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Environmental Assessment

FORSYTHE II PROJECT

Boulder Ranger District, Roosevelt National Forest
Boulder and Gilpin County, Colorado

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1.1 Background

On August 3, 2012 the Forsythe Fuels Reduction Project Decision Notice was signed authorizing vegetation treatments on approximately 5,005 acres (Forsythe Fuels Reduction Project Decision Notice and Finding of No Significant Impact, 2012). The purpose and need for the 2012 Forsythe project was to *reduce hazardous fuels on National Forest lands that may contribute to the increased spread and intensity of wildfires and to manage increasing populations of mountain pine beetle (MPB)*. The following needs were identified as goals for the project area: "1) 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; and 2) there is a need to increase the amount and vigor of quaking aspen stands and meadows across the project area." The vegetation treatment mapping was completed using the U.S. Forest Service (USFS) corporate Geographic Information System (GIS) vegetation database. Through the analysis, the 2012 Forsythe Fuels Reduction Project Decision Notice identified, 1,706 acres of lodgepole pine treatment, 306 acres of salvage/sanitation in the lodgepole pine cover type, 1,533 acres of ponderosa pine treatment, 209 acres of aspen restoration, 283 acres of meadow enhancement, and 968 acres of prescribed broadcast burning.

During implementation of the Forsythe Fuels Reduction Project, neighborhood residents expressed several concerns with the vegetation management activities, primarily based on the discrepancies between the existing and mapped vegetation. A Supplemental Information Report (SIR) was prepared in October 2014, to review the new information brought forward. The SIR focused on cover type discrepancy, treatment description as described in the Forsythe Fuels Reduction Environmental Assessment (EA) versus task order cutting prescriptions, and consistency of project implementation with design criteria (Forsythe Fuels Reduction Project SIR, 2014). The SIR documented that the information presented did not constitute significant new information or changed circumstances that would change the analysis of effects in the project area. However, District Ranger Sylvia Clark recommended that project implementation be halted so that additional public involvement and supplemental analysis could be conducted to utilize the more precise cover type information and location of specific treatment prescriptions to better display impacts and determine if modifications of treatments were warranted.

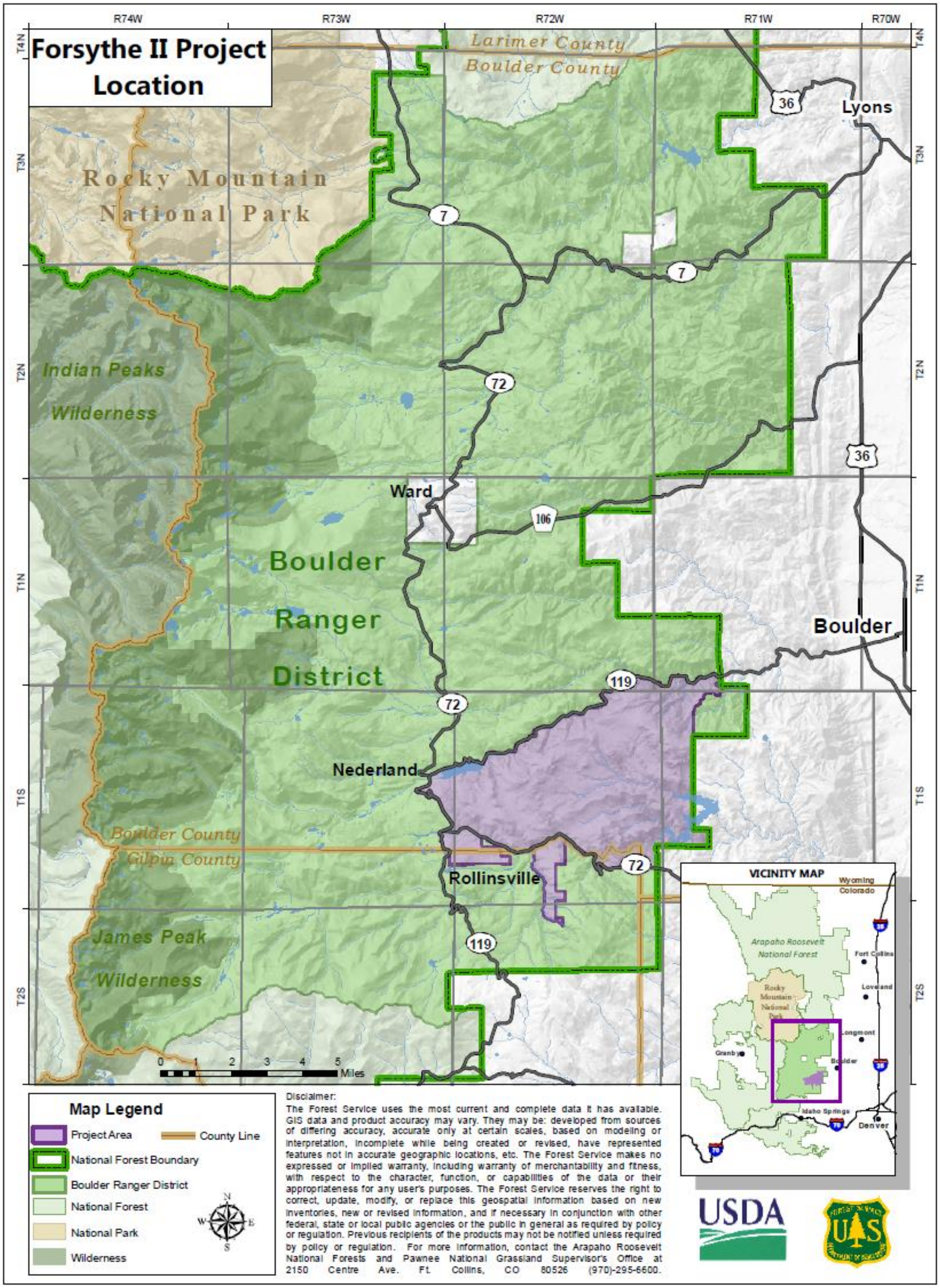
Thus, the Forsythe II Project was initiated under the authorities allowed in the Healthy Forests Restoration Act of 2003 (HFRA). To comply with the National Environmental Policy Act (NEPA), the Forsythe II Project EA has been prepared. This EA tiers to the Environmental Impact Statement (EIS) prepared for the 1997 Revision of the Land and Resource Management Plan for the Arapaho and Roosevelt National Forests and Pawnee National Grassland (Forest Plan). These documents, as well as detailed information from resource specialists in the project record, are available upon request from the Boulder Ranger District, Boulder, Colorado.

1.2 Project Area

The Forsythe II project area is located on the Boulder Ranger District of the Arapaho and Roosevelt National Forests and Pawnee National Grassland (ARP) in Boulder and Gilpin Counties, Colorado. Generally located east of Nederland, CO and west of Gross Reservoir. Legal descriptions include the following: T1N R72W Sec. 35, 36; T1N R71W Sec. 31, 32; T1S R73W Sec. 13, 24, 25; T1S R72W Sec. 1-3, 8-30, 33-36; T1S R71W Sec. 4-7, 18, 19, 29, 30; T2S R72W Sec. 3, 4 (Figure 1). The entire project area encompasses 18,954 acres; 9,930 of those acres are National Forest System (NFS) lands, 2,187 acres are Boulder County Parks and Open Space lands, and 6,837 acres are private lands. Elevation ranges from

6,082 to 8,945 feet. The project area is located within portions of four Forest Plan Geographic Areas: Caribou, Lump Gulch, Sugarloaf, and Thorodin.

Figure 1. Forsythe II Project Vicinity Map



1.3 Purpose and Need

The purpose of the Forsythe II Project is described by four objectives. The need is described in the current condition for each objective. These objectives are:

- **Objective 1 –** Reduce the severity and intensity of a wildfire within the wildland urban interface (WUI).
- **Objective 2 –** Restore ponderosa pine/mixed conifer stands, aspen, and meadows/shrublands toward their characteristic species composition, structure, and spatial patterns in order to increase resistance and resiliency to future natural disturbance.
- **Objective 3 –** Emulate natural disturbance in lodgepole pine dominated stands to mimic variable structural and spatial patterns across the landscape in order to increase resistance and resiliency to future natural disturbance.
- **Objective 4** – Provide private property landowners the opportunity to complete defensible space mitigation around their homes on adjacent NFS lands.

The objectives for this project are described using the current conditions and desired conditions with indicators to differentiate how each of the action alternatives meet these objectives. The current condition describes the state of the project area as it relates to the objective. Desired conditions do not describe a static reference condition. Rather, they highlight how a given ecosystem functions, including the dynamics and disturbance regimes that interact to sustain desired conditions over time. Well-developed desired conditions should also be forward-looking in the context of global change and should use information from the past as a guide to anticipate likely system responses to future climate and disturbance scenarios.

1.3.1 Objective 1

Reduce the severity and intensity of a wildfire within the WUI.

Indicators:

- Flame length
- Rate of spread
- Fireline intensity
- Torching index
- Crowning index
- Fire type
- Fuel hazard rating

Current Condition

The wildland urban interface has received considerable attention because of recent increases in both the number of structures destroyed and the area burned annually by wildland fire (NIFC, 2004). In Boulder County, 232 houses have been destroyed and 11,941 acres have burned within the WUI in just four fires (Black Tiger - 1989, Overland -2003, Fourmile Canyon - 2010, and Cold Springs – 2016 [only a small number of acres burned within the Forsythe II project boundary]). Increased fire activity can be attributed to at least four factors: increasingly hot and dry summers, stronger winds, insect infestations, and human population growth in forested areas.

The town of Nederland has seen a population growth of 38% since 1990 (U.S. Census Bureau, American Fact Finder, 2011). Population growth data for the areas outside the town limits of Nederland is not available, however it can be assumed that there has been a substantial increase in the areas outside of the town limits as well. On November 2, 2015 Tania Schoennagel, PhD from the University of Colorado, Boulder, made a presentation at the Boulder Public Library on the fire history and fire risk in Boulder

County forests. In her presentation she provided statistics about the WUI growth of private homes in this area. According to research from Headwaters Economics, she found that there was a 35% growth in homes in the last decade, and that 60% of this zone had been developed. The WUI within Boulder County is the number one densest WUI development in Colorado, and number 10 in the Western United States. Within the WUI, areas of developed private lands adjacent to fire-prone forest increases wildfire risk and cost. High priorities are managing fire risk in forests in and near communities on federal and private lands (Schoennagel, 2015; Boulder County CWPP, 2011). It is in the WUI where protection of structures from wildland fires is most challenging (Cohen, 2000; Winter & Fried, 2001) and where human-caused fire ignitions are most common (Cardille, Ventura, & Turner, 2001).

Community Wildfire Protection Plans (CWPPs) developed by Nederland Fire Protection District and Boulder County outline and address the fire risk, vegetation, and fire mitigation strategies in the Forsythe II project area. Boulder County summarizes the vision of the CWPPs saying, "By actively implementing this plan, residents, communities, and organizations in Boulder County would significantly increase and improve wildfire mitigation and preparedness efforts in advance of wildfires to accurately reflect the high risk and enormous costs associated with wildfire in the county" (Boulder County CWPP, 2011). Strategically addressing threats at the WUI maximizes the potential for both effective risk mitigation within developments and management for sustainable fire regimes over the broader sweep of landscapes (Moritz et al., 2014).

The subdivisions within the project area are considered high or very high risk fire hazard (Nederland Fire Protection District CWPP, 2011). Fuel hazard across the NFS lands within the project boundary consists of 1,004 acres of low, 2,165 acres of moderate, 2,668 acres of high, and 4,093 acres of very high fuel hazard. The highest priority watersheds…include both Gross and Buttonrock Reservoirs and the Fourmile Creek and Boulder Creek Canyon watersheds (Boulder County CWPP, 2011).

Mixed conifer stands in the upper montane zone are characterized by lower fire frequency and patches of stand-replacing fire in addition to low-severity surface fires (Evans, Everett, Stephens, & Youtz, 2011). The fire return interval for upper montane mixed conifer stands is 40 – 100+ years. Lodgepole pine stands are characterized by closed canopies, long fire return intervals (100+ years), and stand replacing fires that burn with high intensity and severity. The project area has not had a large scale fire since the early 1900's. The Fire Statistics System (FIRESTAT) indicates 125 fires have burned 329 acres within the project area since the ARP began keeping fire history records in 1951. Seventy percent of these fires were human caused and 86% were less than an acre in size which can be attributed to successful initial attack suppression.

Desired Condition

The desired condition for the project area is to create 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 and provide for firefighter and public safety. The desired condition could be achieved by reducing the surface fuel loading, increasing the spacing between tree crowns, and moving the fuel hazard from high and very high to low and moderate.

1.3.2 Objective 2

Restore ponderosa pine/mixed conifer stands, aspen, and meadows/shrublands toward their characteristic species composition, structure, and spatial patterns in order to increase resistance and resiliency to future natural disturbance.

Indicators:

- Acres treated/modified to restore species composition, stand structure, and spatial arrangement in ponderosa pine/mixed conifer dominated stands
- Acres treated/modified to restore aspen clones through conifer removal

- Acres treated/modified to restore meadows/shrublands through conifer removal

Current Condition

Ponderosa Pine/Mixed Conifer

The ponderosa pine/mixed conifer cover type includes stands dominated by ponderosa pine and Douglas-fir which can occur in both the upper and lower montane zones of the Front Range. Lodgepole pine can be found in the upper montane zone. Ponderosa pine is the dominant species of approximately 28% in the project area, Douglas-fir is the dominant species in approximately 25% of the project area, and lodgepole pine is the dominant species in 31% of the project area. Stands of these conifers are found in both pure stands of each conifer species as well as stands of mixed conifers throughout the project area.

The lower montane zone contains a variety of forests and woodlands with complex mixtures of tree species, understory species, local environmental conditions, and histories of natural and human disturbances (Kaufmann, Veblen, & Romme, 2006). This zone is dominated with ponderosa pine trees with Douglas-fir found mainly in drainages or on northerly slopes. These forests occupy the lower montane zone (5,900-8,000 feet in elevation) and are dependent on frequent (every 10 to 30 years) low to moderately intense disturbances to stay healthy (Boulder County CWPP, 2011).

In the upper montane zone there is typically a striking contrast in stand density and species composition on south as opposed to north facing slopes. On xeric, south facing slopes ponderosa pine forms relatively open stands, sometimes with scattered Rocky Mountain juniper. Stands on mesic, north facing slopes are typically much denser and the relative proportion of Douglas-fir is greater (Veblen & Donnegan, 2005). Boulder County's upper montane forests are some of the most diverse forests present in the county with ponderosa pine, Douglas-fir, aspen, lodgepole pine, and limber pine dominating the landscape at the lowest elevation and Engelmann spruce and subalpine fir mixing into these forests on north slopes and at the highest elevation (Boulder County CWPP, 2011). Within the upper montane zone, stands dominated by ponderosa pine also occur so that this cover type extends over a broad range of abiotic and biotic conditions (Veblen & Donnegan, 2005).

Past management practices, the influence of the environment on site productivity, and natural disturbance all play a role in the current landscape pattern of forest structure across the Front Range. Historically these forests were more open and heterogeneous (Kaufmann, Regan, & Brown, 2000(a); Knight & Reiners, 2000), consisting of a mosaic of openings, open woodland and closed canopy across the landscape (Kaufmann, 2000(b)).

Aspen

Quaking aspen can occupy a broad range of habitat types, varying from relatively xeric sites in the lower montane zone to more mesic ones in the upper montane zone (Jones, 1985; Veblen & Donnegan, 2005). It is present throughout the project area, but represents 5% of the forested area as aspen clones. Throughout the project area, small groups consisting of a few aspen trees exist in ponderosa pine and lodgepole pine stands. These trees are remnants of larger clones that deteriorated with the succession of conifer trees.

The productivity and development of aspen in the Front Range depends upon available moisture, which in turn is related to weather patterns, elevation, physiographic position, and soil characteristics. Younger stands of aspen are rare and found only where there has been a recent disturbance or disease outbreak to kill the overstory and trigger reproduction. Suckering is usually proportional to the amount of overstory disturbance and would be heaviest within three years after disturbance.

As a forest grows in absence of disturbance, and shade on the site increases, conifer species eventually replace the aspen making the aspen an under-represented feature across the landscape. The aspen forests provide essential wildlife habitat, are second only to riparian areas in terms of biodiversity richness, provide a natural fire break, and provide aesthetic value to recreationists and private landowners. Individual aspen clones have been reduced in size and numbers by a variety of factors over time. Factor's contributing to aspen decline and lack of regeneration include fire suppression, livestock grazing, wild ungulate browsing and natural succession (Krebill, 1972; Bartos & Campbell, 1998; Gruell & Loope, 1974; Mueggler, 1989; Romme et al., 1995; Kilpatrick, Clause, & Scott, 2003).

Meadows and Shrublands

Meadows and shrublands can occur as small habitats within surrounding forested stands or as large meadow and shrubland habitats. The meadow openings represent approximately 7% of the project area and are located on southerly aspects in the eastern portion of the project area. Meadows are important habitat for a variety of wildlife species, add to the biodiversity of the project area, and provide a natural fire break. Historically, meadow habitat was maintained by natural fire; however, conifer encroachment has continued to increase into meadows.

Desired Condition

The desired condition is a fire resilient, multi-aged structure across vegetation cover types (live and dead) that represent a variety of habitats in a heavily populated WUI. Resilience is scale-dependent, both spatially and temporally. Any given stand may not be resilient, but the landscape as a whole may be resilient when viewed over decades or centuries (Stine et al., 2014). Ideally, the desired condition would resemble a forest structure that functioned similar to pre-settlement conditions yet adapts for fluctuations and variance in the face of a changing climate. Odion et al. (2014) found that diverse forests in different stages of succession, with a high proportion in relatively young stages, occurred prior to fire exclusion. Ecosystems may be more resistant to disturbance if species that are most adapted to the expected future conditions are favored (Janowiak et al., 2011; O'Hara, 2014). Silvicultural activities that favor drought resistant species would lead to stands with greater resilience.

Restoration activities would provide a landscape-level resilience to disturbance. Changes in forest composition and configuration have led to decreased resilience to historical disturbance agents. Creating and maintaining forest and fuels structures consistent with historical fire regimes are generally thought to be sustainable on a landscape scale while providing habitat for all species within a landscape, and can be maintained with burning. Landscape resilience is even more critical in the context of climate change, where fires are projected to be larger, more frequent, and of higher severity than those in the past (Westerling, Hidalgo, Cayan, & Swetnam, 2006).

The modern landscape in the Forsythe II project provides management values and challenges that did not exist in the past including a complex land ownership pattern with structures on private land, high fuel loading, developed recreation sites and high visitor use, and primary drinking water sources for metropolitan areas.

Ponderosa Pine/Mixed Conifer

The Forest Plan emphases managing ponderosa pine to emulate conditions representative of a nonlethal understory fire regime. The Forest Plan further directs the restoration of natural processes through human-induced activities. These activities could include prescribed fire or mechanical treatments of vegetation to improve wildlife habitats, restore forest health, assist in the recruitment of old-growth ponderosa pine, reduce fuel loading and maintain or restore ecological conditions. Recruitment of old growth ponderosa pine would improve habitat for wildlife species such as pygmy nuthatch, an ARP Management Indicator Species (MIS), and USFS Sensitive species flammulated owl.

In the lower montane zone and on hotter, drier, south slopes, sites would be dominated with ponderosa pine. The desired stand condition would be a mosaic of trees with both horizontal and vertical structure. Conifers within these stands would be unevenly spaced across the area, sometimes in small groups with enough space between individual trees or groups of trees so that the crowns of the trees are not continuously intermingled.

Stands on cool, moist, north slopes would be predominately ponderosa pine and Douglas-fir with a mixture of other conifer species and aspen. These stands would be denser than stands on south slopes due to aspect and higher moisture levels.

Historically, openings were prevalent on south and east facing aspects, in the lower montane zone, and on gentler slopes. The findings of Dickinson’s study indicate that forest managers restoring lower montane ponderosa forests on the Colorado Front Range should increase the abundance of openings through silvicultural treatments, focusing particularly on increasing the abundance of small openings (<50m long) by breaking down large contiguous patches (<50 m long) into smaller patches (<50m long) (Dickinson, 2014).

While openings should be created on all aspects, they should be predominantly concentrated on the south and east facing slopes, with greater abundance of forest patches on north and west aspects. Furthermore, in the absence of the natural mixed-severity fire regime to maintain these forest structures, forest managers should plan periodic maintenance treatments that reduce the prevalence of regeneration but allow for the creation of some new openings and regeneration of others within a dynamic shifting mosaic (Dickinson, 2014).

Aspen

The Forest Plan provides direction to encourage the growth and expansion of aspen clones. This would increase the landscape heterogeneity and complexity and provide a greater variety of environments and increased diversity.

Aspen stands would show a range of stand structures reflective of disturbance patterns; even-aged, mixed-age, and mosaics of both may be common where relatively pure stands abut conifer and aspen-mixed conifer forests (Rogers, Landhausser, Pinno, & Ryel, 2014). Young aspen clones would be encouraged and a greater component on the landscape because they are an under-represented feature in the absence of disturbance. Aspen stand structure would be variable with an emphasis of pure clones to reset successional processes of conifer invasion within the clones perimeters.

Aspen enhancement in wetter areas would improve wildlife habitat by providing for future decadent trees for cavity-nesting birds including USFS Sensitive flammulated owl and MIS species mountain bluebird and pygmy nuthatch. Aspen enhancement across the landscape may help to spread out ungulate browsing, allowing more aspen to grow to larger sizes where soil and moisture conditions are suitable.

Meadows and Shrublands

Existing meadows and shrublands would continue to be a component of the landscape. These features may be located throughout, but they would be generally found on southerly exposures, on steeper slopes and vary in size and arrangement to other landscape features. Larger meadows and shrublands would play an important role for wildlife species that need open areas for foraging or nesting, including MIS species elk, mule deer, and mountain bluebird, and also influence disturbance processes such as crown-fire, insects, and disease. Meadows and shrublands would be variable with an emphasis to reduce conifer invasion within these features in order to maintain their presence on the landscape over time.

1.3.3 Objective 3

Emulate natural disturbance in lodgepole pine dominated stands to mimic variable structural and spatial patterns across the landscape in order to increase resistance and resiliency to future natural disturbance.

Indicator:

- Acres treated to maintain structural diversity of lodgepole pine dominated stands across the project area

Current Condition

Lodgepole pine, often viewed as the archetypal post-fire species, establishes from large quantities of seed released by serotinous cones and initially grows relatively rapidly on sites of favorable habitat (Veblen & Donnegan, 2005). Not all lodgepole pine forests are the same. Some forests are composed of nearly pure lodgepole pine established following large wildfires decades or centuries ago. Depending on elevation and aspect, others are mixtures of lodgepole pine associated with mixed conifer species such as ponderosa pine, Douglas-fir, limber pine, Engelmann spruce, subalpine fir, and aspen. Lodgepole pine dominated stands are generally found in the upper montane zone (western side of the project area). The lifecycle of homogenous lodgepole pine usually begins and ends with a crown fire. "Dog hair" stands are extremely dense stands in which trees grow very slowly and do not vary much in size. Such exceptionally dense stands appear to reflect abundant availability of seed, favorable climatic conditions for initial seedling survival, and the lack of self-thinning of the stand (Veblen & Donnegan, 2005).

Lodgepole pine stands have not departed from the historical fire regime. These stands are characterized by closed canopies, long fire return intervals (100+ years), and stand replacing fires that burn with high intensity and severity. Because these stands are homogenous in nature, they become susceptible to insect and disease under drought conditions.

