly beneficial to Group 4 species, if present, by reducing the risk of high-intensity, high-severity wildfire that could spread into suitable habitat and have a potentially adverse impact on species individuals or populations. Yellow lady's-slipper may benefit from some canopy removal (Mergen 2006).

Cumulative Effects for Sensitive Plant Species

The overall landscape in the project area and surroundings has been changed considerably from pre-settlement conditions. Past, present, and reasonably foreseeable future activities that could affect plants and habitat include past firewood cutting and timber harvest, and the following activities that are past and ongoing: motorized and

non-motorized recreation, residential development, cattle grazing, road building and maintenance, use and construction of recreational facilities, commercial outfitter use, utility infrastructure development, fuel reduction, wildfire, and prescribed fire. All of these activities have the potential to negatively affect Sensitive plants or their habitats directly through disturbance of individual plants and indirectly through habitat degradation.

Through the suppression of wildfires, vegetation and stand structural diversity have been altered. It is expected that wildfires would continue to be suppressed in the future to protect other resource values and uses and continued fire suppression would likely result in increasing stand density over time.

Cumulative effects of agency and private actions across the landscape combine with natural disturbances to reduce or accentuate overall impacts. In the project area, past natural disturbances include insect outbreaks that changed the stand structure in portions of the forest, and wildfires. Nonnative, invasive plant species with the potential to displace native species have invaded disturbed areas. Insect outbreaks and invasive plant species invasions are ongoing.

Activities occurring on the Canyon Lakes Ranger District contributing to cumulative impacts include:

- Impacts from recreation use, especially motorized recreation, throughout the landscape are significant at this time. Many roads are in poor condition. The resulting erosion affects streams and vegetation. Residential development has increased in the past several decades.
- Future impacts are expected from increased recreational use, new road construction, insect infestations, continued development on private land in the wildland-urban interface areas, further development of utilities and water resources, and thinning and timber harvest on public and private lands.

In general, effects to sensitive plant habitat and any plants present in the area, as well as plant species and communities of local concern, can be expected to increase over time. Activities under the proposed action will add to the level of disturbance across the landscape. Disturbance may benefit some sensitive and rare species, such as moonworts, which require openings for establishment. For other species, continued and future activities are likely to reduce or degrade sensitive species habitat and could damage or destroy individual sensitive plants present in the project area.

Based on the above discussion, Alternative 1 - No Action may adversely impact individuals, but is not likely to result in a loss of viability in the project area, nor cause a trend toward federal listing of Groups 1, 2, 3, and 4.

Based on the above discussion, Alternative 2 - Proposed Action may adversely impact individuals, but is not likely to result in a loss of viability in the project area, nor cause a trend toward federal listing of Groups 1, 2, 3, and 4.

Effects to Plant Species and Communities of Local Concern - Alternatives 1 and 2

Two plant species of local concern were identified during the 2008 surveys: forked spleenwort (Asplenium septentrionale) and Rocky Mountain polypody (Polypodium saximontanum). Both of these species are found on rock outcrops within open mixed conifer forest. Potential impacts from the No Action Alternative and the Proposed Action would be expected to be similar to impacts described above for Group 1 Sensitive plant species. If additional occurrences of local concern plant species are found, Design Criteria provide for Forest Service botany personnel to determine protection measures if appropriate.

The plant community *Muhlenbergia Montana – Hesperostipa comata* that occurs in the True Gulch PCA near the eastern edge of the Unit 18 Secondary Burn area could be adversely impacted by burning if cheatgrass is present in or near the community. Because active ignition would not occur in the secondary burn area and the community is approximately one mile from the primary burn boundary, it is unlikely that prescribed fire would reach this area. As a precaution, design criteria provide for additional field surveys to determine whether a larger area needs to be excluded from the Secondary Burn area to protect this rare plant community from encroachment by cheatgrass.

Invasive Plants/Noxious Weeds – Alternatives 1 and 2

Implementation of the No Action Alternative could result in continued accumulation of hazardous fuels within the project area, increasing the potential for high-intensity, high-severity wildfire. In the event of wildfire, noxious weeds, particularly cheatgrass, would be expected to spread for reasons discussed below regarding prescribed fire. If wildfire occurs, which is uncertain, depending on the intensity, severity, and extent, which are impossible to predict, noxious weed introduction and spread could be greater or less than under Alternative 2. Without wildfire, the No Action Alternative would not introduce or spread noxious weeds because project activities would not occur.

Project activities under the Proposed Action Alternative are expected to increase the risk of introduction and spread of noxious weeds/invasive plants. This risk is greater where: 1) weeds, especially high priority species, already occur in or near proposed treatment units; 2) project activities involve use of ground-based equipment versus hand crews; 3) project activities involve creation (including temporary) of fire lines, burn piles, and other areas of soil disturbance; 4) where treatments open up the forest canopy the most, because most weed species grow well in open areas; and, 5) where broadcast prescribed fire is used.

Fire tends to release nutrients from the soil and encourages the growth of noxious weeds. Nutrient release may also promote growth of native species, but since natives are rarely nutrient- limited, post-fire responses are often less dramatic than those of noxious weeds. While all noxious weeds species are likely to be stimulated by and spread after prescribed burning under Alternative 2, cheatgrass is particularly adapted to proliferate after fire.

Cheatgrass occurs in Unit 18, the only unit proposed for broadcast prescribed fire. Cheatgrass is difficult to eradicate and is not generally considered a priority for treatment. However, it can be a serious threat to native plant communities and is likely to increase with fuel reduction treatment, especially prescribed burning.

Any ground disturbance increases the risk of invasion, establishment, and spread of noxious weed species. Use of large mechanical equipment is likely to create greater disturbance than thinning by hand. In hand crew treatment areas, the primary areas for weed establishment and spread are burn piles. Manual and mechanical thinning treatments are expected to result in less weed establishment and expansion than broadcast prescribed burning. Manual and mechanical thinning of upland vegetation may result in less weed establishment and spread than a severe wildfire. Project Design Criteria include measures to reduce the risk of establishment and spread of noxious weeds from project activities proposed under Alternative 2.