Desired Condition

The desired condition for the lodgepole pine dominated stands found in the project area, would be patches of varying seral stages distributed across the area. The heterogeneous pattern of lodgepole pine stands would exhibit patches of even-aged stands mixed throughout the general forest to provide a discontinuous crown level that would provide a greater resiliency to large disturbances. Some of these patches would have other conifer species and aspen mixed with the dominant lodgepole pine stand. Where grasses and forbs grow in openings created in lodgepole, foraging opportunities would be improved for ARP MIS elk and mule deer for a period of time.

1.3.4 Objective 4

Provide private property landowners the opportunity to complete defensible space mitigation around their homes on adjacent NFS lands.

Indicator:

- Anticipated acres treated by private residents on NFS lands for defensible space mitigation

Current Condition

Some private property owners have requested to complete defensible space mitigation on NFS lands in order to comply with home insurance companies' standards to insure their personal property. Without the completion of the defensible space mitigation to Colorado State Forest Service (CSFS) Guideline standards, individuals would lose their home and property insurance. Boulder County's "Wildfire Partners" program has assisted private landowners who live in the WUI by providing evaluations of individual properties and access to grant monies to assist in the completion of defensible space mitigation on private lands.

Desired Condition

Private property owners would continue to initiate and maintain defensible space mitigation to the standards established by the CSFS on their personal property as well as adjacent NFS lands, as needed, to be compliant with home insurance companies' policy. Upon request, individuals would need a permit from the USFS to complete fuels mitigation on NFS lands. The permits would outline and direct private landowners of their responsibilities while treating vegetation on NFS lands. As a result of this process, Wildfire Partner's participants and other adjacent homeowners would have the ability to complete the required defensible space across their property boundaries onto NFS lands.

1.4 Proposed Action

The Boulder Ranger District proposes management activities on 3,151[1] acres of the 9,930 acres of NFS lands within the Forsythe II project area to meet the objectives for this project as described above. The proposed action includes 2,483 acres of mechanical/hand treatment and 968 acres of broadcast burning. A combination of mechanical/hand treatment and broadcast burning would occur on 300 acres. Additionally, 2,032 acres are analyzed for defensible space to provide permitted homeowners adjacent to NFS lands the ability to treat on NFS lands. However, based on previous requests and information provided through Boulder County Wildfire Partners it is estimated that up to 10% of the analyzed defensible space acres would be treated, or 203 acres.

Proposed management activities include thinning 1,015 acres of Douglas-fir dominated mixed conifer stands, thinning 392 acres of ponderosa pine dominated mixed conifer stands, thinning 42 acres of old growth mixed conifer stands, patchcutting/clearcutting 741 acres of lodgepole pine stands, thinning 17 acres of regenerated lodgepole pine stands, and cutting 276 acres of conifers within aspen and meadow/shrubland areas (Figure 2). These treatments may be done by either mechanized equipment or hand crews with chainsaws. Mechanized equipment operations are limited by the topography (percent slope and amount of rock). Units that are over 30% slope would be treated manually. However, there may be short distances within a unit where a machine could be working on slopes up to 40%. Reforestation treatments (tree planting of mixed conifer species) would occur in patchcuts/clearcuts. Manually thinning lodgepole pine regeneration in the patchcut/clearcut areas, which would be done under this decision, would continue every 7-15 years, or as needed into the future.

Slash created by these treatments could be piled and burned, chipped, masticated, and/or removed offsite. Where mechanized equipment is used, forest products would most likely be removed in the form of logs, chips, or firewood. After work is completed, firewood may be removed from the hand treatment units.

Approximately seven miles of temporary roads would be constructed to facilitate the vegetation management activities and would be decommissioned after the completion of management activities.

To decrease the risk of erosion and sedimentation and improve hydrologic function, approximately 6 miles of National Forest System Road (NFSR) would be decommissioned and another 2.3 miles converted to administrative use only (not open to public travel) (Figure 6 and Appendix D). Any unauthorized roads on NFS lands not identified on the map but found during implementation would be decommissioned. These mileages affect only the portions that cross NFS lands and take into account the transportation system necessary for public access, motorized recreation, and forest management while also accounting for the effects the roads have on the watershed.

The town of Nederland and residents of the Big Springs Subdivision requested a special use authorization for emergency ingress/egress routes (Figure 2) to the south and east of the subdivision. Two ingress/egress routes were identified (Doe Trail, 0.04 miles on NFS lands, and Wildewood Trail, 0.32 miles on NFS lands), both currently existing as trails, that could become private roads under special use for emergency ingress/egress purposes only. Road work would be done including widening, installing gates, and cutting all trees within the 30 foot road corridor. This clearing would be approximately 3.9 acres (2.6 acres along Doe Trail, 1.3 acres along Wildewood Trail).

Forest Plan Goad 95 states, *Retain the integrity of effective habitat areas* (p. 30) and Forest Plan Standard 2 under Management Area 3.5 states, *Maintain or increase habitat effectiveness, except where new access is required by law* (p. 359). The proposed action would not maintain or increase effective habitat as required therefore, a non-significant Forest Plan Amendment would be needed to remove the applicability of the goal and standard within the Forsythe II project boundary.

[1] These acres are of the proposed treatment and differ from the unit acres.

For a detailed description of this Proposed Action, refer to Chapter 2, Section 2.3.2.

1.5 Management Direction and Supporting Information

1.5.1 Arapaho and Roosevelt National Forests and Pawnee National Grassland Land and Resource Management Plan

Management direction for the Forsythe II project is found in the Forest Plan to which this analysis is tiered. The Forest Plan assigns management areas based on where differing kinds of resource and use opportunities are available to the public and where different management practices may be carried out. There are Forest-wide management emphasis goals and objectives as well as operational goals, standards and guidelines. Each management area has a desired condition and standards and guidelines. The Forsythe II project lies within four management areas (Table 1). The management area direction for this project is described on pages 358-360, 364-367, and 380-381 of the Forest Plan.

Table 1. Acres of NFS land, within the project area, in each Forest Plan Management Area.

Management Area (MA)	NFS Acres
3.5 – Forested Flora and Fauna Habitats	8,634
4.2 – Scenic Areas	406
4.3 – Dispersed Recreation	380
7.1 – National Forest/Residential Intermix	510
Total Acres	**9,930**

1.5.2 U.S. Forest Service Chief's Letter of Intent – 2016 Wildland Fire Letter

The 2015 wildfire season was one of the worst in recorded history. There were many firefighter lives and millions of dollars in homes lost due to the intensity of these wildfires. As a result, USFS Chief Thomas L. Tidwell committed to *increase hazardous fuels and restoration work to reduce the wildland fire threat to communities and to our fire responders.* Furthermore, the ARP delegates to the firefighters that they *implement strategies and tactics that commit responders only to operations where and when they can be successful, and under conditions where important values at risk are protected with the least exposure necessary*. The proposed treatments within the Forsythe II project are designed to decrease the amount of hazardous fuels and restore the vegetation to reduce the wildland fire threat to the communities and fire responders.

1.5.3 Collaborative Forest Landscape Restoration Program (CFLRP) with Title IV of the Omnibus Public Land Management Act of 2009

The CFLRP encourages collaborative, science-based ecosystem restoration of priority forest landscapes. This collaboration process 1) encourages ecological, economic, and sustainability; 2) leverages local resources with national and private resources; 3) facilitates the reduction of wildfire management costs, including through reestablishing natural fire regimes and reducing the risk of uncharacteristic wildfire; and 4) demonstrates the degree to which, a) various ecological restoration techniques – i) achieve ecological and watershed health objectives and ii) affect wildfire activity and management costs; and b) the use of forest restoration byproducts can offset treatment costs while benefitting local rural economies and improving forest health.

The Front Range Roundtable is a dynamic alliance of federal, state and local governments; land management agencies; private landowners; conservation organizations; and other stakeholders who are committed to reducing wildland fire risks through sustained fuels treatment. There is extensive public involvement, participation from local governments, collaboration in identifying and supporting specific project areas and types of treatment, and building on earlier successful projects. The Forsythe II project used these collaborative processes to form the proposed treatments.

1.5.4 Community Wildfire Protection Plans (CWPP)

The Boulder County, Gilpin County, and Nederland Fire Protection District Community Wildfire Protection Plans cover the Forsythe II project area. These plans outline specific wildland fire hazards and risks facing WUI communities and neighborhoods and provides mitigation recommendations that are designed to reduce these hazards and risks. The Forsythe II project used these CWPPs to design the proposed treatments.

1.5.5 National Cohesive Wildland Fire Management Strategy

The National Cohesive Wildland Fire Management Strategy is a national vision for wildland fire management, that defines three national goals (resilient landscapes, fire adapted communities, and safe and effective wildfire response), describes the wildland fire challenges, identifies opportunities to reduce wildfire risks, and establishes national priorities focused on achieving the three national goals. The proposed treatments in the Forsythe II project would move the planning area toward achieving these three national goals.

1.6 Legal Requirements

This EA adheres, through design criteria or project design, to the laws and executive orders included, but not limited to those detailed in this section.

1.6.1 National Environmental Policy Act (NEPA) of 1969, as Amended

The primary purpose of NEPA is to ensure federal agencies assess the environmental effects of proposed actions prior to making a decision.

1.6.2 Clean Air Act of 1970, as Amended

The Clean Air Act is a law that regulates air emissions from stationary and mobile sources. Among other things, this law authorizes U.S. Environmental Protection Agency (USEPA) to establish National Ambient Air Quality Standards (NAAQS) to protect public health and public welfare and to regulate emissions of hazardous air pollutants.

1.6.3 Endangered Species Act (ESA) of 1973

The ESA provides for the conservation of species that are endangered or threatened throughout all or a significant portion of their range, and the conservation of the ecosystems on which they depend.

1.6.4 Migratory Bird Treaty Act (MBTA) of 1918

The MBTA makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations.

1.6.5 Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

Executive Order 13186 directs Executive departments and agencies to take certain actions to further converse migratory birds and their habitats. Each Federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations is directed to develop and implement a Memorandum of Understanding (MOU) with the U.S. Fish and Wildlife Service (USFWS) that shall promote the conservation of migratory bird populations. In 2008, the USFS signed a MOU (#08-MU-1113-2400-264) with the USFWS to promote the conservation of migratory birds.

1.6.6 National Historic Preservation Act (Section 106) of 1966, as Amended

The National Historic Preservation Act requires federal agencies to consider the effects of their actions on historic and cultural resources listed in or eligible for the National Register of Historic Places and consult with the Advisory Council on Historic Preservation regarding those actions that will adversely affect historic resources.

1.6.7 National Forest Management Act (NFMA) of 1976

The NFMA requires the management of renewable resources on national forest lands by developing a management program based on multiple-use, sustained-yield principles, and implementing a resource management plan for each unit of the National Forest System.

1.6.8 Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

Executive Order 12898 and the accompanying Presidential Memorandum requires federal agencies to analyze the environmental effects, including human health, economic and social effects, of Federal actions, including effects on minority communities and low-income communities, when such analysis is required by the NEPA.

1.6.9 Clean Water Act of 1972

The Clean Water Act regulates discharge of pollutants into the waters of the United States and regulates quality standards for surface waters.

1.6.10 Executive Order 13175, Consultation and Coordination with Indian Tribal Governments

Executive Order 13175 requires federal agencies to establish regular and meaningful consultation and collaboration with tribal officials for actions that may have tribal implications.

1.6.11 Executive Order 13112, Invasive Species

Executive Order 13112 requires federal agencies whose actions may affect the status of invasive species, to extent practicable, to prevent the introduction of invasive species; detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; monitor invasive species populations accurately and reliably; provide for restoration of native species and habitat conditions in ecosystems that have been invaded; conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; promote public education on invasive species and the means to address them; and not carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species.

1.6.12 Executive Order 11990, Protection of Wetlands

Executive Order 11990 requires federal agencies to avoid, to the extent possible, the long and short term adverse impacts associated with the destruction or modification of wetlands.

1.7 Public Involvement and Issues

1.7.1 Public Involvement Summary

In October 2014, a SIR was completed which led to a decision, by District Ranger Sylvia Clark, to prepare additional analysis. A public meeting, in Nederland, CO, and field trip, in the project area, was held in December 2014 to discuss concerns and desired outcomes for the new analysis. In April 2015, the USFS attended a public field trip in the project area hosted by Magnolia Forest Group (MFG) to continue discussion on concerns and desired outcomes for the Forsythe II project.

Additional public comments were solicited for the Forsythe II project proposal on September 4, 2015. Approximately 2,400 postcards were mailed to stakeholders, landowners within and adjacent to the project area, and other interested individuals and organizations. This information was also published on the ARP Schedule of Proposed Actions and a news release was sent to the Boulder Daily Camera newspaper as well as other media outlets within Boulder County, Nederland, and Gilpin County. A public field trip was held on September 26, 2015 and attended by approximately 30 people. A webpage was published and made available to the public with up to date information about the project throughout the planning process. The USFS stated that all future announcements and information regarding the project would be shared by email.

A detailed proposed action was developed utilizing the input received from the public and internal USFS resource specialists. The public comment period for the detailed proposed action began on December 31, 2015. Approximately 190 people responded in 2015 to continue receiving information about the project. Emails were sent to those folks during the public comment period. Letters were mailed to the following tribes: Cheyenne and Arapaho Tribes of Oklahoma, Northern Arapaho Tribe, Northern Cheyenne Tribe, Ute Tribe, Southern Ute Indian Tribe, and Ute Mountain Ute Tribe. A legal notice was published in the Boulder Daily Camera and the ARP Schedule of Proposed Actions was updated with the proposed action documents. The USFS received 374 comments on the proposed action. These comments were analyzed by the Interdisciplinary Team (IDT or ID team) to develop issues for the Forsythe II project.

1.7.2 Key Issues

Issues are assigned to one of three categories: Key issues, other issues, and issues not analyzed in detail. "Key issues" are used to develop alternatives, mitigation measures, or design elements to address the effects of proposed activities. "Other issues" do not lead to a new alternative but are analyzed in terms of environmental consequences. "Issues not analyzed in detail" are issues that are not analyzed because they are addressed through the project design, outside the scope of the analysis, already decided by law, regulation, the Forest Plan, or mitigated as standard operating procedures and do not require tracking throughout the document.

Issues are grouped by resource and described using an issue statement, brief background information, and a list of indicators that measure the effects of the proposed activities. Table 4 in Chapter 2 summarizes the effects, by resource, of the alternatives on key and other issues and their indicators. Chapter 3 describes the consequences of the alternatives in terms of the issues.

1.7.2.1 Soils

Soil productivity and hydrologic function may be impacted by vegetation management and prescribed fire treatments as described in the following cause/effect statements. The following cause/effect statements are based on standard predicted/anticipated effects. The degree and extent of potential effects on soil resources would be assessed and this information may be utilized for development of alternatives. Effects would be addressed (avoided or minimized) by project design criteria and mitigation measures.

Issue 1

Background:

Operation of heavy equipment is likely to cause soil compaction and displacement on temporary roads, landings, heavily traveled sections of primary skid trails and isolated/discontinuous compaction and displacement within the matrix of the treatment unit.

Indicators:

- Acres treated with heavy equipment
- Site susceptibility to damage from compaction based on soil properties and potential for compaction based on heavy equipment operation

- Intensity of treatment (based primarily on treatment prescription and stand density)

Issue 2

Background:

Protective ground cover may be impacted by vegetation management treatments, construction of roads and landings and/or application of prescribed fire. Localized erosion and/or sedimentation could occur within and adjacent to areas without adequate protective ground cover.

Indicators:

- Acres treated with heavy equipment
- Amount of protective ground cover retained following treatment
- Acres of steep slopes within treatment units
- Site susceptibility for erosion based on soil properties (erosion hazard rating)
- Intensity of treatment (based primarily on treatment prescription and stand density)

Issue 3

Background:

Patchcuts/clearcuts on sensitive soils may impact above and below ground nutrient cycling processes.

Indicators:

- Patchcut/clearcut acres treated
- Retention of coarse woody debris, fine woody debris, forest litter/duff and organic rich surface layers
- Whole tree removal patchcut/clearcut prescriptions on shallow, rocky coarse textured soils with thin surface layers

Issue 4

Background:

Pile burning may cause moderate to high soil burn severity effects to the limited spatial extent of the burn pile footprints.

Indicators:

- Acres treated
- Fire effects on soils associated with pile burning

Issue 5

Background:

Application of broadcast prescribed fire could result in small localized areas of moderate to high soil burn severity but low burn severity is expected to occur over most of the treatment area. Erosion and sedimentation may occur due to removal of protective ground cover.

Indicators:

- Acres treated
- Acres of steep slopes within treatment units
- Site susceptibility for erosion and sensitivity to damage from fire (erosion hazard rating and limitations ratings for prescribed fire)

- Potential impacts resulting from treatment could be measured or described by Burned Area Emergency Response (BAER) soil burn severity indicators

1.7.2.2 Hydrology/Fisheries

Issue 1

Mechanical timber harvest, permanent and temporary roads, broadcast burns, and burn piles may increase the extent of bare compacted soils and connected disturbed area (surface flow paths that connect upland disturbances directly to stream channels and bypass vegetated buffers or filters), which increases the risk of erosion and sedimentation into streams and aquatic habitat occupied by forest MIS species, macroinvertebrates, and potential habitat for threatened and endangered species (TES) such as the Arapahoe snowfly.

Background:

Mechanical logging equipment, skid trails, and landings increase bare soil and increase risk of erosion within treatment units. Temporary and permanent roads provide additional sources of compacted, bare soil subject to erosion, and can connect upland disturbances to the stream network and create pathways for sediment delivery. Erosion production and sediment delivery from timber harvest activities vary with harvest methods and locations, soil types, slopes, disturbed area, and delivery pathways and distance to stream channels. Broadcast burning and pile burning also remove ground cover and create bare soil that is subject to erosion. Erosion and sedimentation above background levels can reduce aquatic habitat abundance and viability, and decrease macroinvertebrate density and diversity. Design criteria, including buffers around streams and wetlands, limitations on mechanical treatment on steep slopes, and requirements for decommissioning and restoration of skid trails and temporary roads can effectively limit erosion and sediment from harvest activities. Vegetation treatment by hand rarely increases ground disturbance and tends to cause negligible watershed impacts. However, hand treatment often facilitates the need for pile burning.

Indicators:

- Acres of mechanical fuels treatment
- Miles of permanent road construction
- Miles of temporary road construction
- Acres of broadcast burn
- Acres of treatment where burn piles would be constructed to treat slash

Issue 2

Road decommissioning and restoration may decrease the risk of erosion and sedimentation and improve hydrologic function.

Background:

Roads provide bare compacted soils that serve as sources of erosion as well as potentially providing flow paths that connect disturbances to stream networks. Decommissioning and restoration of roads would reduce erosion and sedimentation, revegetate road surfaces, disconnect disturbed area, and improve watershed condition.

Indicators:

- Miles of road decommissioned

1.7.2.3 Terrestrial Wildlife

Issue 1

Proposed vegetation management activities may affect individuals, populations, and/or habitat values for federally Proposed, Threatened or Endangered, Forest Service Sensitive (PTES), MIS, or other terrestrial wildlife species.

Background:

Suitable habitats for wildlife species, in groups mentioned above, may occur within and/or adjacent to the project area. Vegetation management activities may affect wildlife habitat by reducing habitat for some terrestrial species while improving it for others. Vegetation management and associated activities, including construction of temporary roads, may increase human presence and disturbance of wildlife, displace wildlife, and reduce habitat quality. These impacts may occur in the short term during project activities, in the long term after activities are complete, or both.

Indicators:

- Quantification (acres) of available existing wildlife habitat structural stage by vegetation type and proposed alteration based on proposed action and alternatives, and qualitative description of existing habitat and proposed changes.
- Disclosure of effects, both project-specific and cumulative, to PTES species and MIS.

Issue 2

Road decommissioning and restoration may improve wildlife habitat and reduce disturbance and displacement of wildlife.

Background:

Roads impact wildlife habitat by removing vegetation and facilitating human presence that disturbs and displaces wildlife. Decommissioning and restoration of roads has the potential to reduce these impacts. The extent of beneficial impacts to wildlife and habitat would depend on locations of roads to be decommissioned, the extent of decommissioning and revegetation, and the extent to which visitor use along these routes is reduced or eliminated.

Indicators:

- Miles of road decommissioned
- Increase in effective habitat

1.7.3 Other Issues

1.7.3.1 Silviculture

Issue 1

Management activities being applied to the forested stands in the upper montane zone may be inappropriate.

Background:

The WUI is any area where man-made improvements are built close to, or within, natural terrain and flammable vegetation, and where high potential for wildland fire exists (CSFS, 2016). The entire Forsythe II project lies within the WUI. The majority of the area that is proposed to be treated is located in the upper montane zone. In a heavy populated WUI environment, canopy separation and a modified forest structure minimizes and modifies the impacts of a devastating wildfire. Forest restoration objectives are secondary to WUI objectives in highly populated areas regardless of what vegetation zone proposed treatments are located. Therefore, vegetation treatments within a WUI landscape would be more intensive than would be needed if vegetation restoration was the primary objective because of the infrastructure and houses that are at risk to wildland fire.

The proposed vegetation treatments would be applied to stands within the lower and upper montane forests of the project area. Generally, the lower montane zone ranges in elevation from 5,900 to 8,000 feet in elevation and the upper montane zone 8,000 to 9,000 feet. However, vegetation components characteristic of one zone or the other may be found outside of the preferred elevation ranges. Vegetation patterns are complex within the project area and are influenced by a combination of factors including elevation, aspect, soils, and disturbance history.

There is limited research in the upper montane zone of the Front Range. The tree species mix is generally greater in the upper montane as compared to the lower montane zone. Historically, upper montane forests experienced mixed severity/moderate frequency fires which were correlated with drought periods and varied with topography (Schoennagel, 2015). Forests in the upper montane are generally cooler and moister than the lower montane.

The lower montane zone contains a variety of forests and woodlands, with complex mixtures of tree species, understory species, local environmental conditions, and histories of natural and human disturbances. The upper montane zone represents a transition from montane to subalpine forests (Kaufmann, Veblen, & Romme, 2006). Forest management that cut and remove vegetation in these two forest zones may affect the spatial structure and forest density across the landscape.

Indicators:

- WUI fuel reduction acres treated in the upper montane zone

Issue 2

The proposed vegetation treatments may affect old growth (retention, inventoried, and development) integrity and large trees.

Background:

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. Old trees were historically a major component of montane forests in the Colorado Front Range. They are an integral part of the spatial and temporal heterogeneity inherent in the ecosystem. The Forest Plan describes old growth management strategies and identified 482 acres of old growth in all tree species within the project area.

Old growth forest integrity may be impacted or enhanced by the vegetation management treatments. Treatments that remove vegetation may cause changes to all tree size classes, stand densities, and species composition. Vegetation treatments are not targeting large trees for removal; however, some large trees could be removed to create gaps in the tree canopies. The forest is a dynamic system and changes occur in forest stand structure over time, including stand behavior during and after disturbances (both natural and man-made).

Indicators:

- Old growth acres treated

Issue 3

The proposed vegetation treatments, specifically in lodgepole pine dominated stands, may be susceptible to windthrow or blowdown.

Background:

Due to the high winds in the winter and spring within the project area, units proposed for treatment, especially lodgepole pine stands, pose a high potential for windfall or blowdown of remaining trees. The highest wind risk are located on ridgetops, upper windward slopes and saddles in ridges with shallow soils. Stands with many trees with defective tree boles and root systems and dense stands growing on sites with a high water table are also susceptible to windthrow.

Indicators:

- Acres of potential windthrow or blowdown

Issue 4

Vegetation management activities may lead to increased mountain pine beetle, ips, or other insect infestations.