For cumulative impacts on noxious weed infestations, the analysis area is considered to be the Glen Haven analysis area. Past, present and reasonably foreseeable activities are listed under Cumulative Effects for Sensitive Plant Species above. Cumulatively, past and ongoing activities have resulted in soil disturbance, native vegetation removal, modification of hydrology, and the establishment of several noxious weed infestations throughout the project area. Given the projected continuation of these impacts, it is reasonably foreseeable that noxious weed infestations would continue to increase in the future. Continued fuel loading would also increase the potential for a high-severity and/or high-intensity wildfire that would create potential for noxious weed increases.

Rangeland Resources

Affected Environment

The desired condition of livestock grazing management is to provide available forage for both wildlife and domestic livestock in a manner consistent with other resource objectives and environmental constraints. The Dunraven Allotment is the only active grazing allotment that overlaps some or all of treatment units 16, 17, and 18 in the Glen Haven Fuels Reduction Project. The Dunraven Allotment has recently been analyzed as part of the Thompson Area Grazing Allotments Environmental Assessment and a decision was signed on September 28, 2009. The proposed action calls for a modification of the Dunraven Allotment boundary. When the boundary change is adopted, only treatment units 16 and 18 would fall within the allotment. Currently, 50 cow/calf pairs are authorized to graze from June 1 to November 15 by one local permittee.

Alternative 1 – No Action
Direct and Indirect Effects

There would be no impact on the existing grazing permittee or authorized grazing uses. Current livestock grazing management would continue as directed by a Decision Notice,

which would be administered by a ten year Term Grazing Permit. Because no fuel reduction activity would take place under this alternative, greater probability exists for high-intensity wildfires to occur. If a significant wildfire occurs, it could adversely affect livestock grazing and rangeland resources through reduced forage and potentially a need to remove livestock from burned areas for longer periods of recovery time.

Alternative 2 – Proposed Action
Direct and Indirect Effects

Implementation of the broadcast burn in Unit 18 would have little to no effect on livestock grazing in the Dunraven Allotment because grazing rarely occurs in this part of the allotment. Implementation of thinning in Unit 17 would have no impact on livestock grazing as grazing does not occur on this part of the allotment. In addition, when the boundary changes proposed in the Thompson Area Grazing Allotments project are adopted, the Dunraven Allotment will be excluded from Unit 17.

Unit 16 overlaps the area where livestock grazing and travel to and from various water sources occurs most frequently. Implementation of thinning operations during the permitted grazing season (June 1 to November 15) should be closely coordinated with the grazing permittee and range specialist to make any necessary adjustments to allotment use. Impacts of crews working on the allotment could include gates left open for livestock to drift outside allotment boundaries and damage to fences or exclosures. Openings created by vegetation thinning and prescribed burns may have a beneficial impact by increasing available forage to livestock grazing.

Social

Scenery

Affected Environment

The landscape is a typical 'Western' landscape with various pines and aspen interspersed with rock outcrops and high mountains as a backdrop. For many people it is a good contrast to the urban development in the Colorado Front Range metropolitan area because it seems 'wild' and 'natural'. The project area is a favorite and readily accessible recreation outlet for locals and those from the Front Range. The project area is adjacent to northeast corner of Rocky Mountain National Park and U.S. Highway 34, one of the major access routes to the park, serves as the south boundary.

The viewshed of the project area is in the 'M331 Southern Rocky Mountain Steppe – Open Woodland – Coniferous Forest – Alpine Meadow' sub region (Bailey et al., 1994). The region is further subdivided into the ecological 'subsection' of M331Ib—The Northern Front Range. The sub region and subsections are oriented north-south in this area. The subsection varies from the highest elevations of the mountain peaks (over

14,000 feet) down to the 'Foothills' subsection at approximately 6,000 feet where the vegetation changes to grasses, shrubs and open stands of ponderosa pine.

The major vehicular access to the project area is provided by US Highway 34 and Larimer County Road (LCR) 43. Major collector roads that access the project area include LCR 51B (the Dunraven Glade Rd.), and NFSR 128 (the Cedar Park Rd). Minor collector roads include NFSR 326 and 405. In addition, there are some primitive local roads which enter the area.

Numerous hiking trails traverse the project area including the popular North Fork Trail and the Crosier Mountain Trail system. In addition to these Forest Service maintained trails, there are informal, or social trails that cross National Forest land.

There are many residential developments in the area containing both year-round and seasonal residences. Those around Drake, Cedar Park, Glen Haven and the areas of the North Fork of the Thompson River all have views of parts of the project area. Some service development occurs in the area--small stores, restaurants, 'dude' ranches and summer activity camps.

One overriding influence is Rocky Mountain National Park (RMNP). The eastern side of RMNP with its many day-use and overnight facilities and the tourist-dependent town of Estes Park are just a few miles north of the project area. Over 3 million people a year visit RMNP and three developed campgrounds are located on the east side near Estes Park. Estes Park itself has a permanent population of about 10,000, but in the summer that population swells to about 50,000.

Scenic Integrity is a measure of the degree to which a landscape is visually perceived to be 'complete'. The highest scenic integrity ratings are given to those landscapes which have "little or no deviation from the character valued by constituents for its aesthetic appeal" ('Landscape Aesthetics', Agriculture Handbook # 701). Scenic Integrity Objectives (SIO) for the project area are designated in the Forest Plan and are assigned a rating of low, moderate, high, and very high.

The scenic integrity of the project area is primarily influenced by natural forces such as insect and disease outbreaks, wind throw and wildfire. The Bobcat Fire in the northeastern segment of the project area is visible from many vantage points, but no major points or travel corridors. There have been fires on Crosier Mountain (both wild and prescribed) that are not visible from major travel routes, but can be viewed from portions of the Crosier Mountain Trail. Previous timber harvests have been infrequent and are not visually evident. The scenic integrity of the area is also influenced by human development such as residential and tourism development as well as grazing and water development.