Background:

Many insects are found within the forests of the project area, but two insects that have the biggest impact on changing forest structure include the mountain pine beetle and pine engraver beetle. Mountain pine beetle is the most prolific insect pest in Colorado and often kills large numbers of trees during annual outbreaks (Leatherman & Crenshaw, 1998). Population spikes are cyclic occurring approximately every 20 to 30 years impacting susceptible lodgepole, ponderosa, and limber pine trees. Past evidence from mountain pine beetle outbreaks are evident both within and adjacent to the project area. Most *Ips* populations are associated with slash and windthrow material. Currently, mountain pine beetle and *Ips* beetle are at endemic levels.

Indicators:

- Acres of treated area

1.7.3.2 Recreation/Trails

Issue 1

Vegetation management practices may affect recreational access (system and non-system trails and roads) within the project area.

Background:

Recreation use in the project area occurs to varying degrees on all NFS lands. The area is open year-round, with most use occurring between spring and late fall. Ninety-five percent of all recreation uses are non-motorized and mechanized dispersed recreation activities that include hiking, mountain biking, hunting, fishing, camping and horseback riding, and incidental winter sport activities.

Indicators:

- Miles of trails
- Miles of social trails/roads created

1.7.3.3 Visual Resources

Issue 1

Proposed management activities may affect visual resources.

Background:

Vegetation management and associated activities (i.e. road improvement) can alter the visual resource, both spatially and temporally. Spatial affects the change that a person would see at any geographic point. Temporal affects how visuals would change through time.

The Forest Plan describes the visual resource using Scenic Integrity Objective (SIO) which is the goal for the landscape. The SIO can be very high, high, moderate, low, or very low and takes the effect on the "casual forest visitor" into consideration when describing the quality of the view.

Indicators:

- Percent of NFS lands in the project area clearcut/patchcut
- Forest Plan SIO

1.7.3.4 Noxious Weeds

Issue 1

Proposed vegetation management activities may affect occurrence of noxious weeds and other undesirable nonnative plants.

Background:

Forest Service Manual (FSM) 2900-2011-1 states the following: "The term 'noxious weed' means any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment." ARP noxious weed priorities, inventory, treatment and other management activities are specified in the April 2003 ARP Noxious Weed Management Plan, which is tiered to the Forest Plan.

Vegetation management activities can increase the potential for establishment and spread of noxious weed species. Seeds or propagative plant parts can arrive on equipment and fall off during operation. Ground-disturbing activities such as road construction, reconstruction, and obliteration can create conditions for the introduction, germination, establishment, and spread of weed seeds. Activities that disturb soil and remove competitive, desirable vegetation create an ideal seedbed for weeds. These concerns are addressed by design criteria.

Source sites of crushed rock or gravel can become infested with noxious weeds. Seeds produced by infestations on stockpiles can be transported with the aggregate when it is hauled and placed on roads. This concern is addressed by design criteria.

Seed and agricultural straw used for rehabilitation and reclamation work can include weed seeds or propagative plant parts. This concern is addressed by design criteria.

Indicators:

- Qualitative discussion of existing noxious or other weeds and expected effects from alternatives

1.7.4 Issues Not Analyzed in Detail

The Interdisciplinary Team considered the following issues but did not analyze them in Chapter 3 of this document because they are addressed through project design, management requirements, or design criteria (Appendix B).

1.7.4.1 Transportation

Proposed changes to the National Forest transportation system for the Forsythe II project were based on the results of the ARP Travel Management Rule, Subpart A analysis. This process identified the most ecologically, economically and socially sustainable road system in terms of access for recreation, research and other land management activities. The results of the Subpart A analysis served as a basis to inform land managers and the public of future proposed actions, such as Forsythe II project, which are subject to NEPA. The road actions are identified in the action alternatives and impacts to resources such as soils, hydrology, and wildlife are analyzed in Chapter 3.

1.7.4.2 Botany

No federally listed or proposed threatened or endangered plant species were identified within the project area or potentially affected by the proposed project. There are no botanical MIS identified in the Forest Plan. No records of Region 2 Sensitive plant species, nor suitable habitat, were found within the proposed project area during the field reconnaissance or during the office review of Colorado Natural Heritage Program (CNHP) and Natural Resources Information System (NRIS) databases.

1.7.4.4 Heritage

Archaeological sites are non-renewable resources. Archaeological sites, containing or are likely to contain information that contribute knowledge to human history or prehistory, may be damaged or destroyed by the project activities. The USFS shall ensure that qualified archeologists would identify the project actions and areas where these cultural resources may be damaged or destroyed. These areas would be inventoried by a pedestrian survey. Any sites located during these surveys would be recorded and evaluated for their importance. The Colorado State Historic Preservation Officer (SHPO) and Tribes would be consulted as to the importance of the site and if the site is determined to be eligible for listing on the National Register of Historic Places (NRHP) the project actions would be modified to protect the site.

Buildings, structures or archaeological sites that are associated with important historic or prehistoric events, or are associated with important people may be damaged, destroyed or have major modifications to their cultural landscapes caused by the project activities. The USFS shall ensure that qualified archeologists would identify the project actions and areas where these cultural resources may be damaged or destroyed. These areas would be inventoried by a pedestrian survey. Any sites located during these surveys would be recorded and evaluated for their importance. The Colorado SHPO and Tribes would be consulted as to the importance of the site and if the site is determined to be eligible for listing on the NRHP, the project actions would be modified to protect the site.

Cultural sites or landscapes that are important to traditional cultural practices or beliefs of a living community that are rooted in that community's history, and are important in maintaining the continuing cultural identity of the community may be damaged or destroyed by the project activities. The Forest would consult with Tribes that have in the past used the project area as their traditional homeland. The Tribes would be asked to locate any specific area that meets the definition of a cultural site or landscape. If any such areas are located within the project boundary the Forest would work with the Tribes to ensure that the area is protected from damage from the project activities.

1.7.4.5 Climate Change and Carbon Sequestration

The proposed management actions could affect climate change and the forests within the project area could be affected by climate change as described below. However, based primarily on scale, the effects of the proposed activities on global climate change would be imperceptible.

This general qualitative approach is consistent with the 2016 Final Guidance for Consideration of Greenhouse Gas Emissions and Climate Change Impacts from the Council on Environmental Quality.

Summary of Carbon Processes in Forested Ecosystems

Carbon sequestration is the process involved in carbon capture and the long term storage of atmospheric carbon dioxide. Assessment of vegetation management activities and associated impacts on carbon processes in forested ecosystems generally consider capture and storage in short and long term timeframes. In forested ecosystems, it is useful to consider capture, release, storage in biomass and storage in soil.

- The primary mechanism for carbon dioxide capture is photosynthesis which converts carbon dioxide into sugar, cellulose and other carbon-containing carbohydrates. Rates of photosynthesis are determined by vegetative productivity and are generally highest in a mature growing forest.
- Mechanisms for carbon release include carbon dioxide emissions from prescribed fire, wildfire and microbial respiration of organic material.
- Carbon is stored in living biomass as sugar, cellulose and other carbohydrates.
- Carbon is stored in soils in both organic and inorganic forms. Organic carbon is recruited through retention and decay of downed woody debris. Microbial decomposition and respiration generate humus (stable soil organic material) and release carbon dioxide. Soil inorganic carbon consists of mineral forms of carbon, formed primarily from weathering of parent material.

Proposed Vegetation Management Actions and Carbon Processes

- The proposed vegetation management activities would result in lower amounts of carbon stored in living biomass, especially in treatment units where more vegetation is removed.
- The existing forest is likely capturing carbon through photosynthesis. Following implementation of the proposed vegetation removal activities, rates of carbon sequestration might lower in the regenerating forest.
- Prescribed fire would release carbon dioxide and carbon monoxide, contributing to greenhouse gases in the atmosphere,
- Vegetation management and prescribed fire activities could lower the potential for future carbon dioxide release through wildfire.
- Age of forest stands influences carbon capture and storage. Given the range of carbon capture and storage capacities in different forest age classes, management activities that maintain a variety of forest ages may increase the ability of forest tracts to sequester carbon in the long term.
- Management actions that improve the resilience of forests to climate-induced disturbances such as catastrophic wildfire could help sustain the forest’s current carbon sequestration capabilities in the long term.
- At a global or national scale, any short-term reduction in carbon stocks and sequestration rates (or increases in greenhouse gases) within a single project area are imperceptibly small, as are the potential long term benefits.

- The U.S. Environmental Protection Agency concluded that when forest management activities (including fire emissions) are considered together with storage/sequestration activities (reforestation, etc.), at the national level, the cumulative result is a net sequestration of carbon dioxide. This assumes that the proposed activity does not change the land use and the area remains forested.

This issue is dismissed from detailed analysis and additional documentation because there would be no measureable differences between the alternatives in regards to greenhouse gas emissions or climatic impacts.

1.7.4.6 Air Quality

The USEPA is primarily concerned with particulate matter and proposed project activities are likely to increase only particulates over the duration of the project. A smoke permit is issued only after the Colorado Air Pollution Control Division (APCD) considers the size of the proposed burn (acres of broadcast burn or size of piles), type of fuel to be burned, duration of the project including smoldering and potential nighttime smoke, proximity to occupied residents and smoke sensitive receptors, and whether the applicant demonstrates the proposed burn would be conducted in a manner that can and would minimize the emissions and smoke impacts on visibility and public health. Smoke impacts on public health are compared to the NAAQS as adopted by the State of Colorado. In any 24-hour period, the NAAQS for PM (Particulate Matter) 2.5 must not exceed 35 micrograms per cubic meter ($\mu g/m^3$) and 150 $\mu g/m^3$ for PM10.

To improve and protect visibility in Class I areas, the USEPA required the State of Colorado and other federal agencies to collaboratively develop and implement air quality protection plans (Regional Haze Rule) to reduce the pollution that causes visibility impairment. Smoke permits outline under which conditions any given prescribed burn may occur, including the number of piles or acres per day and wind and weather conditions, to meet the Regional Haze Rule. Generally for pile burning, more piles can be burned if they are smaller in size, such as those created by hand piling. For broadcast burning, the allowable number of acres per day depends on distance from occupied homes and potential smoke risk. The permit conditions would not allow the USFS to exceed the air quality standards for pile or broadcast burns.

Because of the information provided above, the design criteria developed, and because the Forest will obtain and follow smoke permits required by the State of Colorado, this is dismissed from further analysis in this document.

1.7.4.7 Economics

The Forsythe II Project area is located within Boulder and Gilpin Counties, Colorado. The consequences of implementing the alternatives on resources for which non-monetary benefits and costs could possibly occur are discussed in the specific resource write-ups such as air, soil or recreation. The assumptions related to the analysis and the results are contained in the specialist reports found in the project record. Non-monetary benefits associated with the implementation of the proposed action or alternatives relates to the four objectives identified in the purpose and need and specific resources such as wildlife, water, air, and scenic values.

Activities associated with management actions may generate various economic benefits and costs depending on the design. The economic values associated with any products or other commodities that may result from project implementation would be less than the associated costs. Agency costs associated with planning and administration are not included in this economic analysis, but are expected to be similar under all action alternatives.

This project is objective driven, meaning that the overall intent of the four objectives was the primary goal during project development. The management activities would not be designed to provide forest products, but if products become available as a result of the activities, they would be reflected in the overall contract bid. The minimal value from revenue associated with product removal was not included in this document because of the uncertainty of markets and lack of a local industry to process the material into forest products. Some material may be processed on site, but the amount would be expected to be very small. It is anticipated that some material may be used for fuelwood, post and poles, and material to generate power at a local biomass conversion power plant in the future.

The economic relationship between the forest in its current condition and the biophysical structure it provides are values that are difficult to quantify. Ecosystem services are typically non-quantifiable attributes of a given landscape. They can include the purification processes of air and water, the generation and preservation of soils, and the perpetuation of aesthetic beauty of a functioning forest. While some ecosystem services may be on a much larger scale than would be measurably affected by this project, such as global warming, some of the proposed activities, on a local scale, can affect certain ecosystem services, and are discussed under the other resources.

Large-scale wildfire could reduce opportunities for future recreation uses, private land development, and increased sedimentation could have economic impacts downstream and within the project area. Management activities, which incur costs and generate impacts, can also change the risk and intensity of wildfires and their associated costs and impacts. Costs and benefits associated with reducing the risk of crown fire initiation and spread are not assigned a dollar value though there would likely be changes in resource values such as increases or decreases in wildlife habitat, scenic value and recreation use, and other ecosystem services, and costs associated with wildfire suppression.

One of the objectives of this project is to reduce the severity and intensity of a wildfire with the WUI. It is important to consider the costs associated with impacts from a potential wildfire and the related suppression costs. There is a considerable range for suppression costs depending on the variety of conditions in which a fire exists. There are many factors that affect suppression costs related to weather, topography, and accessibility. Costs per acre for suppressing small wildfires can be significantly greater than the costs of suppressing large fires, but the total cost would typically be much less for the small fires. It is assumed that firefighters would be better able to control wildfires under the alternatives that reduce ladder fuels and stand density, and raise crown base heights, keeping the overall size of wildfires smaller and minimizing the potential for crown fire initiation and spread resulting in lower total costs for suppression. These costs do not include costs associated with property and private home losses, loss of natural resources and restoration or recovery expenditures.

1.7.4.8 Social Concerns

This social analysis has been prepared relative to the proposed action and range of alternatives presented in this EA. This disclosure, by reference, includes the social analysis in the 2012 Forsythe Project Environmental Analysis. Executive Order 12898 and the accompanying Presidential Memorandum requires federal agencies to analyze the environmental effects, including human health, economic and social effects, of Federal actions, including effects on minority communities and low-income communities, when such analysis is required by the NEPA. Impacts and effects to the recreational experience, fire and fuels, vegetation, and wildlife are disclosed in Chapter 3 of this document.

This section presents information on the social climate complexities on the Boulder Ranger District, specifically in the Forsythe II project area. Included is a general summary of the comments received in response to the Forsythe II Proposed Action and a discussion of the social tradeoffs of forest management.

Current Condition

The ARP covers an estimated 1.5 million acres. The Boulder Ranger District covers 250,000 acres, including approximately 163,000 acres of National Forest System lands with about 87,000 acres of private lands and other public lands (Boulder County and City of Boulder) interspersed across the Ranger District. Many of these private land parcels were patented mining claims that have since been developed with mountain residences and cabins. Much of the Boulder Ranger District is located in the Wildland Urban Interface (see Appendix E Glossary for definition). There is an estimated 1,515 miles of National Forest/private land boundary on the Boulder Ranger District (Tomaschaw, personal communication, 2015), and 110 miles of National Forest/private land boundary within the Forsythe II project area (Odom, personal communication, 2016). Typical National Forest management activities, including vegetation management, can become more difficult with the complex land ownership pattern like those within the Forsythe II project area. Within the WUI and land ownership pattern, natural resource management can be very complex compared to managing large tracks of contiguous National Forest System (NFS) lands. The complexity is due, collectively, to differing values, and beliefs of the surrounding populations and differing management objectives of local land agencies.

In 2005, the population of Colorado was 4.6 million people; today, it's 5.5 million. Population growth in Colorado is estimated at approximately 100,000 people per year, most of which settle on the Front Range (Svaldi, 2015; Blevins, 2016; Birkeland & Hubbard, 2015). Census data anticipates that in 2020, 5.9 million people will be living in Colorado, and 80 percent of that growth is expected to be concentrated along the Front Range. The Forsythe II project area is heavily populated with the community of Nederland to the west, interspersed private lands throughout and the city of Boulder to the east. Boulder County population has grown at a rate of 8.4% per year since 2000. Currently, it is estimated at 319,372 people (US Census Bureau). There is no data available to estimate population growth in western Boulder County and northern Gilpin County, specifically. There are several mountain communities (such as Nederland, Ward, Jamestown, and Allenspark) where private land and populations are more concentrated. However, much of the mountain populations are in subdivisions or scattered throughout the Boulder Ranger District. Except for a few larger tracks, the majority of the other ownership is scattered across the landscape, intermixed with NFS lands.

The Front Range portion of the ARP is proximate to the rapidly growing urban areas including Boulder, Denver, and Fort Collins, CO (Brooks & Champ, 2006). There are currently more than 1 million people living within 50 miles of the forest boundary, the ARP qualifies as an urban forest (English, Froemke, & Hawkos, 2014). More than half the visits to a national forest nationwide are made by people who live within 50 miles, and two-thirds of visits to a national forest are made by those who travel fewer than 100 miles (NVUM 2012). Given these facts, it is likely that, as populations nearby the ARP increase, so too would local visits to the forest. The number of visitors on NFS will continue to increase, while the actual acreage of public land available for recreation will remain relatively constant (English, Froemke, & Hawkos, 2014). Multiple use of NFS lands is evident and user conflicts are common. Some of the uses include hiking, backpacking, horseback riding, target shooting, mountain biking, alpine and Nordic skiing, camping, picnicking, birding, viewing wildlife and the scenery, mountain residents walking daily from their private lands, etc. Forest users experience opportunities for exercise, being a part of nature, relaxation and solitude, enjoyment and peace of mind. Forest use on the Boulder Ranger District and in the project area is frequent, occurring daily throughout the area.

Public Comment on the Proposed Action

There were 374 comment letters received in response to the Forsythe II Proposed Action. Of the comment letters received, 203 were form letters and 171 were unique letters. There were 1,117 comments identified from all the letters received. These comments were used to develop alternatives to the proposed action. The total number of comments is considered characteristic for projects on the Boulder Ranger District, as the number received is similar to other proposal responses. All comment letters are available to view online in the Reading Room on the Planning, Appeals, and Litigation System database (PALS) Forsythe II project page accessed from the ARP's Forsythe II Project (**http://www.fs.usda.gov/goto/arp/Forsythe2**).

Many comments on the Forsythe II Proposed Action expressed concern that management activities would impact social values, including sense of place, quality of life, and peace of mind gained by wildlife viewing, walking in the forest and being in nature. Some felt it would impact their recreational experiences. Some mountain residences expressed concern that the forest management practices proposed would impact or reduce their property values. These comments expressed great emotion and grieving following implementation of some past forest management activities and anxiety and anger over future treatments. Concern that forest conditions commenters have experienced in the past either living near or recreating on the National Forest, would change. There were strong concerns that the qualities commenters value would be lost if forest management activities were implemented. It is clear that some people have fond memories and ongoing experiences with the current forest condition, no matter the forest health conditions, as this is the forest that holds memories of their children playing, the dispersed recreational activities and wildlife viewing that have shaped their attachment to the landscape and created a sense of place for them.

In contrast, there were comments received on the Forsythe II Proposed Action that were in support of the project objectives and forest management. These comments expressed the need to manage the National Forests for improved forest health, restoration, and resiliency. These comments expressed the need to allow for mountain residents, with property adjacent to National Forest, to complete work for defensible space around their homes and communities.

There were also comments received that indicated some portion of those that responded to the proposed action felt there was little to no communication with the public concerning local National Forest management activities, both current and planned. Furthermore, some comments indicated that there is limited trust in the USFS both in knowledge of forest management and project follow through.

Social Impacts of Project Activities

The Forsythe II project area is located next to Nederland and is adjacent to and surrounds several mountain communities and subdivisions. The project area extends east to Gross Reservoir and, as stated earlier, is adjacent to numerous parcels of private lands that have homes and other infrastructure. Project activities may impact mountain residents and forest users if vegetation management were in view from their properties or occurred in the areas where they frequently visit. Those who have special place attachments in the project area may have a difficult time finding a substitute site and may feel displaced by the forest management activities in the short term.

Wildfires

The Forsythe II project area is located in the WUI where public forested land is intermixed and adjacent with private land ownership. A key characteristic in the Forsythe II project area is that land management objectives and beliefs are not consistent across land ownership. Wildfire occurring within the project area is frequent but with suppression activities, fires rarely are greater than one acre. Wildfires can ignite and burn across any and all land ownerships. Wildfire ignition comes from many sources including lightning, powerlines, cars, adjacent property, escape campfires, and cigarettes. Regardless of land ownership or ignition source, impacts are the same in the WUI, and have the potential to impact people and communities where the fires burn; the larger the wildfire, the larger the impact to people and communities. As the local community experienced with the 2016 Cold Springs fire, larger fires are possible and probable based on the forest conditions (continuous tree canopy and a buildup of fuels on the forest floor). Social support for suppression activities is overwhelmingly positive, however there are varying degrees of support for vegetation treatments (such as cutting trees) for defensible space and fuels reduction. Some commenters indicated that they would rather live with the forest they saw when they purchased their home and let it go up in flames versus seeing it be changed. Additionally, there is varying degrees of support and opinion of how vegetation management may affect wildfire suppression.

As experienced by the community during the Cold Springs fire, surviving the impacts of a wildfire event can have lasting and varied psychological and physical effects for an entire community and individual homeowners. The objectives, values, and beliefs are different between landowners and public land managers. Some private landowners live in and prefer the existing condition because that has been accepted by them as a healthy forest. There are some private landowners who prefer to have fuel mitigation adjacent to their property. The initial social response, by most, to vegetation management activities is negative, and a more positive social response occurs as the open areas fill in and the newly created views become the norm.

Vegetation Management

The forest is dynamic by nature, meaning the conditions don't remain static and are ever changing. The USFS completes forest management over the long term to maintain the desired conditions in the absence of wildfire. This requires reoccurring management entries as the forest regrows. This can be from as little 5 to as many as 25 year cycles. In many cases, forest management occurs over a longer period of time than mountain residents occupy their homes. To achieve the goal of creating more resilient forest conditions and reducing hazardous fuels buildup, management activities occur over the long term. Immediately following a vegetation treatment, across the landscape, management activities are obvious and bare ground is evident. Changes to the landscape in the short-term occur 3-5 years after management activities, where many of the openings would be filled in with new grasses, forbs and shrubs, and some cases evergreens. In 2-10+ years, aspen clones are expected to expand into the openings created from the treatment, and residual evergreens would be in a healthier condition because with less competition they have more resources available to them including water, sunlight, and nutrients. While the landscape view can change dramatically after implementation, the area would revegetate and the landscape would soften as it restores.

With the forest management activities as proposed, for some people there may be a sense of loss due to a changing landscape. There would likely be tradeoffs between the degree of forest management activities and the appearance of the existing landscape. With minimal forest treatment activities, the sense of an undisturbed forest would likely remain intact. As the level of forest management increases, specifically with patch-cuts and clear-cuts, there would likely be a sense of monumental change to the appearance of the existing landscape. While the areas that would be harvested would regrow over time, the sudden loss of a place felt by some would likely cause displacement. With management activities, as proposed, there is an opportunity to reduce risks of wildfire impacts to communities, private property, forest resources, provide opportunities for wildfire suppression, and increase landscape resiliency that the ARP and many in the surrounding area feel supports the tradeoffs to the short term and long term impacts to sense of place in the project area.

Types of Vegetation Management Activities

The vegetation management activities proposed, including thinning (taking out some trees throughout), patchcuts (removing all trees in an area up to 5 acres in size) and clearcuts (removing all trees in an area up to 20 acres in size), have different social acceptance and impacts for different people/communities. While thinning with chainsaws seems to be the most socially acceptable, based on public comment, this work does the least for reducing the risk of crown fire and creates an increased amount of slash (includes both tree limbs and boles) across the unit that needs to be disposed of later. However, it can be used to increase forest resiliency and restoration, especially in the mixed conifer forests. Patchcuts and clearcuts, typically applied only in the lodgepole forests, seem less socially acceptable, based on public comment. Acceptability appears to decrease with an increase in the size of the cutting unit. However, this work addresses the need to reduce the risk of crown fire and additionally provides fire suppression opportunities and increase in firefighter safety. For many commenters, it is more acceptable to use chainsaws for cutting trees than to use mechanical harvesters. Again, there are tradeoffs as the sole use of chainsaws for implementation creates more slash (including logs and limbs) across the landscape to be disposed of at a later time. In some areas, large logs may be left on the site. In comparison, use of mechanical harvesting equipment, in which trees are skidded to a central location, provides a greater opportunity for material to be taken off the landscape, leaving only limbs in slash piles to be disposed of later.