The existing Scenic Integrity Objective (SIO) for the project area is briefly described below:

- "Low" SIO (a small portion of the area along the Lookout Mountain and Storm Mountain ridge). The landscape character of Low SIO can be moderately altered. Deviations can begin to dominate, but should be compatible with the valued landscape character.
- "Moderate" SIO (the majority of the project area). In this designation, the valued landscape character can appear slightly altered and where "noticeable deviations must remain visually subordinate to the landscape character being viewed."
- "High" SIO (the portion of the project area alongside US Hwy 34 and the Big Thompson River Canyon. The High SIO is defined as landscapes where the valued landscape character appears unaltered. "Deviations may be present, but must repeat the form, line, color, texture, and pattern common to the landscape character so completely and at such a scale that they are not evident."
- "Very High" SIO (the area within the Comanche Peak Wilderness). Within this SIO, the valued landscape character is 'unaltered'; where "the valued landscape character is intact with only minute if any deviations."

Alternative 1 – No Action
Direct and Indirect Effects

Under the No Action Alternative, current management activities would continue. The landscape would either undergo ecological change or change from those management activities already planned. It would continue to show the effects of fire suppression and recreation impacts. Effects would include a forest more dense with vegetation from fire suppression and more soil compaction, erosion, tree scarring and littering from recreation. Areas of previously treated timber harvest, prescribed fire or wildfire would continue their regeneration and would eventually be considered visually 'recovered' (meaning the area is well-stocked according to the Forest Plan and trees are 20' high). Existing thinned areas will be moderated in their visual nature in that stumps and slash resulting from thinning activities will become less noticeable.

Alternative 1 would have short-term negligible impacts on the scenery of the project area. The stability of the landscape would decrease. However, the impacts could be major and adverse if a large wildfire were to occur.

Alternative 2 – Proposed Action
Direct and Indirect Effects

Alternative 2 proposes thinning and prescribed burning. Slash treatment would include chipping, mastication, lop and scattering and pile burning. The visual effects of this action would be greater interforest visibility and a greater variety in forest vegetation. In the thinned areas, fresh-cut stumps, slash, chips, burn pile scars and broadcast burn areas

would be noticeable in the short term, but this evidence of activity would fade rapidly and not be noticeable to the casual forest visitor after one or two growing seasons. The treatments in and around aspen stands would have minimal visual impact except in the immediate foreground and ultimately encourage aspen spread. These treatments combined would likely lessen the potential for wildfire and its negative visual implications for adjacent communities and cultural developments.

The slash treatments of lopping and scattering, chipping, masticating and piling and burning should not have long-term repercussions for the scenery resource. Burn pile size is limited by design criteria and the majority would be burned after one year. Some piles would be left for wildlife, but these would not dominate the landscape and would be located out of sight of sensitive viewpoints along roads and use areas wherever possible. The long-term visual impact of the burn areas themselves is not expected be noticeable to the casual observer. If chipping or mastication of slash occurs, design criteria are in place to minimize visual effects.

There would be short-term visual impact from the broadcast burn proposed for the area. Initially, blackened boles of trees, singed needles and burned underbrush would be noticeable in the foreground from the Crosier Mountain Trail; however, as the needles drop and grasses and shrubs return, visual effects would become less noticeable. Effects from pile burning would include black circles from pile burns and brown needles on trees adjacent to piles.

Implementation of Alternative 2 would also result in increased openness of the forest and ground disturbance activities would potentially provide greater vegetation variety. Indirect effects would also include a forest that is less susceptible to insects, disease and fire and probably more stable from a visual resources viewpoint because it is less susceptible to drastic change.

Alternative 2 would have minor adverse impacts for the scenery resource in the short and a moderate beneficial impact in the long-term. There will be an increase in the stability of the landscape. Long term effects would include a reduction in the threat of wildfire and greater vegetation diversity. There are no irretrievable or irreversible impacts to the scenery resource.

Cumulative Effects

Projects that are presently active in the vicinity of the project area are the Thompson River Fuel Reduction Project to the southwest, the Estes Valley Fuels Reduction Project to the south, and the Stringtown Gulch Fuels Reduction Project to the north. Activities from these projects are noticeable in the foreground in these areas, but not in the middleground or background and do not violate the SIOs for the area.

Socio-economic

Affected Environment

The Glen Haven Fuels Reduction Project Area is located entirely within Larimer County, Colorado. Larimer County has experienced steady population growth, particularly over the last forty years. In 2008, the estimated population was 292,000 with 70% of that number living in the cities of Fort Collins and Loveland (Compass). Major employers include Colorado State University and several software and computer manufacturing firms. Agriculture, while still a factor in the County economy, is gradually losing ground as lands are developed for housing and water rights are converted from agricultural to municipal use.

When compared to counties nationwide, Larimer County is relatively affluent and educated. According to figures from the 2000 census, the average household income was $60,516. This ranks Larimer County 236th out of the 3,140 counties in the nation. Only 9.2% of County households earn below $16,895 which is considered the poverty level for a family of four. Over 39% of Larimer County residents have received a Bachelor's Degree or higher ranking it 71st out of all the counties in the nation (DataPlace.org).

The main community within the project area is Glen Haven. Settlement of this area and adjacent Estes Park began in the 1870s with the primary land use being cattle grazing. During the early 1900's, the area became a popular tourist destination and construction of summer homes began. The relatively quiet location and cool summer temperatures continue to make the Glen Haven area popular with seasonal residents. Businesses relying on these factors include the Glen Haven General Store, the Inn at Glen Haven and Cheley Camps of Colorado, a summer youth camp. New homes continue to be built in nearby subdivisions such as The Retreat. Some of these are occupied by full time residents that are retired or commute to Estes Park or Loveland, Colorado.