Wildlife

Comments received indicate that mountain residents and National Forest visitors value wildlife viewing while at home or recreating on the National Forest. Commenters describe the seeing ducks/birds, bears, elk, mountain lion and other animals in the forest. There is a concern that management activities would cause wildlife to move away from the area (analysis regarding impacts to wildlife is located in Chapter 3). In the project area, the wildlife have grown accustomed to people, due to the high occurrences of recreation and other community activities. Short term impacts to wildlife movement patterns are likely while treatment activities are occurring. Once the work is completed, wildlife would most likely reestablish their routines and movements patterns in the project area.

Information and Community Involvement

The Forsythe II project was initiated through collaboration with local agencies and the community. Project development was in support of the 2011 Boulder County, 2009 Gilpin County, and Nederland Community Wildfire Protection plans, which by design are resident and community driven. A complete list of Colorado CWPPs can be found on the Colorado State Forest Service webpage http://csfs.colostate.edu/wildfire-mitigation/colorado-community-wildfire-protection-plans/. Additional engagement of mountain communities in project planning is essential to success (Cooke, Williams, Paveglio, & Carroll, 2016). It is necessary for the USFS, ARP specifically, to provide information on project objectives, activities, and timeframes so that community members can understand why a project is occurring and is given time to provide constructive comments on the project’s development. Projects such as Forsythe II on the Boulder Ranger District receive several hundred letters in response to the proposed actions, with a wide range of comments, beliefs, and opinions. While the USFS personnel work to address concerns and listen to input, it is not possible to meet everyone’s specific concerns or needs. In these instances, people may feel that their comments didn’t matter or that they were not listened to. When making decisions on what actions to move forward, the decision maker weighs project objectives with the effects of project activities on resources assessed and input received from the public.

Trust

Community trust with the USFS varies based on expectations and experience. Community members that trust the USFS generally support the project objectives. Others exhibit a lack of trust regarding the ability for the ARP to follow through on the implementation. The ARP recognizes the lack of trust and how it can impact vegetation/fuels treatments. Several studies have found that citizen trust in land management agencies can significantly influence acceptance of the fuel reduction treatments (Toman, Stidham, McCaffrey, & Shindler, 2013). One component of trust is the perceived competency of the agency managers to implement treatments. Another is the shared values between the citizens and the land managers; the more similar the shared values, the higher the support of the project (Toman, Stidham, McCaffrey, & Shindler, 2013). Finding ways to better understand what commonalities or shared values the USFS has with the concerned citizens would be a key step to improve communications and work toward improving trust.

Building and rebuilding trust requires reasonable expectations and acceptance of differing opinions. It includes integrity, competence, and results. Working with transparency and explaining the details of the project implementation, contracting operations and project objectives through various formats can build trust. Follow through with agreements and plans build and maintains trust. Resource limitations in time, budget, and personnel and other forest priorities often hinder the trust building activities the community would like to experience. Often the result is the opposite perception that management does not care and does not listen. Building trust takes time and willingness of all involved.

Property Values

Some comments received in response to the Purposed Action stated concerns that project activities would negatively impact property values. This concern is closely associated with the strong values related to sense of place described previously. The concern may also be related specifically to the view one sees from their mountain property. It is not possible to determine the impact of this accurately, however, there is an indication that property values are negatively affected only if there are ongoing wildfires during a time when someone is looking for a mountain property to purchase and not specifically due to fire mitigation or forest management (Theriault, personal communication, 2016).

Summary

With management activities, as proposed, there is an opportunity to reduce risks of wildfire impacts to communities, private property, forest resources, provide opportunities for wildfire suppression and firefighter safety, and increase landscape resiliency that the ARP and many in the surrounding area feel supports the tradeoffs to the short term and long term impacts to sense of place in the project area.

Forest management in the Forsythe II project area is complex due to the fractured land ownership pattern and the variety and frequency of forest visitors to the area. Additionally, there is a wide and differing variety of land management objectives, values, and beliefs with the land management agencies and community members. Change on the landscape occurs continually because it is dynamic in nature. Sudden changes to the landscape can occur through wildfire, development, or forest management activities. There are varying degrees of social acceptance based on the change agent (wildfire or management activities) and the effects of the change. In selecting a final alternative, it is realized that no alternative would be able to answer all the needs of all communities and individuals interested in the project outcome. All alternatives are compromises between competing uses and values of the National Forest lands and competing definitions of special places. Social values and concerns are broad and complex enough that they do not constitute a single issue that can be easily addressed. The responsible official weighs many things in order to make an informed decision that best serves the resource and the public for present and future generations.

1.8 Decisions to be Made

This EA presents evidence and analysis necessary to determine whether the consequences of the proposed management actions have “significant” effects on the human environment and therefore, whether an EIS is necessary. Upon completion of this determination, the Responsible Official Monte Williams, Forest Supervisor, would document the decision to implement the proposed action or any of the alternatives as well as his decision to amend the Forest Plan in a Decision Notice and Finding of No Significant Impact (FONSI).

Due to delegation of authority for issuing special use authorizations greater than five years, Monte Williams, would also decide the course of action concerning the proposed ingress/egress routes for the Big Springs Subdivision in Nederland. This would be documented in a Categorical Exclusion (CE).

Chapter 2 – Description of Alternatives

2.1 Introduction

This chapter describes and compares the alternatives considered for the Forsythe II project. Included is a description and map of the action alternatives considered and design features for the action alternatives. This section also presents the alternatives in comparative form, defining the differences between each alternative and providing a basis for choice among options by the decision maker.

2.2 Alternatives Considered but Eliminated from Detailed Study

Four alternatives were considered by the USFS, but were not analyzed in detail. These alternatives were recommendations of the public based on the issues and the purpose and need of the project. These alternatives were dropped from further analysis because they did not meet the purpose and need of the project.

2.2.1 Alternate Plan

The Magnolia Forest Group submitted a plan that would have minimal forest cutting and an emphasis on monitoring and patrols. Specifically, the plan suggested the following actions:

- Thinning regenerated lodgepole pine stands
- Surface fuel reduction
- Weed control
- Defensible space
- Wildlife monitoring
- Increased patrols to prevent and control human caused fires

Thinning regenerated lodgepole pine stands previously managed (approximately 17 acres) would not restore forested stands composition, structure and spatial patterns in order to increase resistance and resiliency to future natural disturbance. A combination of both manual and mechanical thinning in various vegetation types is needed to reduce existing stand densities, increase landscape variation and perpetuate forested stands over time. In older lodgepole pine dominated stands, regeneration thinning does not emulate natural disturbance patterns or mimic variable structural and spatial patterns across the landscape in order to increase resistance and resiliency to future natural disturbance. An existing and extensive homogenous lodgepole landscape is more susceptible to landscape scale disturbances, especially in a forecasted changing climate. Areas previously clearcut within the project boundary would be thinned as part of the proposed action.

In the Alternate Plan, surface fuel reduction refers to the slash piles created from previous projects that remain across the project area. The USFS has been disposing of slash piles through pile burning and chipping across the area, as weather permits. Just reducing the piles alone would not reduce the intensity of a wildfire within the WUI.

The Alternate Plan describes previous treatment areas, particularly those treated mechanically, as containing invasive weeds, many of which are highly flammable. The USFS treats noxious weeds as funds are available in treatment areas. Only treating noxious weeds would not reduce the intensity of a wildfire within the WUI.

Allowing for defensible space only does provide an increase in protection to private property. However, it would not reduce the intensity of a wildfire across the project area, nor provide opportunities for fire suppression strategies and tactics. More treatment would be needed outside of these defensible space areas to meet the purpose and need of this project. Considerations for firefighter and public safety during a wildfire event and overall forest stand density within the WUI are not addressed.

The Alternate Plan suggests that wildlife monitoring be done prior to any treatment to determine what species are present within the project area along with what habitat is needed for those species to provide a basis for improving wildlife habitat. The USFS assumes presence of species based on habitat type present within the project area. MIS populations are monitored periodically at the Forest level, not the project level. There is Forest Plan direction to protect known raptor nests. Design criteria provide for surveys to be completed prior to implementation for USFS Sensitive raptor species, and protection of nests. Elk are a USFS MIS and are analyzed, including cumulative effects from other actions across ownerships, in the four action alternatives (see Section 3.6 Terrestrial Wildlife for more information). Analysis for elk includes consideration of the migration corridor, recently updated by Colorado Parks and Wildlife, and design criteria provide for limitation of project activities in important winter range.

The Alternate Plan proposed to initiate longer fire bans, bans on dispersed shooting, along with increased patrols and enforcement to ensure compliance to reduce the threat of catastrophic fire. Though these suggestions are valid to consider, they are beyond the scope of this project.

As proposed, the Alternate Plan would not meet the purpose and need of the project, however some components of the Alternate Plan have been integrated into the action alternatives for this project.

2.2.2 Fuel Breaks Only

The Interdisciplinary Team considered no vegetation treatment other than fuel breaks along subdivisions and ingress/egress routes. Although fuel breaks would be beneficial to reduce wildfire intensity where treatment occurs, this alternative would not reduce the potential negative effects to Gross Reservoir, nor address improving resiliency within the project area.

2.2.3 No Mechanical Treatment

The Interdisciplinary Team considered treating vegetation by manual means only. Only allowing treatment to be done manually would exclude the option to treat the lodgepole pine stands. One of the purposes of this project is to emulate natural disturbance in lodgepole pine dominated stands to mimic variable structural and spatial patterns across the landscape in order to increase resistance and resiliency to future natural disturbance. This alternative would not meet the purpose and need of the project.

2.2.4 Thinning in Mature Lodgepole Pine

The Interdisciplinary Team considered thinning in lodgepole pine rather than clearcutting/patchcutting. Lodgepole pine management in the WUI typically involves a combination of fuels management and forest health objectives. Management in this WUI area is considerably different from management in lodgepole pine forests located away from the WUI. Thinning in lodgepole pine stands, unlike thinning in ponderosa pine and mixed conifer stands, tends to contradict lodgepole pine ecology and ecosystem function. Thinning these mature stands would not emulate a natural disturbance nor create a break in the canopy. The lifecycle of lodgepole pine usually starts and ends with a crown fire. Thinning in mature lodgepole pine stands often results in windthrow of the remaining trees causing an increase in fuel loading on the ground. Thinning in lodgepole pine would not create a variable structure across the project area which is inconsistent with the purpose and need for this project.

2.3 Alternatives Considered in Detail

This section describes the alternatives considered for the Forsythe II project. It includes a description and maps of each alternative considered. Section 2.5 Comparison of Alternatives presents the alternatives in comparative table (Table 2 and Table 3) form providing a clear basis for choice among options by the decision maker. Four action alternatives are analyzed in detail below. These alternatives meet the purpose and need for this project while also addressing concerns expressed during the public involvement process to date.

2.3.1 No Action Alternative

The Healthy Forests Restoration Act does not require a No Action Alternative to be analyzed, rather only the effects of failing to take action. The No Action Alternative serves as a baseline for comparing the effects of the action alternatives on the environment against taking no action.

Under the No Action Alternative, current management plans would continue to guide management of the project area. No vegetation management or other actions from this analysis would be performed therefore the purpose and need for this project would not be met.

2.3.2 Alternative 1 – Proposed Action

The ID team developed Alternative 1, the proposed action, to address the purpose and need for this project as described in Chapter 1 of this document. Actions common to all action alternatives are described in Section 2.4 Activities Common to All Action Alternatives.

Alternative 1 would treat approximately 3,151 acres of the 9,930 acres of NFS lands within the project area. The proposed action includes 2,483 acres of mechanical/hand treatment and 968 acres of broadcast burning. A combination of mechanical/hand treatment and broadcast burning would occur on 300 acres. Additionally, 2,032 acres are analyzed for defensible space to provide permitted homeowners adjacent to NFS lands the ability to treat on NFS lands. However, based on previous requests and information provided through Boulder County Wildfire Partners it is estimated that up to 10% of the analyzed defensible space acres would be treated, or 203 acres.

Proposed management activities include thinning 1,015 acres of Douglas-fir dominated mixed conifer stands, thinning 392 acres of ponderosa pine dominated mixed conifer stands, thinning 42 acres of old growth mixed conifer stands, patchcutting/clearcutting 741 acres of lodgepole pine stands, thinning 17 acres of regenerated lodgepole pine stands, cutting 276 acres of conifers within aspen and meadow/shrubland areas, and broadcast burning 968 acres (Figure 2). Reforestation treatments (tree planting of mixed conifer species) would occur in patchcuts/clearcuts. Manually thinning lodgepole pine regeneration in the patchcut/clearcut areas, which would be done under this decision, would continue every 7-15 years, or as needed into the future. Approximately seven miles of temporary roads would be constructed to facilitate the vegetation management activities and would be decommissioned after the completion of treatment activities.

The dominant vegetation stand conditions that occur across the project area were used to delineate proposed treatment units. The dominant vegetation stand conditions include mixed conifer stands, lodgepole pine stands, aspen stands, and meadows/shrublands. There are conditions that occur within the project area where a management unit might be delineated as a mixed conifer stand but contain aggregations (1/2 acre to 5 acres in size) of the other dominant stand conditions. These aggregations could be expected to occur across 30% of any given unit and across more than 50% of the proposed units. As an example, there may be areas within a unit designated as mixed conifer that contain aspen clones, meadows, or patches of lodgepole pine. In situations where aggregations occur across a unit, the appropriate treatment for that stand type would be implemented as described below. For example, if a patch of aspen occurs within a mixed conifer stand, the aspen patch would be treated to remove conifers as described below for aspen treatment.

Mixed Conifer Stands

There are 971 acres mapped[2] as Douglas-fir mixed conifer treatment, 392 acres as ponderosa pine mixed conifer treatment, 42 acres as old growth mixed conifer treatment, and 44 acres as 2-staged mixed conifer treatment (Figure 2). Treatment prescription in units designated as mixed conifer would be as follows:

- Thin to reduce the stand density by no more than 40% in any given unit, including old growth development areas, from the existing volume or basal area.
- Areas designated as inventoried and retention old growth would have the density reduced by no more than 30%, from the existing volume or basal area.
- All limber pine that do not pose a safety hazard, would be retained.
- All trees 16 inches diameter at breast height (DBH) and larger would be retained.
- Treatment could be done mechanically or manually.

Treatment prescription in Unit 74 is designated as a 2-staged mixed conifer treatment. This unit consists of Douglas-fir dominated stands with heavy downed surface fuels resulting from past disturbances. Because there is heavy fuel loading in the unit, two separate treatments would be performed as described below:

- Stage 1 – Existing downed fuels would be hand piled and later burned. Due to the density of these stands, some live conifers up to 16 inches DBH may be cut and piled with the existing slash in order to establish openings and minimize the scorching of adjacent trees for pile burning.

- Stage 2 – Thin to reduce the stand density by no more than 40% from the existing volume or basal area while incorporating the spatial arrangement mentioned above. All limber pine that do not pose a safety hazard, would be retained. All trees 16 inches DBH and larger would be retained. Treatment could be done mechanically or manually.

Lodgepole Pine Stands

There are 1,482 acres mapped for lodgepole pine treatment (Figure 2). Up to 50% of the mapped acres (741 acres) would be patchcut/clearcut. Treatment prescription in units designated as patchcut/clearcut would be as follows:

- Patchcuts (removal of all conifer trees) could be 1-5 acres in size.
- Clearcuts (removal of all conifer trees) could be 5-20 acres in size.
- No more than 50% of a unit would be patchcut or clearcut.
- Untreated buffers of at least 100 feet would be left between patchcuts and clearcuts.
- Mixed conifer species may be retained in patchcuts or clearcuts if there is minimal potential for blowdown when the remainder of the stand is cut.
- Following patchcut/clearcut treatments, reforestation treatments (tree planting of mixed conifer species) would occur in these areas.
- Treatment could be done mechanically or manually.

There are 17 acres of lodgepole pine mapped as regeneration thin (Figure 2). Treatment prescription in units designated as regeneration thin (areas previously patchcut/clearcut with trees less than 15 feet tall) would be as follows:

- Thin regenerated lodgepole pine to an average spacing of 10-15 feet.
- Treatment could be done mechanically or manually.

[2] Acres were derived by GIS query and are referred to as mapped acres in this document. Exact acreage treated is verified on the ground prior to implementation.

Aspen Stands

There are 231 acres mapped as aspen (Figure 2). Treatment prescription in units designated as aspen restoration would be as follows:

- Cut all conifers, except ponderosa pine 16 inches DBH and greater, within and up to 50 feet of the edge of the aspen clone.
- Retain all limber pine.
- If snags are not available in the aspen stand, create snags within the aspen stand by girdling up to five of the largest conifers less than 16 inches DBH, unless they would pose a safety hazard.
- Treatment could be done mechanically or manually.

Meadows and Shrublands

There are 45 acres mapped as meadow/shrubland (Figure 2). Treatment prescription in units designated as meadow/shrubland restoration would be as follows:

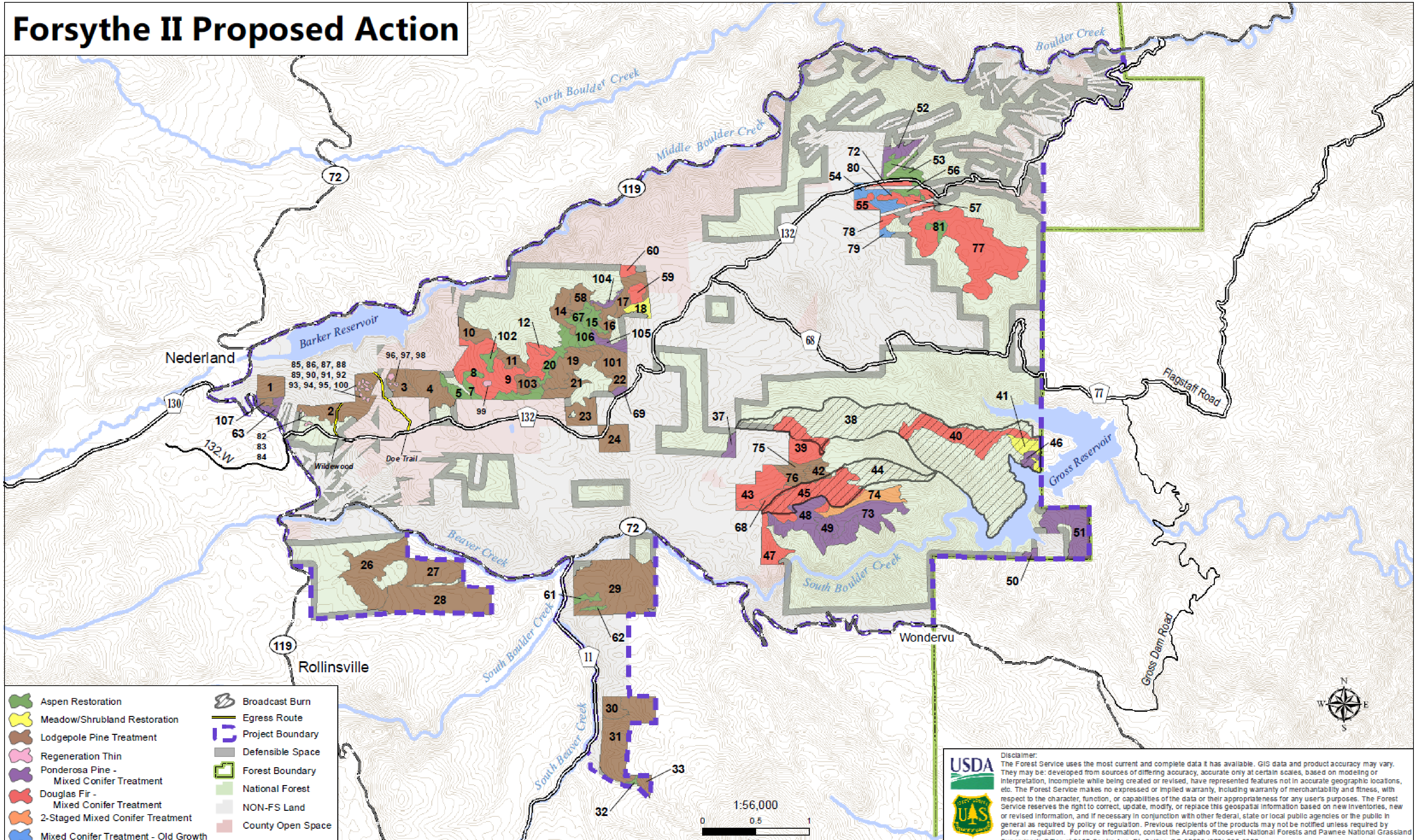
- Cut all ponderosa pine and Douglas-fir up to 14 inches DBH and all lodgepole pine up to 12 inches DBH.
- Retain all limber pine.
- Treatment would be done manually.

Defensible Space

Defensible space is delineated along areas where private property abuts NFS lands, except areas where proposed treatment units are located. Defensible space treatment would not occur in units proposed for different treatment along the private property boundary. Areas where proposed treatment units on NFS lands are not along the private property boundaries, defensible space prescriptions may be applied on NFS lands up to 300 feet from a structure, with an approved permit, to complement defensible space treatments on private property.

There are 2,032 acres mapped as defensible space throughout the project area (Figure 2). It is estimated that only a portion of those mapped acres, up to 10% or 203 acres, would be treated. Treatment could occur out to Zone 3 and follow the guidelines outlined by USFS resource specialists and in the Defensible Space Management Zones as described by the Colorado State Forest Service (CSFS 2012).

Figure 2. Map of Alternative 1 – Proposed Action



2.3.3 Alternative 2

The ID team developed Alternative 2 to address wildlife, soils, and hydrology concerns while still meeting the purpose and need for this project as described in Chapter 1 of this document. Alternative 2, when compared to Alternative 1 – Proposed Action, limits the size of clearcuts to 10 acres, retains trees 14 inch DBH and greater, increases the amount of basal area or volume cut within ponderosa pine mixed conifer treatment units to 50%, and allows up to 30% of any given lodgepole pine treatment unit to be cut. Actions common to all action alternatives are described in Section 2.4 Activities Common to All Action Alternatives.

Alternative 2 would treat approximately 2,334 acres of the 9,930 acres of NFS lands within the project area. The proposed action includes 1,657 acres of mechanical/hand treatment and 968 acres of broadcast burning. A combination of mechanical/hand treatment and broadcast burning would occur on 291 acres. Additionally, 2,862 acres are analyzed for defensible space to provide permitted homeowners adjacent to NFS lands the ability to treat on NFS lands. However, based on previous requests and information provided through Boulder County Wildfire Partners it is estimated that up to 10% of the analyzed defensible space acres would be treated, or 286 acres.

Proposed management activities include thinning 796 acres of Douglas-fir dominated mixed conifer stands, thinning 293 acres of ponderosa pine dominated mixed conifer stands, patchcutting/clearcutting 308 acres of lodgepole pine stands, thinning 8 acres of regenerated lodgepole pine stands, cutting 200 acres of conifers within aspen and meadow/shrubland areas, and broadcast burning 968 acres (Figure 3). Reforestation treatments (tree planting of mixed conifer species) would occur in patchcuts/clearcuts. Manually thinning lodgepole pine regeneration in the patchcut/clearcut areas, which would be done under this decision, would continue every 7-15 years, or as needed into the future. Approximately seven miles of temporary roads would be constructed to facilitate the vegetation management activities and would be decommissioned after the completion of treatment activities.

The dominant vegetation stand conditions that occur across the project area were used to delineate proposed treatment units. The dominant vegetation stand conditions include mixed conifer stands, lodgepole pine stands, aspen stands, and meadows/shrublands. There are conditions that occur across the project area where a management unit might be delineated as a mixed conifer stand but contain aggregations (1/2 acre to 5 acres in size) of the other dominant stand conditions. These aggregations could be expected to occur across 30% of any given unit and across more than 50% of the proposed units. As an example, there may be areas within a unit designated as mixed conifer that contain aspen clones, meadows, or patches of lodgepole pine. In situations where aggregations occur across a unit, the appropriate treatment for that stand type would be implemented as described below. For example, if a patch of aspen occurs within a mixed conifer stand, the aspen patch would be treated to remove conifers as described below for aspen treatment.

<u>Mixed Conifer Stands</u>

There are 796 acres mapped[3] as Douglas-fir mixed conifer treatment, 293 acres as ponderosa pine mixed conifer treatment, 8 acres as old growth mixed conifer treatment, and 44 acres as 2-staged mixed conifer treatment (Figure 3). Treatment prescription in these units would be as follows:

- Thin to reduce the stand density by no more than 50% in ponderosa pine dominated units, from the existing volume or basal area.
- Thin to reduce the stand density by no more than 40% in Douglas-fir dominated units, from the existing volume or basal area.

[3] Acres were derived by GIS query and are referred to as mapped acres in this document. Exact acreage treated is verified on the ground prior to implementation.

- Areas designated as inventoried and retention old growth would have the density reduced by no more than 30%, from the existing volume or basal.
- All limber pine that do not pose a safety hazard, would be retained.
- All trees 14 inches DBH and larger would be retained.
- Treatment could be done mechanically or manually.

Treatment prescription in Unit 74 is designated as a 2-staged mixed conifer treatment. This unit consists of Douglas-fir dominated stands with heavy downed surface fuels resulting from past disturbances. Because there is heavy fuel loading in the unit, two separate treatments would be performed as described below:

- <u>Stage 1</u> – Existing downed fuels would be hand piled and later burned. Due to the density of these stands, some live conifers up to 14 inches DBH may be cut and piled with the existing slash in order to establish openings and minimize the scorching of adjacent trees for pile burning.

- <u>Stage 2</u> – Thin to reduce the stand density by no more than 40% from the existing volume or basal area while incorporating the spatial arrangement mentioned above. All limber pine that do not pose a safety hazard, would be retained. All trees 14 inches DBH and larger would be retained. Treatment could be done mechanically or manually.

<u>Lodgepole Pine Stands</u>

There are 1,028 acres mapped as lodgepole pine treatment (Figure 3). Up to 30% of the mapped acres (308 acres) would be patchcut/clearcut. Treatment prescription in units designated as patchcut/clearcut would be as follows:

- Patchcuts (removal of all conifer trees) could be 1-5 acres in size.
- Clearcuts (removal of all conifer trees) could be 5-10 acres in size.
- No more than 30% of a unit would be patchcut or clearcut.
- Untreated buffers of at least 100 feet would be left between patchcuts and clearcuts.
- Mixed conifer species may be retained in patchcuts or clearcuts if there is minimal potential for blowdown when the remainder of the stand is cut.
- Following patchcut/clearcut treatments, reforestation treatments (tree planting of mixed conifer species) would occur in these areas.
- Treatment could be done mechanically or manually.

There are 8 acres of lodgepole pine mapped as regeneration thin (Figure 3). Treatment prescription in units designated as regeneration thin (areas previously patchcut/clearcut with trees less than 15 feet tall) would be as follows:

- Thin regenerated lodgepole pine to an average spacing of 10-15 feet.
- Treatment could be done mechanically or manually.

<u>Aspen Stands</u>

There are 163 acres mapped as aspen (Figure 3). Treatment prescription in units designated as aspen restoration would be as follows:

- Cut all conifers, except ponderosa pine 14 inches DBH and greater, within and up to 10 feet of the edge of the aspen clone.
- Retain all limber pine.
- If snags are not available in the aspen stand, create snags within the aspen stand by girdling up to five of the largest conifers less than 14 inches DBH, unless they would pose a safety hazard.
- Treatment could be done mechanically or manually.

Meadows and Shrublands

There are 37 acres mapped as meadow/shrubland (Figure 3). Treatment prescription in units designated as meadow/shrubland restoration would be as follows:

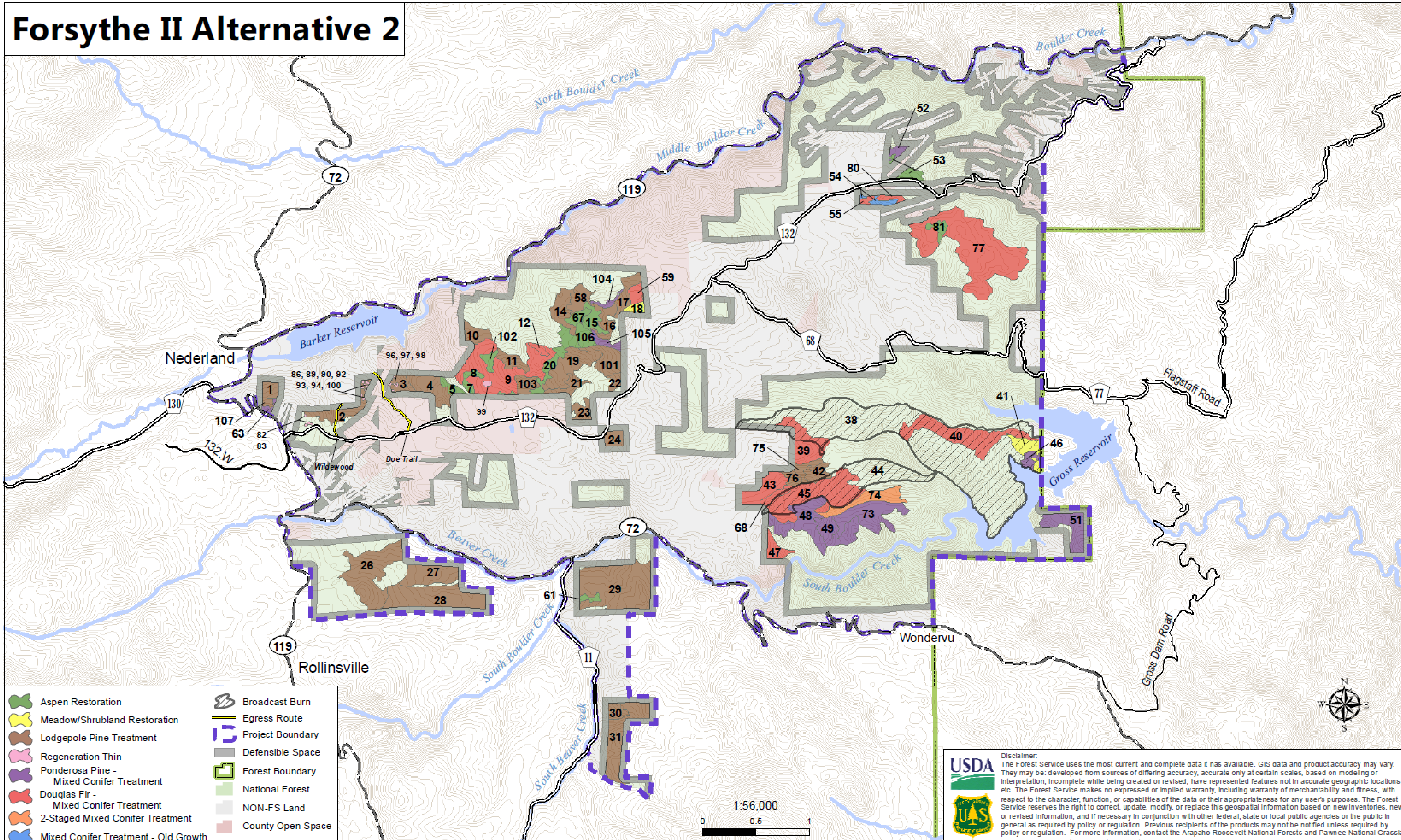
- Cut all ponderosa pine and Douglas-fir up to 14 inches DBH and all lodgepole pine up to 14 inches DBH.
- Retain all limber pine.
- Treatment would be done manually.

Defensible Space

Defensible space is delineated along areas where private property abuts NFS lands. No proposed treatment units would abut private property boundaries. Defensible space prescriptions would be applied on NFS lands up to 300 feet from a structure, with an approved permit, to complement defensible space treatments on private property.

There are 2,862 acres mapped as defensible space throughout the project area (Figure 3). It is estimated that only a portion of those mapped acres, up to 10% or 286 acres, would be treated. Treatment could occur out to Zone 3 and follow the guidelines outlined by USFS resource specialists and in the Defensible Space Management Zones as described by the Colorado State Forest Service (CSFS 2012).

Figure 3. Map of Alternative 2 – Prescription Change



2.3.4 Alternative 3

The ID team developed Alternative 3 to address wildlife, soils, and hydrology concerns while still meeting the purpose and need for this project as described in Chapter 1 of this document. For Alternative 3, when compared to Alternative 1 – Proposed Action, 15 units were dropped and another 10 units became smaller units. These changes decreased the treatment acres by 438 acres, however another five units were added, 88 acres, to address public comments received. Actions common to all action alternatives are described in Section 2.4 Activities Common to All Action Alternatives.

Alternative 3 would treat approximately 2,717 acres of the 9,930 acres of NFS lands within the project area. The proposed action includes 2,045 acres of mechanical/hand treatment and 968 acres of broadcast burning. A combination of mechanical/hand treatment and broadcast burning would occur on 296 acres. Additionally, 2,200 acres are analyzed for defensible space to provide permitted homeowners adjacent to NFS lands the ability to treat on NFS lands. However, based on previous requests and information provided through Boulder County Wildfire Partners it is estimated that up to 10% of the analyzed defensible space acres would be treated, or 220 acres.

Proposed management activities include thinning 885 acres of Douglas-fir dominated mixed conifer stands, thinning 370 acres of ponderosa pine mixed conifer stands, patchcutting/clearcutting 383 acres of lodgepole pine stands, thinning 17 acres of regenerated lodgepole pine stands, cutting 287 acres of conifers within aspen and meadow/shrubland areas, and broadcast burning 968 acres (Figure 4). Reforestation treatments (tree planting of mixed conifer species) would occur in patchcuts/clearcuts. Manually thinning lodgepole pine regeneration in the patchcut/clearcut areas, which would be done under this decision, would continue every 7-15 years, or as needed into the future. Approximately five miles of temporary roads would be constructed to facilitate the vegetation management activities and would be decommissioned after the completion of treatment activities.

The dominant vegetation stand conditions that occur across the project area were used to delineate proposed treatment units. The dominant vegetation stand conditions include mixed conifer stands, lodgepole pine stands, aspen stands, and meadows/shrublands. There are conditions that occur across the project area where a management unit might be delineated as a mixed conifer stand but contain aggregations (1/2 acre to 5 acres in size) of the other dominant stand conditions. These aggregations could be expected to occur across 30% of any given unit and across more than 50% of the proposed units. As an example, there may be areas within a unit designated as mixed conifer that contain aspen clones, meadows, or patches of lodgepole pine. In situations where aggregations occur across a unit, the appropriate treatment for that stand type would be implemented as described below. For example, if a patch of aspen occurs within a mixed conifer stand, the aspen patch would be treated to remove conifers as described below for aspen treatment.

Mixed Conifer Stands

There are 885 acres mapped[4] as Douglas-fir mixed conifer treatment, 370 acres as ponderosa pine mixed conifer treatment, 42 acres as old growth mixed conifer treatment, and 61 acres as thin from below treatment (Figure 4). Treatment prescription in these units would be as follows:

- Thin to reduce the stand density by no more than 40% in any given unit, including old growth development areas, from the existing volume or basal area.
- Areas designated as inventoried and retention old growth would have the density reduced by no more than 30%, from the existing volume or basal area.
- All limber pine that do not pose a safety hazard, would be retained.
- All trees 16 inches DBH and larger would be retained.

[4] Acres were derived by GIS query and are referred to as mapped acres in this document. Exact acreage treated is verified on the ground prior to implementation.

- Unit 109 would be thinned from below to a diameter limit of 5 inches DBH and less
- Treatment could be done mechanically or manually.

<u>Lodgepole Pine Stands</u>

There are 765 acres mapped as lodgepole pine treatment (Figure 4). Up to 50% of the mapped acres (383 acres) would be patchcut/clearcut. Treatment prescription in units designated as patchcut/clearcut would be as follows:

- Patchcuts (removal of all conifer trees) could be 1-5 acres in size.
- Clearcuts (removal of all conifer trees) could be 5-20 acres in size.
- No more than 50% of a unit would be patchcut or clearcut.
- Untreated buffers of at least 100 feet would be left between patchcuts and clearcuts.
- Mixed conifer species may be retained in patchcuts or clearcuts if there is minimal potential for blowdown when the remainder of the stand is cut.
- Following patchcut/clearcut treatments, reforestation treatments (tree planting of mixed conifer species) would occur in these areas.
- Treatment could be done mechanically or manually.

There are 17 acres of lodgepole pine mapped as regeneration thin (Figure 4). Treatment prescription in units designated as regeneration thin (areas previously patchcut/clearcut with trees less than 15 feet tall) would be as follows:

- Thin regenerated lodgepole pine to an average spacing of 10-15 feet.
- Treatment could be done mechanically or manually.

<u>Aspen Stands</u>

There are 255 acres mapped as aspen (Figure 4). Treatment prescription in units designated as aspen restoration would be as follows:

- Cut all conifers, except ponderosa pine 16 inches DBH and greater, within and up to 50 feet of the edge of the aspen clone.
- Retain all limber pine.
- If snags are not available in the aspen stand, create snags within the aspen stand by girdling up to five of the largest conifers less than 16 inches DBH, unless they would pose a safety hazard.
- Treatment could be done mechanically or manually.

<u>Meadows and Shrublands</u>

There are 32 acres mapped as meadow/shrubland (Figure 4). Treatment prescription in units designated as meadow/shrubland restoration would be as follows:

- Cut all ponderosa pine and Douglas-fir up to 14 inches DBH and all lodgepole pine up to 12 inches DBH.
- Retain all limber pine.
- Treatment would be done manually.

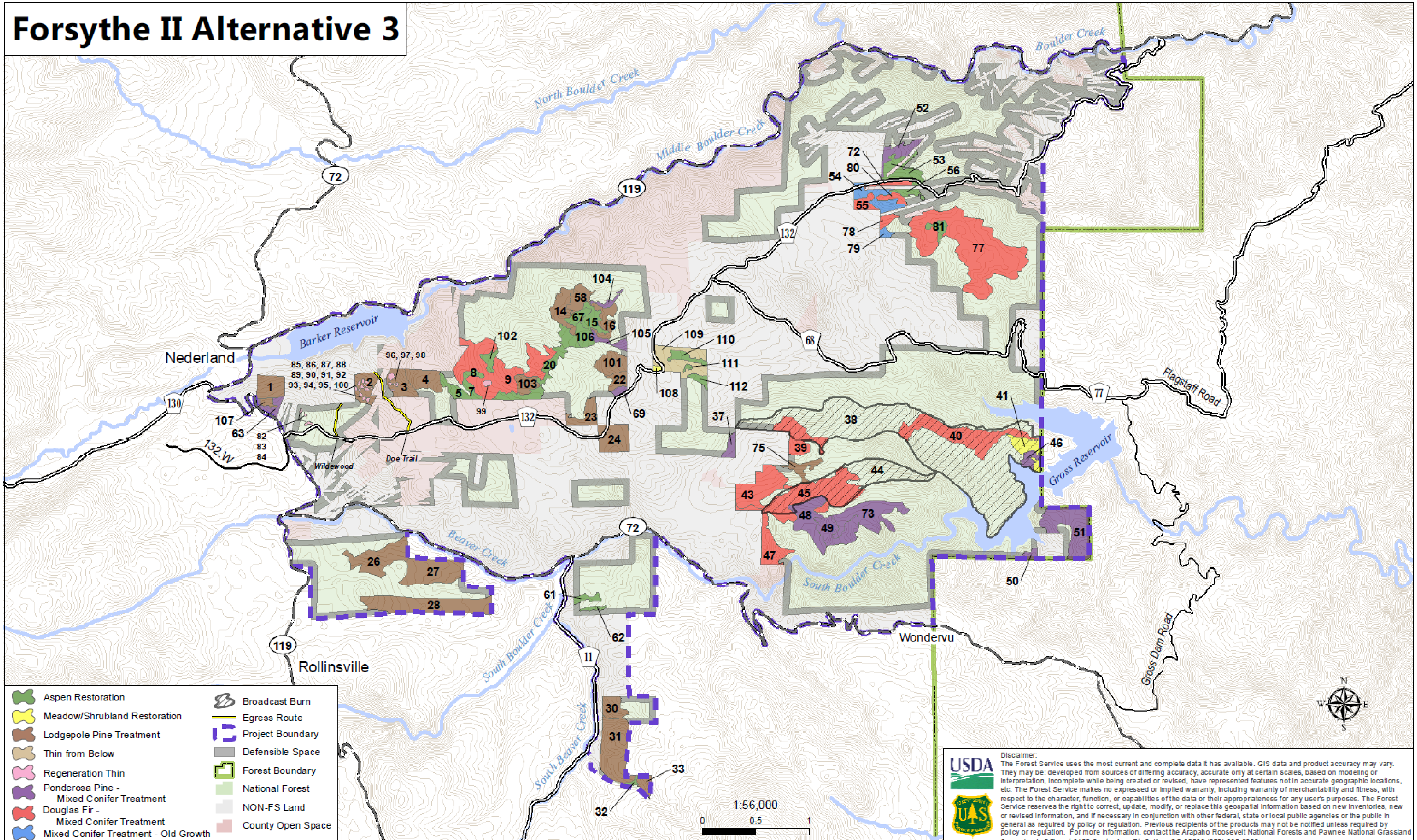
<u>Defensible Space</u>

Defensible space is delineated along areas where private property abuts NFS lands, except areas where proposed treatment units are located. Defensible space treatment would not occur in proposed treatment units along the private property boundary. Areas where proposed treatment units on NFS lands are not along the private property boundaries, defensible space prescriptions would be applied on NFS lands up to

300 feet from a structure, with an approved permit, to complement defensible space treatments on private property.

There are 2,862 acres mapped as defensible space throughout the project area (Figure 4). It is estimated that only a portion of those mapped acres, up to 10% or 286 acres, would be treated. Treatment could occur out to Zone 3 and follow the guidelines outlined by USFS resource specialists and in the Defensible Space Management Zones as described by the Colorado State Forest Service (CSFS 2012).

Figure 4. Map of Alternative 3 – Reduced Treatment



2.3.5 Alternative 4

The ID team developed Alternative 4 to address wildlife, soils, and hydrology concerns as well as public comments received during the scoping period while still meeting the purpose and need for this project as described in Chapter 1 of this document. Alternative 4 differs from Alternative 1 – Proposed Action, because the treatments would be done manually except in areas mapped as lodgepole pine treatment and the diameter cut limit would be 12 inches DBH. The lodgepole pine treatment could be completed either mechanically or manually, only patchcuts up to five acres in size would be allowed, and up to 30% of any given unit could be cut. Actions common to all action alternatives are described in Section 2.4 Activities Common to All Action Alternatives.

Alternative 4 would treat approximately 2,855 acres of the 9,930 acres of NFS lands within the project area. The proposed action includes 2,187 acres of mechanical/hand treatment and 968 acres of broadcast burning. A combination of mechanical/hand treatment and broadcast burning would occur on 300 acres. Additionally, 878 acres are analyzed for defensible space to provide permitted homeowners adjacent to NFS lands the ability to treat on NFS lands. However, based on previous requests and information provided through Boulder County Wildfire Partners it is estimated that up to 10% of the analyzed defensible space acres would be treated, or 88 acres.

Proposed management activities include thinning 971 acres of Douglas-fir dominated mixed conifer stands, 392 acres of ponderosa pine dominated mixed conifer stands, patchcutting 445 acres of lodgepole pine stands, thinning 17 acres of regenerated lodgepole pine stands, cutting 276 acres of conifers within aspen and meadow/shrubland areas, and broadcast burning 968 acres (Figure 5). Reforestation treatments (tree planting of mixed conifer species) would occur in patchcuts. Manually thinning lodgepole pine regeneration in the patchcut/clearcut areas, which would be done under this decision, would continue every 7-15 years, or as needed into the future. Approximately five miles of temporary roads would be constructed to facilitate the vegetation management activities and would be decommissioned after the completion of treatment activities.

The dominant vegetation stand conditions that occur across the project area were used to delineate proposed treatment units. The dominant vegetation stand conditions include mixed conifer stands, lodgepole pine stands, aspen stands, and meadows/shrublands. There are conditions that occur across the project area where a management unit might be delineated as a mixed conifer stand but contain aggregations (1/2 acre to 5 acres in size) of the other dominant stand conditions. These aggregations could be expected to occur across 30% of any given unit and across more than 50% of the proposed units. As an example, there may be areas within a unit designated as mixed conifer that contain aspen clones, meadows, or patches of lodgepole pine. In situations where aggregations occur across a unit, the appropriate treatment for that stand type would be implemented as described below. For example, if a patch of aspen occurs within a mixed conifer stand, the aspen patch would be treated to remove conifers as described below for aspen treatment.

Mixed Conifer Stands

There are 971 acres mapped[5] as Douglas-fir mixed conifer treatment, 392 acres as ponderosa pine mixed conifer treatment, 42 acres as old growth mixed conifer treatment, and 44 acres as 2-staged mixed conifer treatment (Figure 5). Treatment prescription in units designated as mixed conifer would be as follows:

- Thin to reduce the stand density by no more than 40% in any given unit, including old growth development areas, from the existing volume or basal area.
- Areas designated as inventoried and retention old growth would have the density reduced by no more than 30%, from the existing volume or basal.

[5] Acres were derived by GIS query and are referred to as mapped acres in this document. Exact acreage treated is verified on the ground prior to implementation.

- All limber pine that do not pose a safety hazard, would be retained.
- All trees 12 inches DBH and larger would be retained.
- Treatment would be done manually.

Treatment prescription in Unit 74 is designated as a 2-staged mixed conifer treatment. This unit consists of Douglas-fir dominated stands with heavy downed surface fuels resulting from past disturbances. Because there is heavy fuel loading in the unit, two separate treatments would be performed as described below:

- Stage 1 – Existing downed fuels would be hand piled and later burned. Due to the density of these stands, some live conifers up to 16 inches DBH may be cut and piled with the existing slash in order to establish openings and minimize the scorching of adjacent trees for pile burning.

- Stage 2 – Thin to reduce the stand density by no more than 40% from the existing volume or basal area while incorporating the spatial arrangement mentioned above. All limber pine that do not pose a safety hazard, would be retained. All trees 16 inches DBH and larger would be retained. Treatment could be done mechanically or manually.

Lodgepole Pine Stands

There are 1,482 acres mapped as lodgepole pine treatment (Figure 5). Up to 30% of the mapped acres (445 acres) would be patchcut. Treatment prescription in units designated as patchcut would be as follows:

- Patchcuts (removal of all conifer trees) could be 1-5 acres in size.
- No more than 30% of a unit would be patchcut.
- Untreated buffers of at least 100 feet would be left between patchcuts and clearcuts.
- Mixed conifer species may be retained in patchcuts or clearcuts if there is minimal potential for blowdown when the remainder of the stand is cut.
- Following treatment, plant patchcut/clearcut areas with mixture of conifer species.
- Treatment could be done mechanically or manually.

There are 17 acres of lodgepole pine mapped as regeneration thin (Figure 5). Treatment prescription in units designated as regeneration thin (areas previously patchcut/clearcut with trees less than 15 feet tall) would be as follows:

- Thin regenerated lodgepole pine to an average spacing of 10-15 feet.
- Treatment would be done manually.

Aspen Stands

There are 231 acres mapped as aspen (Figure 5). Treatment prescription in units designated as aspen restoration would be as follows:

- Cut all conifers, except ponderosa pine 12 inches DBH and greater, within and up to 50 feet of the edge of the aspen clone.
- Retain all limber pine.
- If snags are not available in the aspen stand, create snags within the aspen stand by girdling up to five of the largest conifers less than 12 inches DBH, unless they would pose a safety hazard.
- Treatment would be done manually.