Alternative 1 – No Action
Direct and Indirect Effects

The amount of private homes and infrastructure would be expected to slightly increase or remain the same. Under Alternative 1, no hazardous fuel reduction activities would occur to change wildfire behavior and reduce the risk of economic loss to these areas. The potential loss of or damage to infrastructure such as electrical transmission lines would not be reduced.

Under the No Action Alternative, there would be no direct costs associated with completing the treatments. If no fuel reduction treatments were completed, it is likely that fire suppression costs as well as other economic and social costs would be higher during a wildfire event.

The per acre cost of suppressing wildfires is highly variable. Primary factors that influence costs include number of acres involved, weather conditions, fuel types, the

physical location of the fire (e.g. adjacent to private property), and the tactics used to suppress the fire. Hazardous fuel reduction treatments would be expected to lower the cost of fire suppression based on the assumption that smaller, less intense fires are less expensive to control. Because of the threat to life and property, fire ignitions near subdivisions and developed properties are aggressively suppressed and therefore can have higher per acre costs.

In addition to direct costs of suppression, indirect costs of fires would include temporary reduction in property values, losses of uninsured property, and costs to replace infrastructure such as utility lines, roads and water storage or diversion facilities. Any necessary emergency rehabilitation costs to control erosion and potential damage to watersheds would also increase costs. Because of the variability involved, these indirect costs are difficult to average; however, given the high degree of development within the Glen Haven area, there is potential for a sizable increase to the economic impacts of wildfire.

Visitors to the communities within and adjacent to the Glen Haven Project Area help support the local economies. Large and severe wildfires can eliminate visitation while the fire is actively burning and can reduce numbers of visitors for several years as the visual impacts recover. Any reduction in wildfire potential can lessen the potential for this negative economic effect.

Alternative 2 – Proposed Action
Direct and Indirect Effects

Implementation of Alternative 2 would allow for mechanical hazardous fuel reduction treatments on an estimated maximum of 5,130 acres and 250 acres of broadcast prescribed fire. Much of the mechanical treatment would be along the boundary between private and federal land. Effects to these adjacent landowners would include noise from chainsaws or mechanized equipment during tree cutting operations. There would also be a temporary increase in the amount of traffic on roads used to access the treatment areas. When slash from the tree cutting operations is piled and burned, smoke may be noticeable to private landowners. Depending on the size of the crew or the type of equipment, anywhere from five to forty acres of this type of fuel reduction treatment could be accomplished in a day. Based on this rate, the effects to individual landowners would be short term.

Implementation of broadcast prescribed fire could produce smoke that would be noticeable to residents in the area. Prescribed burns are conducted under weather conditions when smoke would be expected to rapidly disperse; however, there could be instances during a burning period when smoke would be visible to adjacent landowners. These effects would also be short term and infrequent.

The cost of treating the proposed units also has a high degree of variability. If thinning treatments are completed by hand crews with chainsaws, costs are now averaging $600 per acre. An additional $100 per acre is typically required for Forest Service crews to

burn the hand piles. If thinning treatments are completed with mechanized equipment such as tree shears or hydro-axes, costs can average over $900 per acre. With this type of equipment, trees are generally treated in place and there is no follow up piling or burning required.

Again, given the variability involved, it is difficult to directly correlate the number of acres treated with the number of acres that would be burned in a wildfire. However, any reduction in fire size and intensity would show a reduction in fire suppression costs and reduce the potential economic loss of private infrastructure.

Under certain conditions, treatment costs can be partially offset through the sale of forest products and the proposed action considers this possibility. These sales could either be "stewardship" type contracts where the stumpage cost of the product would be used to offset the cost of the treatment, or, sold to a purchaser through the appropriate timber sale contract. Several factors limit opportunities to recover costs from projects located along the Colorado's Front Range. First, the majority of the material that needs to be removed consists of smaller diameter trees. Currently, there is not a high demand locally for products that can be processed from this size of material. Secondly, ponderosa pine and Douglas fir are the main tree species that would be cut. With the exception of firewood and perhaps wood chips or mulch, there are few products that can be manufactured from these trees. Lastly, roads within the Glen Haven Project Area are generally not designed for efficient removal of commercial forest products further limiting options for offsetting treatment costs.

Cumulative Effects

Under the No Action Alternative, hazardous fuel reduction treatments would continue to take place on private property without the benefit of treatments on adjacent National Forest land. If markets develop for products that utilize smaller diameter material such as industrial type pellets for energy, the ability to offset treatment costs would improve. Land that is currently vacant would likely continue to be developed increasing the amount of infrastructure and values at risk to wildfire.

Executive Order 12898, Environmental Justice, requires all federal agencies to consider the effect of a proposed action on low income and minority populations. From the 2000 Census data, 85.3% of the population in Larimer County is white with the Hispanic or Latino population estimated at 9.8% (2007 American Community Survey). Figures for landownership by race or ethnicity are not available specifically for the project area; however, there is no information that would suggest any higher proportion of minority populations. The average household income in Larimer County of $60,516 is well above the $16,895 that is considered the Federal Poverty Guideline. Based on these numbers, implementation of either alternative would not be expected to have negative impacts to low income or minority populations.

Lands, Special Uses, and Minerals

Affected Environment

The project area is intermixed with federal land and parcels of private land including several platted subdivisions. A key consideration in planning for this project is to identify and determine existing Forest Service legal access rights and needed access across private lands to reach the proposed treatment units. Property boundaries between non-federal and federal properties have not been posted for all landline within the project area.

Also identified in this section are non-recreation special use authorizations to use National Forest land that may be affected by the proposed project. The types of authorizations may include a number of uses, the most common of which include special use permits or easements (or pending proposals) for utilities, roads, ditches, and pipelines. Within the Glen Haven Project Area, the Estes Park Light and Power Department operates and maintains electrical distribution lines and Qwest Communications utilizes an existing right-of-way for an overhead telephone cable.