Meadows and Shrublands

There are 45 acres mapped as meadow/shrubland (Figure 5). Treatment prescription in units designated as meadow/shrubland restoration would be as follows:

- Cut all ponderosa pine, lodgepole pine, and Douglas-fir up to 12 inches DBH

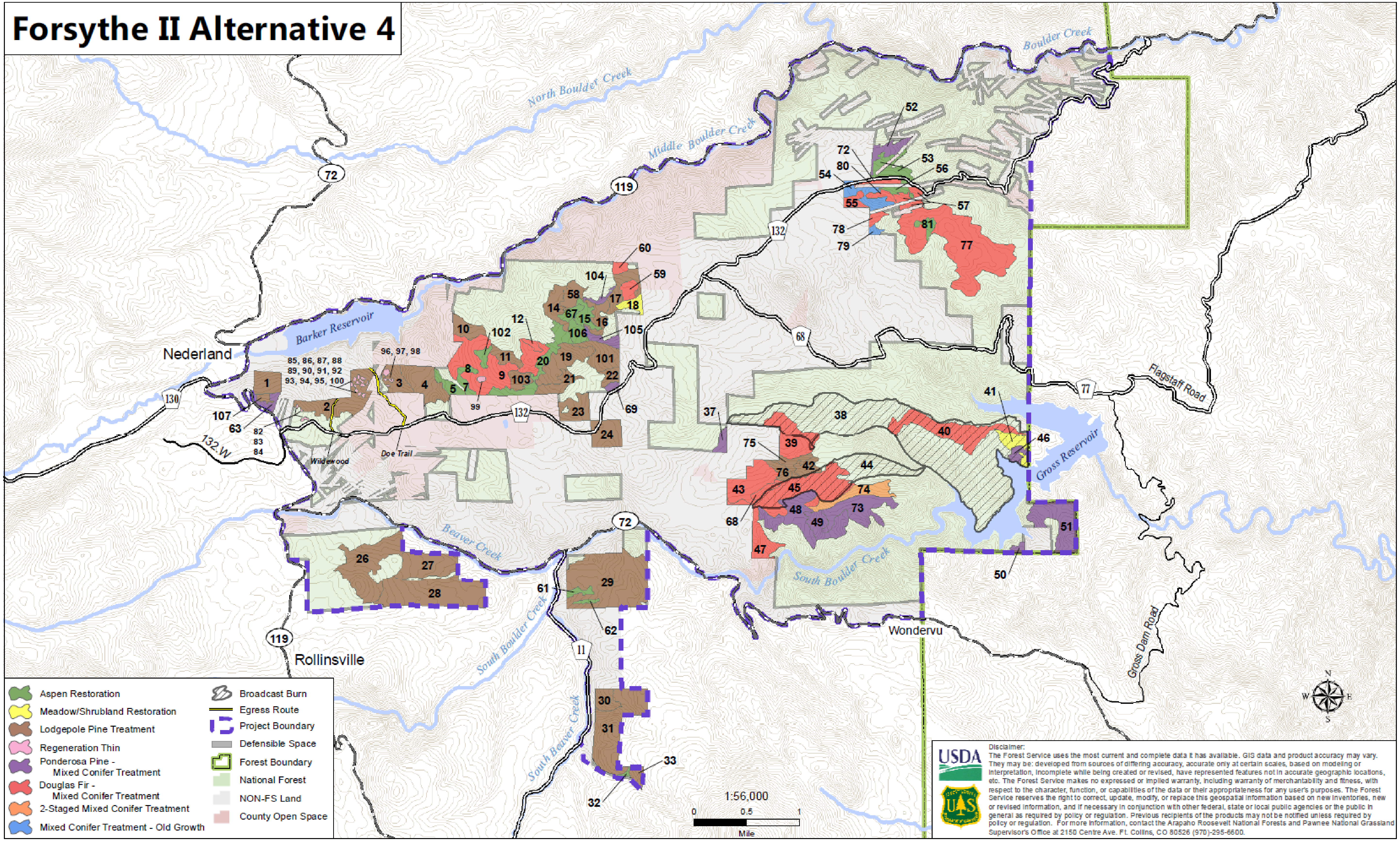
- Retain all limber pine.
- Treatment would be done manually.

Defensible Space

Defensible space is delineated along areas where private property abuts NFS lands, except areas where proposed treatment units are located. Defensible space treatment would not occur in proposed treatment units along the private property boundary. Areas where proposed treatment units on NFS lands are not along the private property boundaries, defensible space prescriptions would be applied on NFS lands up to 100 feet from a structure, with an approved permit, to complement defensible space treatments on private property.

There are 878 acres mapped as defensible space throughout the project area (Figure 5). It is estimated that only a portion of those mapped acres, up to 10% or 88 acres, would be treated. Treatment could occur out to Zone 2 and follow the guidelines outlined by USFS resource specialists and in the Defensible Space Management Zones as described by the Colorado State Forest Service (CSFS 2012).

Figure 5. Map of Alternative 4 – Treatment Method Change



2.4 Activities Common to All Action Alternatives

2.4.1 Introduction

The information contained in this section describe activities that would occur across all action alternatives.

2.4.2 Slash Treatment

Slash created by these treatments could be piled and burned, chipped, masticated, and/or removed offsite. Where mechanized equipment is used, forest products would most likely be removed in the form of logs, chips, or firewood. After work is completed, firewood may be removed from the hand treatment units.

2.4.3 Design Criteria

Design criteria (Appendix B) were developed to address site specific concerns and provide additional detail to the management activities described in the action alternatives in Section 2.3. Design criteria minimize the potential impacts the action alternatives may cause. This design criteria would be used during implementation of any of the action alternatives.

2.4.4 Road Actions

To decrease the risk of erosion and sedimentation and improve hydrologic function, approximately 6 miles of NFSR would be decommissioned, approximately 2.3 miles would be converted to administrative use only (not open to public travel) (Figure 6 and Appendix D), and approximately 19 miles would be reconstructed/maintained. Any unauthorized roads on NFS lands not identified on the map but found during implementation would be decommissioned. These mileages effect only the portions that cross NFS lands and take into account the transportation system necessary for public access, motorized recreation, and forest management while also accounting for the effects the roads have on the watershed.

The town of Nederland and residents of the Big Springs Subdivision requested a special use authorization for emergency ingress/egress routes (Figure 5) out of the subdivision to the south. There are two possible ingress/egress routes identified (Doe Trail, 0.04 miles on NFS lands, and Wildewood Trail, 0.32 miles on NFS lands), both currently existing as trails, that could be converted to NFSR for emergency ingress/egress purposes only. Road work would be done including widening, installing gates, and cutting all trees within the 30 foot road corridor. This clearing would be approximately 3.9 acres (2.6 acres along Doe Trail, 1.3 acres along Wildewood Trail).

2.4.5 Broadcast Burning

Broadcast burning would be implemented across 968 mapped acres (Figure 5) after the completion of mechanical/hand treatments that overlap the burn units. The location of the broadcast burn unit boundaries is based on control features surrounding the primary burn areas, including forest roads and Gross Reservoir. The burn would be broken up into six operational burn blocks ranging from 72-340 acres in size to reduce the number of acres burned at any one time to allow the area to recover. Implementation of the burn would be phased over a 3-5 year period of time to allow for recovery. The broadcast burn would focus on consuming up to 75% of the understory, including shrubs. Overstory mortality of up to 35% would be acceptable but not the focus of the broadcast burn.

2.4.6 Implementation

It is expected that implementation of the management activities could take 10-15 years to complete. The implementation of the proposed treatments would be completed by contractors and/or by USFS employees. The proposed treatments could be done by either mechanized equipment (mechanically) or hand crews with chainsaws (manually). Mechanized equipment operations are limited by the percent slope and amount of rock within a unit. Treatment units that are over 30% slope would be treated manually. However, there may be short distances within a unit where a machine could be working on slopes up to 40%. In some instances, a unit may be designated as a mechanical unit but there may be areas within the unit that are too steep or rocky for a machine to work. In those circumstances, these areas would be treated manually or left untreated to incorporate variable density within the area.

2.4.7 Non-Significant Forest Plan Amendment

Forest Plan Goad 95 states, *Retain the integrity of effective habitat areas* (p. 30) and Forest Plan Standard 2 under Management Area 3.5 states, *Maintain or increase habitat effectiveness, except where new access is required by law* (p. 359). A non-significant Forest Plan Amendment is proposed to remove the applicability of this goal and standard for effective habitat within the Forsythe II project boundary for Alternatives 1-4. Alternatives 1-4 would reduce effective habitat and therefore, would not meet this goal and standard (Appendix C).

2.4.8 Defensible Space

Property owners in cooperation with the Colorado State Forest Service and Boulder County are continuing to create areas of defensible space around homes and other improvements on private lands. In order to comply with home insurance companies, some private landowners have been required to complete defensible space mitigation around their homes. Defensible space is the area around a home or other structure that has been modified to reduce fire hazard. In this area, natural and manmade fuels are treated, cleared or reduced to slow the spread of wildfire. Creating an effective defensible space involves a series of management zones in which different treatment techniques are used.

Some of these private homes are in close proximity or adjacent to NFS lands. For vegetation treatments to be most effective for these private property owners, the treatments need to be applied in a manner and location that complements existing defensible space efforts on private land. Homeowners would have the ability to complete the required defensible space across their property boundaries onto NFS lands with an approved permit which would include appropriate specialists review.

There are three zones that characterize defensible space and are defined as the following:

- Zone 1 is the area nearest to the structures that requires maximum hazard reduction. This zone extends up to 30 feet outward from a structure where the most flammable vegetation would be removed including most trees. Remaining trees would be pruned to a height of 10 feet from the ground and be spaced at least 30 feet, or more if on steep slopes, between crowns.
- Zone 2 is a transitional area of fuels reduction between Zones 1 and 3. Typically this zone should extend at least 100 feet from structures. Stressed, diseased, dead or dying trees would be removed along with ladder fuels. Trees would be thinned to a crown spacing of at least 10 feet, or more if on steep slopes. Retained trees would be pruned to a height of 10 feet from the ground. Groups of trees may be left in areas however these groups would have at least 30 feet spacing between the crowns of the group and any surrounding trees.
- Zone 3 is the area farthest from the structure. It extends from the edge of Zone 2 out to 300 feet from the structure. Crown space thinning between retained trees would be variable and based on steepness of slope. Ladder fuels would be removed from underneath retained trees. Retained trees would be pruned to a height of 10 feet if located along trails or firefighter access routes.

The dominant vegetation type (i.e. mixed conifer, lodgepole pine, and aspen) surrounding the structure would determine the prescriptions for the vegetation type to be cut by a permittee. Proximity of the structure to the boundary of NFS lands and average slope of the permitted area would also determine the intensity of the cutting. The defensible space prescriptions are not for restoration purposes; instead, they are intended for structure protection and may be more intensive than other prescriptions within the project area.

All treatments would be completed manually (chainsaws) and treated material would be removed by hand. Skidding of material would not be allowed. All treated material would be transported to the permittee's land, using an ATV (all-terrain vehicle) or UTV (utility vehicle), and the slash disposed of by the permittee. The prescriptions listed below are general in nature and assume the area is flat.

Mixed Conifer Stands:

- Zone 1: All conifers less than 14 inches DBH would be cut and removed, and branches from the remaining trees pruned up to 10 feet from the ground. Aspen would not be cut unless it's to remove a "hung up" conifer or one that has been damaged during the felling activity.
- Zone 2: Conifers would be thinned to approximately 100 to 150 trees per acre or less with at least a 10 foot crown spacing between the residual trees. The largest and healthiest (good vigor, at least 40% crown ratio, no insect/disease, and damage free) trees would be retained while the stressed, diseased, dead, or dying trees would be removed along with ladder fuels. Retained trees would be pruned to a height of 10 feet from the ground. Species preference for cutting would be lodgepole pine, then Douglas-fir, then limber pine, and then ponderosa pine. Aspen would not be cut unless it's to remove a "hung up" conifer or one that has been damaged during the felling activity.
- Zone 3: Conifers would be thinned to approximately 250+ trees per acre by cutting and removing the ladder fuels. The largest and healthiest (good vigor, at least 40% crown ratio, no insect/disease, and damage free) trees would be retained while the stressed, diseased, dead, or dying trees would be removed along with ladder fuels (trees less than 6 inches DBH) would be targeted. Species preference for cutting would be lodgepole pine, then Douglas-fir, then limber pine, and then ponderosa pine. Aspen would not be cut unless it's to remove a "hung up" conifer or one that has been damaged during the felling activity.

Lodgepole Pine Stands:

- Zone1: All conifers would be cut and removed. Aspen would not be cut unless it's to remove a "hung up" conifer or one that has been damaged during the felling activity.
- Zone 2: Conifers would be thinned to retain groups of conifers (20 to 30 trees) and a crown spacing of 20 feet between the groups. Groups of trees instead of individual trees would be retained in order to reduce the potential for windthrow. Approximately 5 to 8 groups per acre would be left, and the groups would be arranged in a mosaic pattern (non-uniform). Within the groups all dead conifers and ladder fuels would be cut and removed. Aspen would not be cut unless it's to remove a "hung up" conifer or one that has been damaged during the felling activity.
- Zone 3: Conifers would be thinned to retain groups of conifers (40 to 60 trees) and a crown spacing of 20 feet between the groups. Groups of trees instead of individual trees would be retained in order to reduce the potential for windthrow. Approximately 3 to 4 groups per acre would be left, and the groups would be arranged in a mosaic pattern (non-uniform). Within the groups all dead conifers and ladder fuels would be cut and removed. Aspen would not be cut unless it's to remove a "hung up" conifer or one that has been damaged during the felling activity.

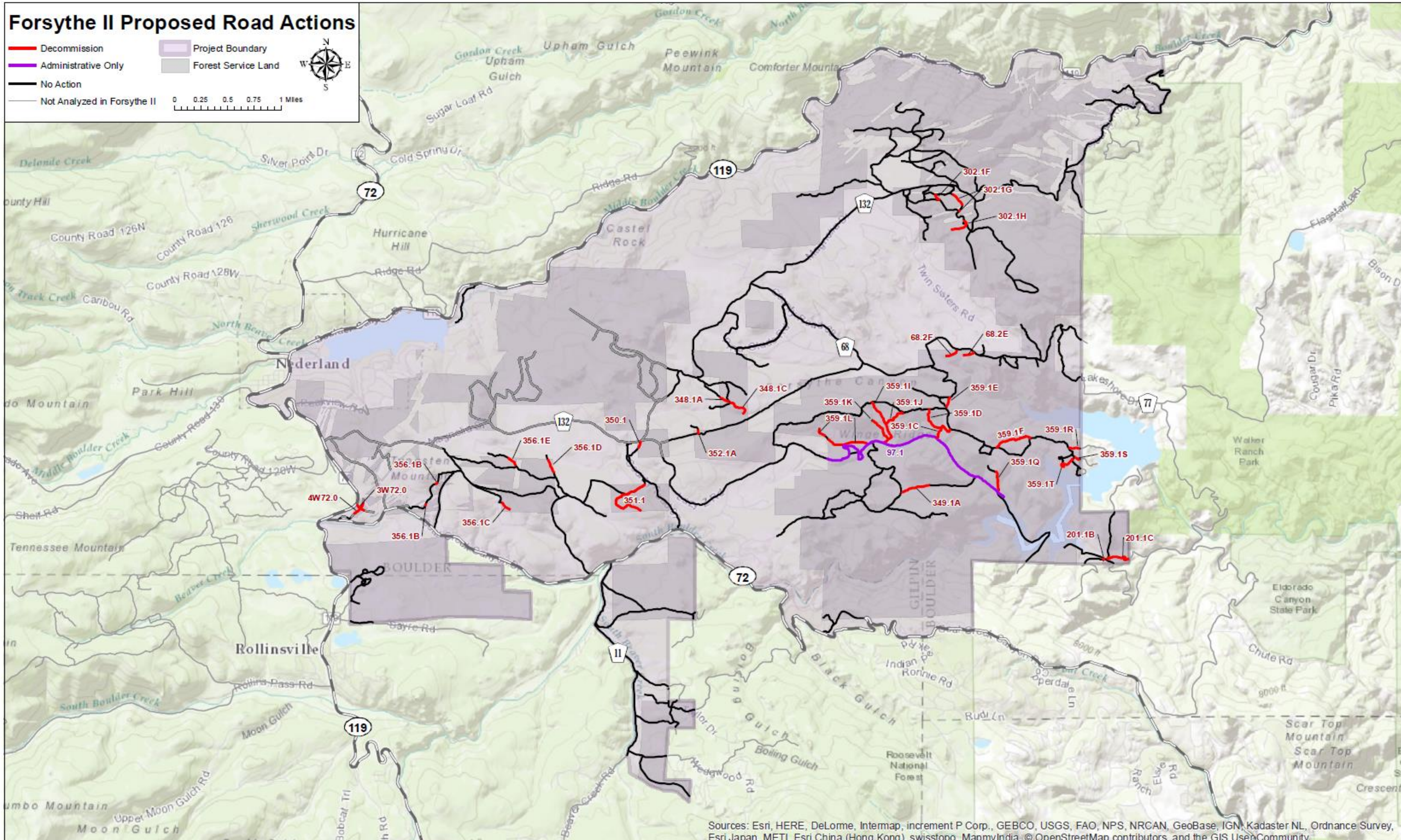
Aspen Stands:

Structures surrounded by aspen for 300 feet are rare, and most likely this prescription would be combined with one of the prescriptions identified above.

- Zone1: All conifers within the zone would be cut and removed. Aspen would not be cut unless it's to remove a "hung up" conifer or one that has been damaged during the felling activity.

- Zone 2: All conifers less than 16 inches DBH would be cut and removed, and branches from the remaining trees pruned up to 10 feet from the ground. Aspen would not be cut unless it's to remove a "hung up" conifer or one that has been damaged during the felling activity.
- Zone 3: All conifers less than 16 inches DBH would be cut and removed, and branches from the remaining trees pruned up to 10 feet from the ground. Aspen would not be cut unless it's to remove a "hung up" conifer or one that has been damaged during the felling activity.

Figure 6. Map of Proposed Road Actions for All Action Alternatives



2.5 Comparison of Alternatives

Table 2. Comparison of proposed treatment acres by each action alternative.

Treatment	Alternative 1 Proposed Action	Alternative 2	Alternative 3	Alternative 4
Mixed Conifer Old Growth Treatment	42	8	42	42
2-Staged Mixed Conifer Treatment	44	44	n/a	44
Douglas-fir Mixed Conifer Treatment	971	796	885	971
Ponderosa Pine Mixed Conifer Treatment	392	293	370	392
Thin from Below	n/a	n/a	61	n/a
Lodgepole Pine Treatment	741	308	383	445
Regeneration Thin	17	8	17	17
Aspen Restoration	231	163	255	231
Meadow/Shrubland Restoration	45	37	32	45
Broadcast Burn	968	968	968	968
Total Treatment Acres	**3,151**[1]	**2,334**[2]	**2,717**[3]	**2,855**[4]
Defensible Space	203	286	220	88

[1] Total Treatment Acres excludes the 300 acres that would receive a combination of mechanical/hand treatment and broadcast burning so as not to count those acres twice.

[2] Total Treatment Acres excludes the 291 acres that would receive a combination of mechanical/hand treatment and broadcast burning so as not to count those acres twice.

[3] Total Treatment Acres excludes the 296 acres that would receive a combination of mechanical/hand treatment and broadcast burning so as not to count those acres twice.

[4] Total Treatment Acres excludes the 300 acres that would receive a combination of mechanical/hand treatment and broadcast burning so as not to count those acres twice.

Table 3. Breakdown of proposed treatment activities by each action alternative.

Mixed Conifer Treatment	Alternative 1 Proposed Action	Alternative 2	Alternative 3	Alternative 4
Old Growth Basal Area (BA) Reduction	up to 30%	up to 30%	up to 30%	up to 30%
Douglas-fir BA Reduction	up to 40%	up to 40%	up to 40%	up to 40%
Ponderosa Pine BA Reduction	up to 40%	up to 50%	up to 40%	up to 40%
2-Staged BA Reduction	up to 40%	up to 40%	n/a	up to 40%
Thin from Below	n/a	n/a	5 inches DBH (Unit 109)	n/a
Maximum Cut Limit	16 inches DBH	14 inches DBH	16 inches DBH	12 inches DBH
Treatment Method	Mechanically or Manually	Mechanically or Manually	Mechanically or Manually	Manually
Total Mixed Conifer Treatment Acres	**1,449**	**1,141**	**1,358**	**1,449**

Lodgepole Pine Treatment	Alternative 1 Proposed Action	Alternative 2	Alternative 3	Alternative 4
Percent of unit patchcut/clearcut	up to 50%	up to 30%	up to 50%	up to 30%
Patchcut Size	1-5 acres	1-5 acres	1-5 acres	1-5 acres
Clearcut Size	5-20 acres	5-10 acres	5-20 acres	n/a
Treatment Method	Mechanically or Manually	Mechanically or Manually	Mechanically or Manually	Mechanically or Manually
Total Lodgepole Pine Treatment Acres	**741**	**308**	**383**	**445**

Regeneration Thin Treatment (Lodgepole Pine)	Alternative 1 Proposed Action	Alternative 2	Alternative 3	Alternative 4
Regeneration Thin Spacing	10-15 feet	10-15 feet	10-15 feet	10-15 feet
Treatment Method	Manually	Manually	Manually	Manually
Total Regeneration Thin Treatment Acres	**17**	**8**	**17**	**17**

Aspen Restoration Treatment	Alternative 1 Proposed Action	Alternative 2	Alternative 3	Alternative 4
Maximum Conifer Cut Limit	16 inches DBH	14 inches DBH	16 inches DBH	12 inches DBH
Conifer Removal Distance from Edge of Aspen Stand	50 feet	10 feet	50 feet	50 feet
Treatment Method	Mechanically or Manually	Mechanically or Manually	Mechanically or Manually	Manually
Total Aspen Restoration Treatment Acres	**231**	**163**	**255**	**231**

Meadow/Shrubland Restoration Treatment	Alternative 1 Proposed Action	Alternative 2	Alternative 3	Alternative 4
Maximum Conifer Cut Limit	14 inches DBH for ponderosa pine and Douglas-fir; 12 inches DBH for lodgepole pine	14 inches DBH	14 inches DBH for ponderosa pine and Douglas-fir; 12 inches DBH for lodgepole pine	12 inches DBH
Treatment Method	Manually	Manually	Manually	Manually
Total Meadow/Shrubland Restoration Treatment Acres	**45**	**37**	**32**	**45**
Broadcast Burn	**Alternative 1 Proposed Action**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Total Broadcast Burn Acres	**968**	**968**	**968**	**968**
Defensible Space	**Alternative 1 Proposed Action**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Treatment Distance from Structure	up to 300 feet	up to 300 feet	up to 300 feet	up to 100 feet
Estimated Percent of Total Acres Treated	10	10	10	10
Total Defensible Space Acres	2,032	2,862	2,200	878
Total Defensible Space Treatment Acres	**203**	**286**	**220**	**88**
Roads	**Alternative 1 Proposed Action**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Miles of Decommissioning	6	6	6	6
Miles of Reconstruction/Maintenance	19.6	19	19	19.6
Miles to Convert to Administrative Use Only (not open to public use)	2.3	2.3	2.3	2.3
Temporary Road Construction	7	7	5	5
Miles of Construction for Ingress/Egress Emergency Access Road (NFS lands only)	0.36	0.36	0.36	0.36

Table 4. Effects comparison by alternative.