Alternative 1 – No Action
Direct and Indirect Effects

Under Alternative 1, there would be no impact on the existing landownership pattern or authorized permitted uses on the National Forest. There would not be a need to post boundary lines for fuel reduction treatments or an immediate need to acquire rights-of-way. Boundary would continue to be posted as required by any future projects. Rights-of-way would be acquired or reciprocated as opportunity, staffing and funding allow. Current authorizations (permit or easement) allowing uses on NFS land would continue to be administered and any applications for special use permits processed.

Alternative 2 – Proposed Action
Direct and Indirect Effects

Implementation of this project would require the acquisition of numerous rights-of-way (ROW) through private land, either easements or temporary road use permits, to access proposed treatment units. The majority of the needed ROWs are on roads through major subdivisions, including Glen Haven, Retreat Landowners and West Creek Property Owners (Dennis subdivision). An increase in the use of the roads by the Forest Service and contractors to the treatment units would not be to an extent to significantly impact the roads. Use of NFS lands by the public would not increase as most of the access would likely be through temporary road use permits for Forest Service administrative use only. Inability to acquire access from a landowner may result in not treating some of the proposed treatment units.

To determine the legal access and jurisdiction of roads across private property to NFS land within the project planning area, plats of subdivisions or individual parcels were

researched at the Larimer County Courthouse and/or in the Forest land status atlas and files. County roads are open to public access and any questions about jurisdiction were verified with right-of-way specialists with Larimer County.

Acquiring legal access for this project is critical to the successful implementation of some of the proposed treatment units. There are risks in not acquiring legal access across private land or relying on verbal agreements. Those risks include: the landowner could decide to deny access at any point during implementation of the project; the land could change ownership and a new owner may or may not be willing to allow access; there are liability risks for the responsible official; and, potential road maintenance issues if agreements are not in place prior to project implementation. With an authorization in place, a maintenance plan (referenced in the permit or easement) can be agreed to between the Forest Service and a landowner ahead of time to cover potential road maintenance issues and responsibilities.

Treatment units potentially requiring access across non-federal lands are summarized as follows:

- **Units 2 and 3** – access would be required through the Retreat Landowners Association and from individual landowners not with the subdivision
- **Unit 4** – may require access across a private inholding from NFSR 153C
- **Unit 7** – from County Road 43 to Dunraven Glade road (51B) then across private land
- **Unit 9** – County Road 43 then access required from the Glen Haven Road Association through the subdivision (North Fork Road)
- **Unit 10** – from County Road 43 to Dunraven Glade Road; reaching the southwest side of the unit would require access through the Glen Haven subdivision
- **Units 11 and 12 –** County Road 43 then access through roads within the Glen Haven Subdivision
- **Unit 13 –** County Road 43 then access on road through the West Creek Property Owners Association
- **Unit 14 –** County Road 43 across private land not within a subdivision
- **Unit 16 –** County Road 43 to road known as 405 which requires access across private land
- **Unit 17 –** access is through the Cedar Park Subdivision and may be on a subdivision road that is not a "dedicated public road."
- **Units 19, 20 , 21 –** County Road 63E (Dry Gulch Road) to Lory Lane (on private land in different ownerships)
- **Unit 23 –** from Highway 34 (Big Thompson Canyon) across private property to the south of NFS land
- **Unit 24 –** off of County Road 43, then across private land
- **Unit 25 –** from County Road 43 to McGraw Ranch Road, then across private property

Cumulative Effects

For lands and special uses, only cumulative effects within the project area were considered. The No Action Alternative would not have impacts on special use authorizations, landownership adjustments or minerals within the project area so there are no known cumulative effects.

For Alternative 2, the majority of access acquired would be temporary authorizations or limited-use easements (Forest Service or private contractors only) and would only increase use into an area for short periods of time and not be expected to have any cumulative impacts.

Transportation

Affected Environment

The main access to the south and east portion of the Glen Haven Project Area is provided by U.S. Highway 34. Larimer County Road 43 intersects Highway 34 at the community of Drake, Colorado and accesses the middle portion of the planning area.

The transportation system within the project area (58.5 square miles) is comprised of approximately 78.6 miles of existing roads. National Forest System Road (NFSR) 128, 7.2 miles, is included in this mileage because it is the primary access to units 5, 6, and 17; however, much of the road lies outside of the project boundary. Additionally, NFSR 128 is comprised of 3.9 miles of road with Forest Service jurisdiction and 3.3 miles that is a dedicated public road with no County maintenance. Highway 34 accounts for 10.2 miles and roads with Larimer County jurisdiction account for 13.9 miles. There are 15.1 miles of National Forest System Roads, 1.6 miles of unauthorized roads on National Forest land, and 34.6 miles of roads on private property with no Forest Service jurisdiction. Including only the NFSR and unauthorized roads, the road density of the project area is 0.3 miles of road per square mile of land area.

Within the analysis area, 10.2 miles of road are maintained by the State and 13.9 miles are maintained by the County. NFSR 128 is maintained annually by the Cedar Park/Cedar Springs Road Association. The remaining 11.2 miles of National Forest System Roads are reviewed for maintenance needs every five years or sooner if identified for other management needs or causing resource damage. The unauthorized roads are not maintained. At some future date, these roads would be decommissioned, converted to a trail, added to the Forest Service system, or authorized for use under a special use permit or other authority.

Alternative 1 - No Action
Direct and Indirect Effects

Under this alternative, there would be no changes to the existing road system. Unauthorized roads that would have been decommissioned by the project would not be obliterated. Vehicle use patterns would likely continue and the long-term watershed condition and terrestrial and aquatic wildlife habitat may degrade. Outstanding access issues associated with the road system may not be resolved. Deferred maintenance of the transportation system would continue to increase.

Alternative 2 – Proposed Action
Direct and Indirect Effects

Implementation of Alternative 2 would also not require any changes to the existing National Forest Road system. During implementation of the hazardous fuel reduction treatments, some unauthorized roads may be used for access. These roads would be considered temporary roads and upon completion of the treatments, would be closed to motorized use. The existing unauthorized roads are not legally open to public motorized use; therefore, closing these roads would not reduce the number of miles of road available to the public.

Temporary roads and off-road tracks from project implementation may be used illegally by all terrain vehicles (ATVs) if not decommissioned effectively. Thinning trees for fuel reduction along roadsides may also make it easier for unauthorized motorized use off designated routes and make it more difficult to restore areas impacted by vehicle use during project implementation. Project design features such as the use of fencing or other barriers have been included to address these potential impacts.

Cumulative Effects

Other fuel reduction projects have been or will be implemented in and adjacent to the Glen Haven Project Area. Initial planning for the Cedar Park Fuel Reduction Project begins in the summer of 2009 and similar treatments and use of roads for access are likely to occur in this project area.

Recreation

Affected Environment

Recreational use within the Glen Haven Project Area is highly variable. Limited public access across private lands restricts use of some National Forest lands. Where public access is available, recreation use is high due to the proximity of the project area to Front Range cities. Recreational use also comes from visitors passing through on their way to Rocky Mountain National Park.

Specially designated features located within the project area include three roadless areas (Comanche Adjacent Areas G & H and Crosier Mountain), three picnic sites, four trailheads and 45 miles of system trail.

The project area varies in elevation from around 6,200 feet to a high point of 11,262 feet at the top of Signal Mountain, providing recreationists with a variety of terrain, habitat, and opportunities to play. Vegetative scenery varies from meadows to pine, aspen, spruce, and fir.

The transportation system's primary access routes are U.S. Highway 34, and Larimer County Road 43. Other than the primary access routes there are few other roads in the project area. Access to National Forest lands within the project area is limited due in part to a lack of public easements through subdivisions. NFSR 153, 153.B, 153.C are the few roads that provide legal access into the project area.

There are twelve National Forest system trails located within the project area. The North Fork Trail is in the west central part of the project area and receives heavy recreational use compared to other trails on the Canyon Lakes Ranger District. The trail begins at the end of Larimer County Road 51B and proceeds to the boundary with Rocky Mountain National Park. Another popular group of system trails are those on Crosier Mountain. The Crosier Mountain trails all receive moderate recreational use. The other system trails in the project area, mostly north of the North Fork Trail, all receive comparatively low amounts of recreation use.

Data from the 2008 summer season shows an average of nine hikers and riders per day were encountered on the Crosier Mountain trails, 33 hikers and riders per day were encountered on the North Fork Trail and six hikers and riders per day were encountered on the Bulwark Trail by Forest Service patrols (Poudre Wilderness Volunteers statistics). There is no data on Donner Pass, Miller Fork and the Indian trails.

Motorized use statistics for Forest Road 153, Forest Road 153.B, and Forest Road 153.C is anecdotal. Recreation and law enforcement patrols of these areas during the summer/fall months the roads are open find low to moderate use on weekends and low use on weekdays.

Other recreational activities in the project area include dispersed motorized camping, hunting, horseback riding and some four-wheel driving opportunities. The project area is within Unit 20 of Colorado Division of Wildlife's hunting unit map. All treatment units within the project area are open to hunting. Hunting within the project area is considered to cover the entire range from high to low (primarily due to limited public access). Units 2 through 6 and 17 are considered to be in a high use hunting area. Units 14, 15, 16, 18, 19, 20, 21, 22, and 24 are considered to be in a moderate use hunting area. Units 7 through 13, 25 and 26 are considered to be in a low use hunting area, primarily due to few public easements and steep terrain. Hunted species in the area include elk, deer, and predators such as cougar and coyote.

Recreational motorized use occurs primarily on the NFSR 153 network. Both four-wheel drive vehicles and ATVs have created a small number of social routes off of these roads. Limited off-road damage has occurred elsewhere in the project area. Motorized use has been occurring from private property onto public lands where the general public does not have access. This raises concerns about public lands being used exclusively by private landowners and making enforcement or monitoring difficult by the Forest Service.

Alternative 1 - No Action
Direct and Indirect Effects

Under the No Action alternative, current management plans would continue to guide management of the project area. No fuel reduction activities would be implemented to accomplish the project purpose and need. No roads would be reconstructed.

Under this alternative, no fuels reduction activities would occur. This alternative would have no immediate, direct effects on recreation and recreation infrastructure. No mitigations would be necessary.

The No Action alternative would have the indirect effect of maintaining or gradually increasing the current level of fuels within the project area. Fuel loads and the increased potential for a catastrophic wildfire are a threat to recreation, recreation infrastructure, and the character and diversity of Inventoried Roadless Areas. If nothing is done to reduce these risks, recreation resources in the area are more vulnerable to modification or destruction.