Purpose and Need Statement	Indicator	No Action Alternative		Alternative 1 – Proposed Action		Alternative 2		Alternative 3		Alternative 4	
Reduce the severity and intensity of a wildfire within the WUI.	Flame Length (feet)	**20-ft. WS[6]**	**Gust WS**	**20-ft. WS**	**Gust WS**	**20-ft. WS**	**Gust WS**	**20-ft. WS**	**Gust WS**	**20-ft. WS**	**Gust WS**
		1 – 19	10 – 99	1 – 11	2 – 20	1 – 11	2 – 20	1 – 11	2 – 20	1 – 11	2 – 20
	Rate of Spread (chains/hour)	**20-ft. WS**	**Gust WS**	**20-ft. WS**	**Gust WS**	**20-ft. WS**	**Gust WS**	**20-ft. WS**	**Gust WS**	**20-ft. WS**	**Gust WS**
		2 – 182	72 – 376	2 – 182	4 – 376	2 – 182	4 – 376	2 – 182	4 – 376	2 – 182	4 – 376
	Fireline Intensity (British Thermal Unit [BTU]/ft./sec.)	**20-ft. WS**	**Gust WS**	**20-ft. WS**	**Gust WS**	**20-ft. WS**	**Gust WS**	**20-ft. WS**	**Gust WS**	**20-ft. WS**	**Gust WS**
		7 – 1,526	817 – 10,988	7 – 1,045	17 – 3,818	7 – 1,045	17 – 3,818	7 – 1,045	17 – 3,818	7 – 1,045	17 – 3,818
	Torching Index (miles/hour)	0 – 74		35 – 262		35 – 262		35 – 262		35 – 262	
	Crowning Index (miles/hour)	16 – 24		34		34 – 39		34		34	
	Fire Type[7]	**20-ft. WS**	**Gust WS**	**20-ft. WS**	**Gust WS**	**20-ft. WS**	**Gust WS**	**20-ft. WS**	**Gust WS**	**20-ft. WS**	**Gust WS**
		S, P	S, CC, AC	S	S	S	S	S	S	S	S
	Low Fuel Hazard (acres)	1,004		1,677		1,293		1,405		1,437	
	Moderate Fuel Hazard (acres)	2,165		3,099		2,802		3,024		2,947	
	High Fuel Hazard (acres)	2,668		2,064		2,416		2,334		2,285	
	Very High Fuel Hazard (acres)	4,093		3,090		3,419		3,167		3,261	
Restore ponderosa pine, mixed conifer, aspen, and meadows/shrublands toward their characteristic composition, structure, and spatial patterns in order to increase resistance and resiliency to future natural disturbance.	Acres treated/modified to restore ponderosa pine dominated stands	0		392		293		370		392	
	Acres treated/modified to restore aspen clones	0		231		163		255		231	
	Acres treated/modified to restore meadows/shrublands	0		45		37		32		45	
Emulate natural disturbance in lodgepole pine dominated stands to mimic variable structural and spatial patterns across the landscape in order to increase resistance and resiliency to future natural disturbance.	Acres treated to maintain structural diversity of lodgepole pine dominated stands across the project area	0		741		308		383		445	
Provide private property landowners the opportunity to complete defensible space mitigation around their homes on adjacent NFS lands.	Anticipated acres treated by private residents for defensible space mitigation	0		203		286		220		88	

Soils Resource

Issue Statement	Indicator	No Action Alternative	Alternative 1 – Proposed Action	Alternative 2	Alternative 3	Alternative 4
Operation of heavy equipment may cause soil compaction and displacement on temporary roads, landings, heavily traveled sections of primary skid trails and isolated/discontinuous compaction within the matrix of the treatment unit.	Acres treated with heavy equipment	0	2,330	1,545	1,863	445
	Site susceptibility to damage from compaction based on soil properties	No acres treated indicates no potential for compaction Lowest risk of all alternatives	Highest risk of all action alternatives for potential compaction effects	3rd highest risk of all action alternatives for potential compaction effects	Reduction of patchcut acres on sensitive soils is beneficial but overall ranking is 2nd highest risk of all action alternatives for potential compaction effects	Lowest risk of all action alternatives for potential compaction effects
	Intensity of treatment (based primarily on treatment prescription and stand density)					

[6] WS = wind speed
[7] S = surface fire; P = passive (torching) fire; CC = conditional crown fire; AC = active crown fire

Protective ground cover may be impacted by vegetation management treatments, construction of roads and landings and/or application of prescribed fire. Localized erosion and/or sedimentation could occur within and adjacent to areas without adequate protective ground cover.	Acres treated with heavy equipment	0	2,330	1,545	1,863	445
	Amount of protective ground cover retained following treatment Acres of steep slopes within treatment units Site susceptibility for erosion based on soil properties (erosion hazard rating) Intensity of treatment (based primarily on treatment prescription and stand density)	No acres treated indicates no increased potential for ground cover removal and associated erosion/sedimentation Lowest risk of all alternatives	Highest risk of all action alternatives for potential ground cover removal and associated erosion/sedimentation effects	3rd highest risk of all action alternatives for potential ground cover removal and associated erosion/sedimentation effects	Reduction of patchcut acres on sensitive soils is beneficial but overall ranking is 2nd highest risk of all action alternatives for potential ground cover removal and associated erosion/sedimentation effects	Lowest risk of all action alternatives for potential ground cover removal and associated erosion/sedimentation effects
Patchcuts/clearcuts on sensitive soils may impact above and below ground nutrient cycling processes.	Patchcut/clearcut acres treated	0	741	308	383	445
	Retention of coarse woody, fine woody debris, forest litter/duff and organic rich surface layers Whole tree removal patchcut/clearcut prescriptions on shallow, rocky coarse textured soils with thin surface layers	No acres treated indicates no project related impacts on above and below ground nutrient cycling Lowest risk of all alternatives	Highest risk of all action alternatives for potential project related impacts on above and below ground nutrient cycling.	Potential project related impacts on above and below ground nutrient cycling similar to Alternative 3.	Potential project related impacts on above and below ground nutrient cycling similar to Alternative 2.	2nd Highest risk for potential project related impacts on above and below ground nutrient cycling.
Pile burning may cause moderate to high soil burn severity effects to the limited spatial extent of the burn pile footprints.	Acres treated	0	2,483	1,657	2,044	2,186
	Fire effects on soils associated with pile burning	No piles burned indicates no potential for pile burning effects Lowest risk of all alternatives	Generally, fire effects on soil resources from large piles are more severe than effects from small piles. However, building many small piles versus few large piles generates a larger effect spatially. In manually treated units, the spatial footprint of hand built (small) burn piles is not likely to exceed 15% of the activity area. In mechanically treated units, the spatial footprint is not likely to exceed 3% of the activity area.			
Application of prescribed fire a could result in small localized areas of moderate to high soil burn severity but low burn severity is expected to occur over most of the treatment area. Erosion and sedimentation may occur due to removal of protective ground cover.	Acres treated	0	968	968	968	968
	Acres of steep slopes within treatment units Site susceptibility for erosion and sensitivity to damage from fire (erosion hazard rating and limitations ratings for prescribed fire) Potential impacts resulting from treatment could be measured or described by BAER soil burn severity indicators	No prescribed fire effects Lowest risk of all alternatives	No difference between alternatives. The expected effect is a mosaic of low and moderate soil burn severity effects. Where prescribed burning is proposed, vegetative recovery would be expected to be rapid if burn intensities are low to moderate. Hill-slope erosion rates would typically drop to pre-fire levels within 2-4 years. Hydrologic recovery after fuel treatments also tends to be more rapid than after wildfire because it is likely lower acreages of land and proportions of sub-watersheds would be impacted by high and/or moderate soil burn effects. Small areas within burned units could experience higher soil burn severity, which could increase the potential for erosion and runoff and increase recovery time following the burn. Due to steep slopes and increased risk for soil erosion following the burns, it is likely some sediment delivery to Winiger Gulch and/or Gross Reservoir would occur in response to high intensity thundershowers within 1-4 years following the burn. A detailed assessment of site characteristics and fire effects at the burn block scale is contained on pages 11-12 of the project's soils report. The assessment is based on controlled burning within the prescription outlined in the project burn plan. Under these conditions, the expected effect is a mosaic of low and moderate soil burn severity effects.			

Hydrology/Fisheries

Issue Statement	Indicator	No Action Alternative	Alternative 1 – Proposed Action	Alternative 2	Alternative 3	Alternative 4
Mechanical timber harvest, permanent and temporary roads, broadcast burns, and burn piles may increase the extent of bare compacted soils and connected disturbed area (surface flow paths that connect upland disturbances directly to stream channels and bypass vegetated buffers or filters), which increases the risk of erosion and sedimentation into streams and aquatic habitat occupied by forest MIS species, macroinvertebrates, and potential habitat for threatened and endangered species such as the Arapahoe snowfly.	Acres of mechanical fuels treatment	0	2,330	1,545	1,864	445
	Miles of permanent road construction	0	0.4	0.4	0.4	0.4
	Miles of temporary road construction	0	7.0	7.0	5.4	5.4
	Acres of broadcast burn	0	968	968	968	968
	Acres of treatment where burn piles would be constructed to treat slash	0	2,483	1,657	2,044	2,186
Road decommissioning and restoration may decrease the risk of erosion and sedimentation and improve hydrologic function.	Miles of road decommissioned	0	6.0	6.0	6.0	6.0

Terrestrial Wildlife

Issue Statement	Indicator	No Action Alternative	Alternative 1 – Proposed Action	Alternative 2	Alternative 3	Alternative 4
Proposed vegetation management activities may affect individuals, populations, and/or habitat values for federally Proposed, Threatened or Endangered, Forest Service Sensitive (PTES), MIS, or other terrestrial wildlife species.	Quantification (acres) of available existing wildlife habitat structural stage by vegetation type and proposed alteration based on proposed action and alternatives, and qualitative description of existing habitat and proposed changes.	Refer to habitat structural stage (HSS) Table 18 for acres of existing habitat by HSS in the project area. Existing habitat across the project area, consists of forested habitat over a majority of the area. Forested and other habitats provide habitat for a variety of wildlife species, including PTES and MIS. Future wildfires could impact wildlife habitat, often with a mix of beneficial and detrimental habitat impacts and varying by species.	Refer to HSS Table 18 for acres of existing habitat in treatment units and proposed changes by alternative. Alternative 1 would treat the most total acres and would create the most acres of openings in lodgepole pine. Overall, Alternative 1 is expected to reduce dense forested habitat and increase openings more than other action alternatives. Habitat impacts would be mixed for species that use both forested and open habitats, with relative benefits and detrimental impacts varying by species. Future wildfires could impact wildlife habitat, often with a mix of beneficial and negative habitat impacts and varying by species. The action alternatives may help to reduce severity and/or size of future wildfires, but the extent and locations cannot be accurately predicted.	Refer to HSS Table 18 for acres of existing habitat in treatment units and proposed changes by alternative. Alternative 2 would treat the least total acres, create the fewest acres of openings in lodgepole pine stands, and would thin the fewest acres of mixed conifer. Overall, Alternative 2 would reduce dense forested habitat and increase openings the least of the action alternatives. Habitat impacts would be mixed for species that use both forested and open habitats, with relative benefits and negative impacts varying by species. Future wildfires could impact wildlife habitat, often with a mix of beneficial and negative habitat impacts and varying by species. The action alternatives may help to reduce severity and/or size of future wildfires, but the extent and locations cannot be accurately predicted.	Refer to HSS Table 18 for acres of existing habitat in treatment units and proposed changes by alternative. Alternative 3 would treat the third most total acres, create the third most acres of openings in lodgepole pine, and treat the second most mixed conifer acres. Alternative 3 would reduce dense forested habitat less than Alternatives 1 and 4 and increase openings more than Alternative 2. Habitat impacts would be mixed for species that use both forested and open habitats, with relative benefits and negative impacts varying by species. Future wildfires could impact wildlife habitat, often with a mix of beneficial and negative habitat impacts and varying by species. The action alternatives may help to reduce severity and/or size of future wildfires, but the extent and locations cannot be accurately predicted.	Refer to HSS Table 18 for acres of existing habitat in treatment units and proposed changes by alternative. Alternative 4 would treat the second most total acres, create the second most acres of openings in lodgepole pine, and treat the same number of mixed conifer acres as Alternative 1. Alternative 4 would reduce dense forested habitat less than Alternative 1 and increase openings more than Alternatives 2 and 3. Habitat impacts would be mixed for species that use both forested and open habitats, with relative benefits and negative impacts varying by species. Future wildfires could impact wildlife habitat, often with a mix of beneficial and negative habitat impacts and varying by species. The action alternatives may help to reduce severity and/or size of future wildfires, but the extent and locations cannot be accurately predicted.

	Disclosure of effects, both project-specific and cumulative, to PTES species and MIS.	A determination of *no effect* was made for the two threatened species analyzed for this project. A determination of *no impact* was made for the 13 USFS Sensitive species analyzed for this project. An estimate of influence of *no change to populations of project MIS locally or on the planning area* was made for the nine MIS analyzed for this project. No species of local concern other than PTES and MIS were identified for this project. No impacts would occur to other habitats or habitat values under No Action.	Threatened: Determination of *may affect, not likely to adversely affect* for <u>Mexican spotted owl</u> and <u>Preble's meadow jumping mouse</u>; effects similar among all action alternatives. USFS Sensitive: Determination of *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing* for 12 sensitive species; *no impact* for: <u>American peregrine falcon.</u> Highest habitat impacts for American marten (denning habitat reduction), flammulated owl (habitat improvement), and fringed myotis and hoary bats (roost habitat reduction). Long-term habitat impacts similar among all action alternatives for Townsend's big-eared bat, river otter, bald eagle, Lewis's woodpecker, northern goshawk, olive-sided flycatcher, boreal toad, and northern leopard frog. Generally highest potential for negative impacts to individuals based on highest treatment acres of action alternatives. Project MIS: Estimation of influence of *no change to local or planning area populations,* except *negative influence to local populations for Golden-crowned kinglet and positive influence to local populations for warbling vireo.* Overall least favorable alternative for elk and mule deer. Highest potential negative habitat influence for golden-crowned kinglet. Highest short-term negative habitat influence for hairy woodpecker and highest positive habitat influence for mountain bluebird. Similar long-term habitat influence under all action alternatives for hairy woodpecker, mountain bluebird, warbling vireo, Wilson's warbler, and boreal toad.	Threatened: Determination of *may affect, not likely to adversely affect* for <u>Mexican spotted owl</u> and <u>Preble's meadow jumping mouse</u>; effects similar among all action alternatives. USFS Sensitive: Determination of *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing* for 12 sensitive species; *no impact* for: <u>American peregrine falcon</u>. Lowest habitat impacts for American marten (denning habitat reduction), and flammulated owl (habitat improvement), and fringed myotis and hoary bats (roost habitat reduction). Long-term habitat impacts similar among all action alternatives for Townsend's big-eared bat, river otter, bald eagle, Lewis's woodpecker, northern goshawk, olive-sided flycatcher, boreal toad, and northern leopard frog. Generally lowest potential for negative impacts to individuals based on lowest treatment acres of action alternatives. Project MIS: Estimation of influence of *no change to local or planning area populations*, except *negative influence to local populations for Golden-crowned kinglet and positive influence to local populations for warbling vireo.* Overall second least favorable alternative for elk and mule deer. Lowest potential negative habitat influence for golden-crowned kinglet. Lowest short-term negative habitat influence for hairy woodpecker and lowest positive habitat influence for mountain bluebird. Similar long-term habitat influence under all action alternatives for hairy woodpecker, mountain bluebird, warbling vireo, Wilson's warbler, and boreal toad.	Threatened: Determination of *may affect, not likely to adversely affect* for <u>Mexican spotted owl</u> and <u>Preble's meadow jumping</u> mouse; effects similar among all action alternatives. USFS Sensitive: Determination of *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing* for 12 sensitive species; *no impact* for: <u>American peregrine falcon</u>. Second highest habitat impacts for American marten (denning habitat reduction) and flammulated owl (habitat improvement). Highest habitat impacts for fringed myotis and hoary bats (roost habitat reduction). Long-term habitat impacts similar among all action alternatives for Townsend's big-eared bat, river otter, bald eagle, Lewis's woodpecker, northern goshawk, olive-sided flycatcher, boreal toad, and northern leopard frog. Generally second lowest potential for negative impacts to individuals based on second lowest treatment acres of action alternatives. Project MIS: Estimation of influence of *no change to local or planning area populations*, except *negative influence to local populations for Golden-crowned kinglet and positive influence to local populations for warbling vireo.* Overall most favorable for elk and mule deer. Second lowest potential negative habitat influence for golden-crowned kinglet. Second lowest short-term negative habitat influence for hairy woodpecker and second lowest positive habitat influence for mountain bluebird. Similar long-term habitat influence under all action alternatives for hairy woodpecker, mountain bluebird, warbling vireo, Wilson's warbler, and boreal toad.	Threatened: Determination of *may affect, not likely to adversely affect* for <u>Mexican spotted owl</u> and <u>Preble's meadow jumping mouse</u>; effects similar among all action alternatives. USFS Sensitive: Determination of *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing* for 12 sensitive species; *no impact* for: <u>American peregrine falcon</u>. Second lowest habitat impacts for American marten (denning habitat reduction). Highest acres habitat impacts for flammulated owl (same acres as Alternative1, habitat improvement). Highest habitat impacts for fringed myotis and hoary bats (roost habitat reduction). Long-term habitat impacts similar among all action alternatives for Townsend's big-eared bat, river otter, bald eagle, Lewis's woodpecker, northern goshawk, olive-sided flycatcher, boreal toad, and northern leopard frog. Generally second highest potential for negative impacts to individuals based on second highest treatment acres of action alternatives. Project MIS: Estimation of influence of *no change to local or planning area populations*, except *negative influence to local populations for Golden-crowned kinglet and positive influence to local populations for warbling vireo.* Overall second least favorable for elk and mule deer. Second highest potential short-term negative habitat influence for golden-crowned kinglet. Second highest short-term negative habitat influence for hairy woodpecker and second highest short-term positive habitat influence for mountain bluebird. Similar long-term habitat influence under all action alternatives for hairy woodpecker, mountain bluebird, warbling vireo, Wilson's warbler, and boreal toad.

Road decommissioning and restoration may improve wildlife habitat and reduce disturbance and displacement of wildlife.	Miles of road decommissioned	N/A	6.0	6.0	6.0	6.0
	Increase in effective habitat	N/A	It is expected that some road closures may contribute to returning some areas to functioning as effective habitat. Because the same mileage of roads would be decommissioned under all four action alternatives, potential improvements to effective habitat are expected to be similar for Alternatives 1, 2, 3, and 4.			
Silviculture						
Issue Statement	**Indicator**	**No Action Alternative**	**Alternative 1 – Proposed Action**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Management activities being applied to the forested stands in the upper montane zone may be inappropriate.	WUI fuel reduction acres treated in the upper montane zone	0	1,781	1,077	1,434	1,781
The proposed vegetation treatments may affect old growth (retention, inventoried, and development) integrity and large trees.	Old growth acres treated	0	890	787	694	890
The proposed vegetation treatments, specifically in lodgepole pine dominated stands, may be susceptible to windthrow or blowdown.	Acres of potential windthrow or blowdown	0	741	308	383	445
Vegetation management activities may lead to increased mountain pine beetle, ips, or other insect infestations.	Acres of treated area	0	3,151	2,325	2,713	2,855
Recreation/Trails						
Issue Statement	**Indicator**	**No Action Alternative**	**Alternative 1 – Proposed Action**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Vegetation management practices may affect recreational access (system and non-system trails and roads) within the project area.	Miles of trails	0	3.2	2.4	2.3	3.2
	Miles of social trails/roads created	0	0	0	0	0

Noxious Weeds						
Issue Statement	**Indicator**	**No Action Alternative**	**Alternative 1 – Proposed Action**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Proposed vegetation management activities may affect occurrence of noxious weeds and other undesirable nonnative plants.	Qualitative discussion of existing noxious or other weeds and expected effects from alternatives	Acres currently infested are not available for the project area. Known priority species in project area are discussed under Affect Environment (No Action). Infested acres would continue to increase, but less than under any action alternative.	Acres currently infested are not available for the proposed treatment units. Likely greater increase in weed-infested acres than Alternatives 2, 3, and 4 based on total treatment acres and likely more mechanical treatment than Alternatives 2, 3, and 4. Design criteria addresses priority weed infestations in treatment units.	Acres currently infested are not available for the proposed treatment units. Fewer overall treatment acres means smaller total footprint for weed infestation increase than Alternatives 1, 3, and 4. Likely fewer mechanical acres than Alternatives 1 and 3, therefore anticipate less weed increase than Alternatives 1 and 3. Up to three times more mechanical acres as compared to Alternative 4, which would offset to an unknown degree fewer total acres than Alternative 4. Design criteria addresses priority weed infestations in treatment units.	Acres currently infested not available for proposed treatment units. Likely somewhat less increase in weed-infested acres compared to Alternative 1, based on total overall treatment acres and total possible mechanical treatment acres. Likely greater increase in weed-infested acres than Alternative 2 based on higher overall treatment acres and possible mechanical treatment acres. Likely greater weed increase than Alternative 4 based on small difference in overall treatment acres and fewer mechanical acres under Alternative 4. Design criteria addresses priority weed infestations in treatment units.	Acres currently infested not available for proposed treatment units. Likely less weed acres increase than Alternatives 1 and 3 based on lower total treatment acres and lower mechanical treatment acres. Likely lower impacts than Alternative 2 from mechanical treatments due to lower mechanical treatment acres; however this would be offset to an unknown degree by higher overall treatment acres than Alternative 2. Design criteria addresses priority weed infestations in treatment units.

Visual Resources						
Issue Statement	**Indicator**	**No Action Alternative**	**Alternative 1 – Proposed Action**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Proposed management activities may affect visual resources.	Percent of NFS lands in the project area clearcut/patchcut	0	7.5	3.1	3.9	4.5
	Forest Plan SIO	Meets	Meets	Meets	Meets	Meets

Non-Significant Forest Plan Amendment					
Forest Plan Amendment Needed	**No Action Alternative**	**Alternative 1 – Proposed Action**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Forest Plan Goad 95 states, *Retain the integrity of effective habitat areas.*	No	Yes	Yes	Yes	Yes
Forest Plan Standard 2 under Management Area 3.5 requires the USFS to *Maintain or increase habitat effectiveness, except where new access is required by law.*	No	Yes	Yes	Yes	Yes

2.6 Monitoring and Evaluation

2.6.1 Introduction

Monitoring and evaluating provides information about the progress and results of project implementation for the decision-maker and the public. The monitoring process involves collecting data to determine if the activity was implemented as described in Chapter 2, or whether the project activities produce the effects predicted in the scientific analyses presented in Chapter 3.

2.6.2 Soils

Implementation monitoring would be conducted during and following treatment on selected units by ARP watershed and implementation personnel. Effectiveness monitoring would be conducted on selected treatment units in years 1 and 5 following treatments by watershed, planning and implementation personnel. Specific monitoring items include:

- Mechanical Treatments: Conduct soil disturbance classification monitoring and make other monitoring observations/measurements to determine effectiveness of soil and water design criteria and mitigation measures for protection of long term soil productivity.
- Manual Treatments: Burn pile effects and recovery
- Broadcast Burn Treatments: Soil burn severity and post treatment erosion

2.6.3 Silviculture

The objective of monitoring for the silvicultural resource would be to:

- Ensure that decisions made as a result of the analysis are implemented.
- Determine the effects of vegetation management and related treatments identify adverse impacts and mitigate if necessary.

Summaries of accomplishments would be reported electronically in the USFS Activity Tracking System (FACTS) database on the ARP for upward reporting and district use.

2.6.4 Wildlife

Known raptor nest sites would continue to be monitored for occupancy and reproductive success at least until full completion of all project activities.