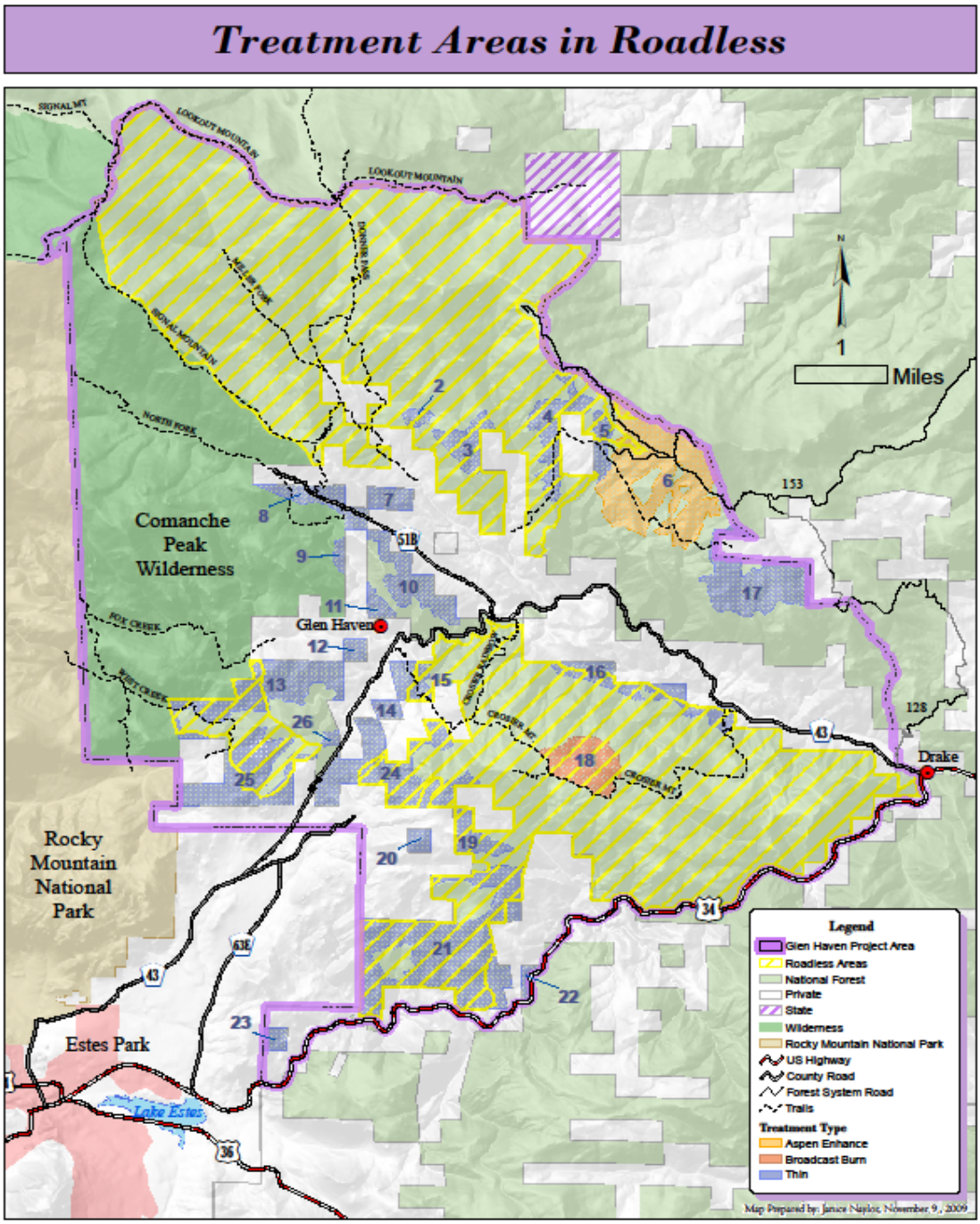
Alternative 2 – Proposed Action
Direct and Indirect Effects

Several activities within the proposed action have the potential to impact recreation and recreation resources within the project area. Prescribed fire and machinery used to treat slash could damage or destroy wooden structures such as fences, gates and signs. Thinning and surface fuel reductions could open up new areas to off-road vehicle trespass and resource damage. Temporary road closures, if necessary for project implementation, would impact recreational use of the area during the fall big-game hunting seasons. Design criteria listed in Chapter 2 have been prescribed to minimize or avoid these potential impacts.

Of the 11,191 acres within the three Inventoried Roadless Areas, fuel reduction treatments are proposed for up to 2,527 acres. These treatment acres are located within the boundaries of the approved Community Wildfire Protection Plans developed for the communities of Estes Park and Glen Haven and all are within one and a half miles of improvements that are at risk to wildland fire. All treatments within Inventoried Roadless Areas would be completed by hand crews with chainsaws. Mechanized equipment such as tree shears and ATVs would not be used. Slash would be treated by pile burning. Within Inventoried Roadless Areas, trees would be flush-cut (4 inches or less of stump remaining above the ground). Where rocks or other obstructions may

prevent flush-cutting, the stem would be cut as close as safely possible to the ground. Temporary or permanent roads would not be constructed into Inventoried Roadless Areas. By following these guidelines, thinning and broadcast prescribed fire operations in Inventoried Roadless Areas would maintain the natural appearance of these areas and roadless characteristics would not be altered.

Map 3. Treatment Units and Roadless Areas



The proposed action could increase the potential for resource damage due to off-road vehicular access without mitigations in some of the treatment units. Other units are located in fairly inaccessible terrain, inaccessible to the public by road or far enough from roads to remain unaffected by the proposed action. By implementing project design measures, no dispersed recreation effects are expected.

The reduction of fuels in the project area would have indirect effects on recreation resources by reducing the probability that an uncontrolled wildfire could damage or destroy recreation infrastructure, and alter recreational experiences for the Inventoried Roadless Area and other areas within the project boundary.

Cumulative Effects of the No Action and Proposed Action Alternatives

Under the no-action alternative, recreational activities would continue to increase as the population and desire for natural experiences increases. The urban interface will continue to grow and become more complex, and the same areas that are impacted now will continue to be impacted by off-road vehicular use increasing the likelihood of restrictions on road access. At the same time, fuels and the potential for insect epidemics will continue to build up within the area, leading to the possibility of catastrophic wildfires which would have the potential to destroy recreation infrastructure and degrade both the recreational experience and the natural character of the area's Inventoried Roadless Areas.

Current management of the area includes installing barriers where possible, obliterating illegal and damaging routes, re-aligning routes out of fragile soils, and installing signage in order to restore existing damage and ensure that impacts of this kind will not continue. Planned uses in this area need to take into account this type of illegal off-road use and strive to design projects that will produce no net increase in this type of resource damage.

Recreational use and a desire for quality outdoor experiences will continue to grow as the population grows and expands into the urban interface. The reduction in forest fuels proposed by the project may help to reduce the possibility of catastrophic wildfire and decimation by insects and disease. At the same time, portions of the area will be restored to a more natural-looking appearance, maintaining both the desired characteristics of the Inventoried Roadless Areas and the aesthetic qualities of recreational experiences.

Heritage

Affected Environment

Section 106 of the *National Historic Preservation Act of 1966* (NHPA), as amended, requires Federal agencies to determine if federally funded, permitted, or licensed activities would adversely affect significant historic properties (36 CFR 800). Cultural resources are considered historic properties if they are eligible for the National Register of Historic Places (NRHP). Determination of the eligibility of cultural resources, and the

potential effects that undertakings may have on historic properties are conducted in consultation with the State Historic Preservation Office (SHPO), relevant Indian Tribes, and Certified Local Governments, if present.

According to the 2004 revised regulations [36 CFR 800.4(d)(1)] for the National Historic Preservation Act (16 U.S.C. 470f), sites considered not eligible to the NRHP may be directly affected once adequately recorded and evaluated, and concurrence is received from the State Historic Preservation Office regarding NRHP eligibility.

The Glen Haven Fuels Reduction Project is located in an area that has had some previous cultural resource inventory. The majority of cultural resources that have been found within the project area are related to homesteading or other historical uses, although a few isolated prehistoric resources have been found within the area as well.

A total of 316 acres within the proposed treatment units have been inventoried for cultural resources between 1977 and 2003. As some of these surveys were conducted over 30 years ago, it is possible that there are undocumented historical sites within these survey areas that have met the 50 year age limit since the survey was completed. Two cultural resources have been recorded within the treatment units, including a historic trail and a historic lodge. These sites have been determined to be not eligible for the National Register of Historic Places.

In addition, four NRHP-eligible cultural resources (5LR1197, 5LR1198, 5LR1199, and 5LR1200) have been found within the proposed secondary burn area surrounding Unit 18. These sites contain flammable materials. Although this secondary burn area would not be actively ignited, prescribed fire would be allowed to burn into these secondary burn areas as long as the weather and fuel moisture are still within the initial prescription for the primary burn.

Prior to project implementation of the proposed action, a Class II (sample) cultural resource inventory would be conducted in order to identify additional cultural resources within proposed treatment units. This sample inventory would be based on a predictive model designed to identify areas in which prehistoric and historic occupation is most likely to have occurred. All newly recorded sites and previously unevaluated sites would be evaluated for NRHP eligibility. If any sites are determined to be eligible for the NRHP, they would be protected from activities that might cause adverse effects to them, as described in the Design Criteria.

Alternative 1 – No Action
Direct and Indirect Effects

The No Action Alternative would have little to no effect on cultural resources within the analysis area. Under the no action alternative, current management plans would continue to guide management of the project area. No fuel reduction activities would be implemented to accomplish the project purpose and need. No roads would be reconstructed or closed.

Under this alternative, no fuels reduction activities would occur. This alternative would have no immediate, direct effects on significant cultural resources. No mitigations would be necessary.

The No Action Alternative would have the indirect effect of maintaining the current level of fuels in the area surrounding the known significant cultural resources within the analysis area. Large fuel loads and the increased potential for a catastrophic wildfire are a real threat to cultural resources, especially from high severity fires. If nothing is done to reduce these risks, significant cultural resources are vulnerable to modification or destruction.

Alternative 2 – Proposed Action
Direct and Indirect Effects

Primary impacts to cultural resources from mechanical thinning may include the displacement, alteration, and destruction of surface artifacts and cultural features, as well as disturbance to site soil deposition and site stability. In addition, architectural components such as standing wooden or stone walls may be knocked down by machinery.

Primary impacts to cultural resources from thinning could include disturbance of cultural resources within ATV or vehicle access routes and damage to architectural components during cutting. Mechanized thinning or slash treatment could also cause ground disturbance which may destroy buried cultural deposits. Road improvement and/or deconstruction may disturb subsurface cultural deposits.

Chainsaw thinning is not considered to have the potential to adversely affect cultural resources, except those sites, such as culturally peeled trees or arborglyphs, that are themselves cultural resources (USFS AR Agreement No. 07-MU-11021000-025).

Broadcast burning poses relatively little threat to cultural resources, except for wooden architectural sites such as log cabins or corrals or arborglyphs and culturally peeled trees. Construction of ground-disturbing control lines has the potential to disturb subsurface cultural deposits.

The reduction of fuels in the analysis area would have indirect effects on significant historic properties in the project vicinity by reducing the probability that an uncontrolled wildfire would modify or destroy these sites.

Cumulative Effects

Cultural resources are non-renewable. The loss of archaeological resources has occurred in the past and will continue to occur in the future through both natural and human causes. Although efforts have been made to locate cultural resources within the project area, it is possible that there are undiscovered cultural resources that may be affected by project activities. The accumulated loss of individual cultural resources has the potential

to limit our ability to understand broad patterns of human history as well as local historical events. Over time, fewer cultural resources would be available for study and interpretation. Although individual cultural resources may be impacted by proposed activities, these resources are not considered to be significant, as none are eligible for the NRHP.

CHAPTER 4 CONSULTATION AND COORDINATION

The Forest Service contacted, consulted, and scoped with the following individuals, Federal, State, and local agencies, and tribes during the development of this environmental assessment:

Interdisciplinary Team Members

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Federal, State, and Local Agencies

Colorado State Forest Service
Larimer County
Colorado State Historic Preservation Office
Colorado Division of Wildlife
U.S. Fish and Wildlife Service

Tribes

Cheyenne and Arapaho Tribes of Oklahoma
Northern Arapaho Tribe
Northern Cheyenne Tribe
Northern Ute Tribe
Southern Ute Tribe

Others

Colorado Congressional Delegation
Local Residents
Environmental and Ecological Organizations
Local Residential Developments and Associations
Off-Road Organizations
Private Citizens

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