To maintain as much effective habitat as possible and avoid further reduction, monitor for effectiveness of all closed features (temporary roads, landings, and skid trails).

2.6.5 Noxious Weeds

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. The highest risk project areas are generally mechanically treated areas, particularly landings and other areas of heavy activity and/or where mineral soil is exposed; areas where piles have been burned; and areas where high priority weeds were already present.

2.6.6 Cultural Resources

Monitoring is recommended to occur the first year following implementation. Monitoring should be conducted by ARP Heritage personnel to determine if the design criteria were sufficient to protect historic properties.

2.6.7 Transportation

Implementation monitoring of road maintenance, reconstruction and new construction activities would be accomplished through site inspections conducted by District personnel and certified Engineering personnel to ensure contract specifications and road designs are implemented as described in the road contract. Measured and visual monitoring would determine physical effects, success of natural and enhanced revegetation, and to ensure traffic safety and compliance with state and federal laws.

2.6.8 Collaborative Implementation and Effectiveness Monitoring

Section 102(g)(5) of the HFRA instructs the USFS to establish a collaborative multiparty monitoring, evaluation, and accountability process when significant interest is expressed in such an approach. The process would be used to assess the positive or negative ecological and social effects of authorized fuel-reduction projects. In addition, monitoring would be used to determine maintenance needs.

The multi-party monitoring group would be comprised of a diverse group of interested stakeholder and agency personnel. This group would meet a minimum of one time per year, to review implementation, during the length of this project.

Chapter 3 – Environmental Consequences

3.1 Introduction

This chapter discloses the existing condition of the project area (Affected Environment) and the environmental effects of the action alternatives, for each resource area, as they relate to the issues. All resource specialist reports are available in the project record.

The Affected Environment describes the existing conditions and presents the consequences of No Action. Direct effects are caused by the action and occur at the same time and place as the action taken. Indirect effects are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (i.e. likely to occur within the life of the project).

Cumulative effects are the effects on the environment which results from the incremental effect of the action when added to other past, present, and reasonably foreseeable future action's effects regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time (40 Code of Federal Regulations 1508.7, NEPA Implementation Regulations).

Projects identified for the Forsythe II project which could lead to cumulative effects are listed below. Not all of these projects apply to each resource.

<u>Past Projects/Activities</u>

- Forsythe Fuels Reduction Project (thinning, patchcutting, clearcutting, pile burning) – 2012
- Lump Gulch Fuel Treatment Project (thinning, patchcutting, clearcutting, pile burning) – 2009
- Residential Development
- Mining
- Four Mile Canyon fire (6,181 acres) – 2011
- Black Tiger fire (1,804.6 acres) – 1989
- Cold Springs fire (528 acres) – 2016
- Winiger Ridge Ecosystem Mgmt. Project (thinning, patchcuts, pile and broadcast burning) – 2001
- Fuels treatments on private property and Boulder County lands
- Timber stand improvement (lodgepole regeneration thinning)
- Campsite and parking area construction in Winiger Ridge area – 2010
- Jenny Creek Restoration and Motorized Trail Reroute Project – 2013
- Caribou and West Magnolia Travel Management – 2003
- Nederland Water Treatment Plant Hazardous Fuels Reduction – 2012
- Forest-wide Hazard Tree Removal – 2010
- Emergency Power Line Clearing Project – 2010
- Toll Property Conservation Easement – 2015
- Existing Public and Private Road and Trail Systems
- Recreational use on National Forest System lands

<u>Present and Reasonably Foreseeable Projects/Activities</u>

- Eldora Ski Area Operations and Proposed Expansion – 2015
- Magnolia Trails Project – 2016
- Denver Water/Federal Energy Regulatory Commission (FERC) – Gross Reservoir Expansion
- Boulder County Reynold’s Ranch Fuels Project
- Boulder County Reynold’s Ranch Trails System Project
- Residential and other development on private land

- Outfitter and guides in West Magnolia area
- Annexation of property in Town of Nederland near high school
- Timber stand improvement (lodgepole regeneration thinning) of clearcut/patchcut lodgepole pine stands
- Fuels treatments on private property and Boulder County lands
- Recreational use on National Forest System lands

3.2 Fire/Fuels

3.2.1 Affected Environment (No Action)

The Forsythe II Project is located mainly within the Lump Gulch, Sugarloaf, and Thorodin Geographic Areas, but also includes a small portion of the Caribou Geographic Area. The communities of Nederland, Wondervu, Pinecliffe, Lincoln Hills, Pactolus; the subdivisions of Tungsten, Walker Ranch, Big Springs, Sugarloaf and several other properties not associated with subdivisions are within or adjacent to the project area. Gross Reservoir, located on the east side of the project area, is one of Denver’s water sources. The City of Boulder also has some Open Space within the project area.

The town of Nederland has seen a population growth of 27% since 1990 (U.S. Census Bureau, American Fact Finder, 2011). Population growth data for the areas outside the town limits of Nederland is not available, however it can be assumed that there has been a significant increase in the areas outside of the town limits as well. The subdivisions within the project area are considered high or very high risk fire hazard (Nederland Fire Protection District CWPP, 2011). The highest priority watersheds include both Gross and Buttonrock Reservoirs and the Fourmile Creek and Boulder Creek Canyon watersheds (Boulder County CWPP, 2011).

Fire return intervals are dependent on elevation and vegetation. Generally, as you go up in elevation the frequency of fires decrease because the climate is usually wetter in the higher elevations. The fire intervals for the Colorado Front Range ponderosa pine and Douglas-fir forest types have varied considerably over the past 700 years, ranging from relatively frequent (16.8 year interval) fires to moderate fire intervals to one long interval (more than 50 years) (Graham, McCaffrey, & Jain, 2004), but generally range from 13 to 26 years (Evans, Everett, Stephens, & Youtz, 2011). Historical fire severity across the Colorado Front Range for the time period in the 1800s shows high severity fire occurred about every 249 years and these high severity areas ranged from 422-20,590 acres. The historic fire records show that the mixed-severity fire regime of the Front Range had a higher-severity component that created extensive burn patches. High-severity fires were the primary fire type on over 60% of the landscape, with moderate-severity fires dominant on greater than 30%, and lower-severity fires dominant only at the lowest elevations (<6,200 ft.). Modern fires within the ponderosa pine/mixed conifer seem to be within the range of historical variability (Williams & Baker, 2012).

Fire intervals within the pure lodgepole pine forest types have historically ranged from 20 to 100+ years. Fire severity within this vegetation type depends on health of the trees and climatic conditions. Healthy pure lodgepole pine stands are adapted to crown fires and generally need high severity fires to enable reproduction of the species. These crown fires usually only occur when there is an extended drought coupled with high winds. However, lodgepole pine becomes susceptible to crown fires outside of these climatic conditions when other disturbance agents exist (i.e. mountain pine beetle) due to a lowered moisture content in the needles.

FIRESTAT reports fire history in the Caribou, Thorodin, Sugarloaf, and Lump Gulch Geographic Areas shows 283 fires, but only 15 wildfires over 10 acres in size (Table 5). There have only been two wildfires within the project boundary over 10 acres in size and are denoted by ‘*’ in the table. The Comforter fire in 1976 is the largest wildfire within the project boundary. There have been 125 fires occur within the project boundary for a total acreage burned of 329 acres. All five of the large fires were human caused. The Black

Tiger, Four Mile Canyon, and Cold Springs fire scars are still identifiable on the landscape. The majority of the Cold Springs fire burned just north of the project area, however there were spot fires from the Cold Springs fire within the Forsythe II project boundary that were suppressed. Eight homes were destroyed as a result of the Cold Springs fire.

Table 5. Wildfires over 10 acres in size within Caribou, Thorodin, Sugarloaf, and Lump Gulch Geographic Areas.

Fire Name	Date	Acres Burned
*Winiger Point	9/4/1978	19
Pactolus	3/29/1968	27
Fire Number 032	1954	33
Tall Timbers	9/3/1984	51
Fire Number 034	1954	68
Fire Number 035	1952	74
Fire Number 033	1959	75
Fire Number 053	1943	97
Fire Number 075	1939	140
*Comforter	6/11/1976	256
Cold Springs	7/9/2016	528
Fire Number 076	1932	551
Fire Number 074	1938	615
Black Tiger	7/9/1989	1,804.6
Four Mile Canyon	9/6/2010	6,181

*Occurred within project boundary.

About 90% of the fires that occurred within the above mentioned geographic areas have been 1 acre or less in size. This is due to in part because of active fire suppression tactics to help minimize resource damage and prevent loss of private property. Most fires, 75% of the total, have occurred in June, July, August, and September within the geographic areas represented in the project area. July, with 67 fires recorded, has been the most active fire month since fire history has been tracked for the area. Human caused fires account for about 68% of the total number of fires that have occurred within the above mentioned geographic areas, with 66% occurring between June and September.

Fuel hazard is defined by the percent canopy cover, tree/shrub/forb/grass species, and the presence of ladder fuels (Table 5). There are 1,004 acres classified as 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 2,165 acres of the project area and is defined by having a canopy closure of 11 – 39% with some ladder fuels. There are 2,668 acres of high fuel hazard, defined as 40 - 69% canopy closure and more ladder fuels than in moderate fuel hazard. There are 4,093 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 have a very high fuel hazard.

Table 6. Acres of fuel hazard on NFS lands by class for the entire project area.

Low	Moderate	High	Very High
1,004	2,165	2,668	4,093

The fuel hazard can further be broken down by vegetation and habitat structure stage (Tables 7-10). In general, pure healthy lodgepole pine stands have a high canopy closure percentage but a low percentage of ladder and surface fuels and therefore do not have a very high fuel hazard.

Table 7. Acres of low fuel hazard by vegetation and habitat structure stage.

	2T	3A	3B	3C	4A	4B	4C	Total
Rock/Barren/Water	-	-	-	-	-	-	-	195
Ponderosa	27	-	-	-	-	-	-	27
Aspen	31	149	109	41	9	22	-	361
Lodgepole	235	186	-	-	-	-	-	421

HSS Key: 1M = grass/forbs, 2T = seedlings/saplings, 3 = immature, 4 = mature
A = 10-39% canopy cover, B = 40-69% canopy cover, C = 70+% canopy cover

Table 8. Acres of moderate fuel hazard by vegetation and habitat structure stage.

	2T	3A	3B	3C	4A	4B	4C	Total
Grass	-	-	-	-	-	-	-	360
Shrub	-	-	-	-	-	-	-	10
Douglas-fir	-	259	-	-	286	-	-	545
Lodgepole	-	-	-	-	116	-	-	116
Ponderosa	-	540	-	-	594	-	-	1,134

HSS Key: 1M = grass/forbs, 2T = seedlings/saplings, 3 = immature, 4 = mature
A = 10-39% canopy cover, B = 40-69% canopy cover, C = 70+% canopy cover

Table 9. Acres of high fuel hazard by vegetation and habitat structure stage.

	2T	3A	3B	3C	4A	4B	4C	Total
Lodgepole	-	-	1,262	761	-	564	59	2,646
Pinyon Juniper	-	7	-	-	-	-	-	7
Spruce/fir	-	-	-	-	-	15	-	15

HSS Key: 1M = grass/forbs, 2T = seedlings/saplings, 3 = immature, 4 = mature
A = 10-39% canopy cover, B = 40-69% canopy cover, C = 70+% canopy cover

Table 10. Acres of very high fuel hazard by vegetation and habitat structure stage.

	2T	3A	3B	3C	4A	4B	4C	Total
Douglas-fir	-	-	715	1,095	-	458	508	2,776
Ponderosa	-	-	707	18	-	592	-	1,317

HSS Key: 1M = grass/forbs, 2T = seedlings/saplings, 3 = immature, 4 = mature
A = 10-39% canopy cover, B = 40-69% canopy cover, C = 70+% canopy cover

To predict potential fire behavior across the project area for the existing conditions, representative fuel models were chosen. Fuel models are used in fire behavior prediction models and describe the predominant type of surface fuel that would carry fire across an area. The fuel models used for this analysis were obtained using the new 40 fuel models (Scott & Burgan, 2005). The new set of 40 fuel models are broken down by general fire-carrying fuel type. These fuel types are non-burnable (NB), grass (GR), grass-shrub (GS), shrub (SH), timber litter (TL), timber with a grass or shrub understory (TU), and slash or blowdown (SB). Each of these fuel types have different fuel bed characteristics (i.e. fuel loading, surface-area-to-volume, heat content, depth, and dead fuel moisture of extinction) that describe the surface fuels that contribute to fire behavior. The following fuel types are represented across the project area (Table 11): GR2 (Low Load, Dry Climate Grass) – represents meadows, GS2 (Moderate Load, Dry Climate Grass-Shrub) – represents southern aspects that have a grass-shrub mix with more shrubs than GS1, GS1 (Low Load, Dry Climate Grass-Shrub – represents southern aspects that have a grass-shrub with less shrubs than GS2 including some of the ponderosa pine mixed conifer stands), TU5 (Very High Load, Dry Climate Timber-Shrub) – represents Douglas-fir mixed conifer stands, TL3 (Moderate Load Conifer Litter) – represents lodgepole pine stands, TL5 (High Load Conifer Litter) – represents mixed conifer stands with dead and down woody material, TL6 (Moderate Load Broadleaf Litter) – represents the aspen stands, TL8 (Long-Needle Litter) – represents ponderosa pine mixed conifer stands, and SB1 (Low Load Activity Fuel) – represents areas within the broadcast burn units where material has been lopped and scattered.

Table 11. Percentage of area represented by each fuel model across the project area.

Fuel Model	Percent of Project Area
TL3	34%
TL8	27%
TU5	14%
TL6	10%
GR2	7%
GS2, GS1, TL5	8%
SB1	< 1%

Percentile weather is often used to help gauge what alterations to the landscape may be needed to help reduce fire behavior in critical areas. Percentile levels give an indication of the current situation compared to previous years in the weather database. 90th percentile weather conditions are good parameters to use for modeling fire behavior. 90th percentile weather is defined as the severest 10% of the historical fire weather (i.e. hot, dry, windy conditions occurring on midafternoons during the fire season).

The 90th percentile weather from the most representative weather station, Pickle Gulch Remote Automated Weather Station (RAWS) with archived readings since 1995, was used to model fire behavior during the fire season, typically May through September, for the last 16 years for the project area. Fire behavior prediction programs BehavePlus 5.0 and NEXUS 2.0 were used to calculate predicted surface and crown fire behavior for all fuel models represented within the project area. These programs assume the atmospheric conditions, slope, fuel moisture, and fuels are continuous, uniform, and homogenous across the landscape. Because of assumptions such as these, the predicted fire behavior presented in this analysis could be underestimated or overestimated for the existing stands. The predicted fire behavior that could be represented within the existing stands under 90th percentile weather conditions are presented in Table 12.

Table 12. Predicted fire behavior results for the existing conditions under 90th percentile weather.

Fuel Model	Fire Type*		Rate of Spread (ch/hr)		Fireline Intensity (BTU&/ft/sec)		Flame Length (ft)		Torching Index (mi/hr)	Crowning Index (mi/hr)
	20-ft WS#	Gust WS	20-ft WS	Gust WS	20-ft WS	Gust WS	20-ft WS	Gust WS		
TL3	S	CC	2	117	7	3,552	1	47	74	16
TL8	P	AC	9	117	178	6,365	5	69	8	24
TU5	P	AC	21	117	1,526	10,988	19	99	0	24
TL6	S	S	22	84	218	817	5	10	n/a	n/a
GR2	S	S	182	244	866	1,165	10	12	n/a	n/a
GS2	S	S	103	376	1,045	3,818	11	20	n/a	n/a
GS1	S	S	75	149	465	926	8	10	n/a	n/a
TL5	S	AC	4	117	30	5,471	2	62	21	24
SB1	S	S	22	72	266	885	6	10	n/a	n/a

*S = surface fire; P = passive fire (torching); CC = conditional crown fire; AC = active crown fire
WS = wind speed
& BTU = British thermal unit

Surface fires are defined as fires that do not get into the canopy, but rather remain on the ground only. Passive crown fires, also called torching fires, are defined as when individual or small groups of trees torch out, but solid flame is not consistently maintained in the canopy. Conditional crown fires are defined as a potential type of fire in which conditions for sustained active crown fire spread are met but conditions for crown fire initiation are not. In other words, if a fire begins as a surface fire, then it is expected to remain so. If a crown fire has already initiated, for example in an adjacent stand, then it may continue to spread as an active crown fire through those modeled stands. Active crown fires, also called a running or continuous crown fire, are defined as 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.

The fire behavior models predict the wind speed at which a surface fire would transition to a passive fire, the torching index, or a crown fire, the crowning index. Torching index is defined as the open wind speed at which crown fire activity can initiate for the specified fire environment (surface and canopy fuel characteristics – i.e. fuel model, wind speed and direction, relative humidity, and slope steepness). Crowning index is defined as the open wind speed at which active crown fire is possible for the specified fire environment (surface and canopy fuel characteristics – i.e. fuel model, wind speed and direction, relative humidity, and slope steepness). In other words, at wind speeds less than the torching index a surface fire is expected. If the wind speed is greater than the torching index but less than the crowning index a passive crown fire (torching) is expected. When wind speeds are greater than the crowning index an active crown fire can be expected.

Overall under 90th percentile conditions, the existing stands would exhibit intense fire behavior, too much for ground suppression crews to use direct suppression tactics (Table 12). Ground crews are able to directly suppress wildfires safely when fireline intensities are less than 100 BTU/ft/sec and flame lengths are less than four feet. Because most stands in the project area are so dense, use of firefighting aircraft to drop retardant along the fires edge would be ineffective. Firefighting aircraft would be effective in the grass and shrub fuel models because the retardant would reach the ground fuels thus increasing the fuel moisture in the 1-hour fuels and effectively suppressing the head of a fire. However, these fuel types only occur across about 10% of the project area.

Areas on south or southwest facing slopes generally contain more grass and shrubs in the understory. Grass and shrubs are considered fine flashy fuels because they react to changes in moisture almost immediately and dry out much faster than forested areas. These fine flashy fuels readily burn under 90th percentile weather conditions as is noted in the predicted fire behavior in Table 12. Higher flame lengths and very fast rates of spread would be expected.

Most pure lodgepole pine stands tend to have tight, dense canopies with little sunlight and moisture getting through to the understory. Because of the lack of sunlight and moisture, not much grows in the understory. There may be a few shrubs here and there but the majority of the understory is made up of needles that have fallen to the forest floor (needle cast) and are tightly compacted. Fires in needle cast tend to burn slowly and can be described as low intensity, low flame length, creeping ground fires. However, depending on where the stands are growing in relation to aspect and elevation, some lodgepole pine stands are more open with small amounts of grass in the understory. Fire in these stands would be more intense because of the grass component. The grass component would allow fire to advance faster than it would in the needle cast under the closed canopy lodgepole pine stands. These stands may have an occasional heavy accumulation of dead and down woody material, referred to as a jackpot of fuel, in the understory. When fire encounters these jackpots, more heat is produced, preheating the needles in the canopy, allowing for the fire to more easily go from the ground to the crown.

The lodgepole pine stands are susceptible to conditional crown fires when the wind speeds increase to about 16 miles per hour (mph). As long as the fire in an adjacent stand is a crown fire and the wind speeds are conductive to keeping the fire in the crowns, the fire would continue as a crown fire into the pure lodgepole pine stands. Once the wind speeds decrease or there is a significant break in the canopy, the fire would again drop back down to the surface and burn slowly through the understory. For the most part, fires within the dense canopy lodgepole pine stands would allow ground crews to easily suppress fires. The expected flame lengths range from 1 – 47 feet and fireline intensities from 7 – 3,552 BTU/ft/sec in the lodgepole pine stands, depending on wind speed. Even though the predicted fire behavior is intense in these stands with gust wind speeds, the results fall within the historical fire severity for lodgepole pine. However, because the project area is intermixed with private property with homes and other infrastructure, this fire behavior is less desirable.

Fire within mixed conifer stands have historically been characterized as mixed severity. Lower elevation ponderosa pine stands experienced frequent fire, but higher elevation mixed conifer forests were characterized by a much lower fire frequency and patches of stand-replacing fire in addition to low-severity surface fires (Evans, Everett, Stephens, & Youtz, 2011). These stands contain ladder fuels in the understory which allows fires to get into the overstory crowns. The flame lengths produced by the understory vegetation and low canopy base height creates an opportunity for fire to get into the crowns of the trees. Crown fuels are the biomass available for crown fire, which can be propagated from a surface fire via understory shrubs and trees, or from crown to crown. The shrub/small tree stratum is also involved in crown fires by increasing surface fire intensity and serving as "ladder fuels" that provide continuity from the surface fuels to canopy fuels, thereby facilitating crown fires. 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 (Graham, McCaffrey, & Jain, 2004).

Predicted fire behavior within the mixed conifer stands show flame lengths ranging from 2 – 99 feet and fireline intensities from 30 – 10,988 BTU/ft/sec, depending on wind speed. Most of the mixed conifer stands would exhibit passive fire behavior immediately under the 90th percentile weather conditions and wind speeds of less than 10 miles per hour. With increased wind speeds, these stands would become active crown fires. The mixed conifer stands, in their current state, are susceptible to crown fires with gust wind speeds, threatening firefighters, infrastructure, and nearby houses on private property. During a crown fire event, only a significant break in the canopy would inhibit fire spread through the crowns. In the past, periodic landscape wildfires spread for many miles when weather remained dry and windy in summers with little rain, such as associated with drought conditions similar to what the area has experienced over the last several years. With strong winds, topography normally has little influence on fire spread. Even with current suppression capabilities, major crown fires on the Arapaho and Roosevelt National Forests can cover five or more miles in one day, such as the High Park fire in 2012 which is the largest recorded wildfire on the Forest. Under the existing conditions, a wildfire would need a change in weather conditions, tree crown separation, or change in fuel type to help contain it.

The aspen stands within the project area have different characteristics. Some of the stands have only leaf litter in the understory, where other stands have a mix of conifer, forbs, and leaf litter. Fires within these fuel types, for the most part, are slower burning and have a low intensity under 90th percentile weather conditions. Aspen stands with conifer trees mixed in would have an increased fire behavior. Most aspen stands are moist and therefore the leaf litter retains more moisture keeping the fire from burning through the stand rapidly. This is especially true in the spring and early summer. As the air gets hotter and drier, the litter begins to dry out allowing for fire to move faster in these stands. Generally, ground suppression resources would have no problem suppressing fire within these stands.

As the stands currently exist, wildfires within the project area could be catastrophic under the right weather conditions. Wildfires could pose a serious risk to firefighter and public safety as well as infrastructure within and surrounding the project area.

3.2.2 Direct and Indirect Effects of Action Alternatives

Each action alternative differs in the number of acres treated and aggressiveness of treatment. Alternative 1 – Proposed Action, treats the most number of acres and includes large openings created by clearcutting up to 50% of a given lodgepole pine treatment unit. Alternative 2 – Prescription Change, treats the fewest number of acres and reduces the size of large openings created by clearcutting to 10 acres or less across up to 30% of a given lodgepole pine treatment unit. Alternative 3 – Reduced Treatment, treats the third highest number of acres and includes large openings created by clearcutting up to 50% of a given lodgepole pine treatment unit. Alternative 4 – Treatment Method Change, treats the second highest number of acres however, this alternative reduces the openings to 5 acres or less by patchcutting across up to 30% of a given lodgepole pine treatment unit. Larger openings near ridges change fire behavior more than smaller openings scattered across the landscape. Larger openings allow firefighters to use a wider range of suppression tactics to fight a wildfire.

The same 90th percentile weather conditions used in the No Action Alternative were also used for the analysis of the proposed treatments in all action alternatives. BehavePlus 5.0.5 and NEXUS 2.0 were also used for modeling fire behavior in the stands post treatment.

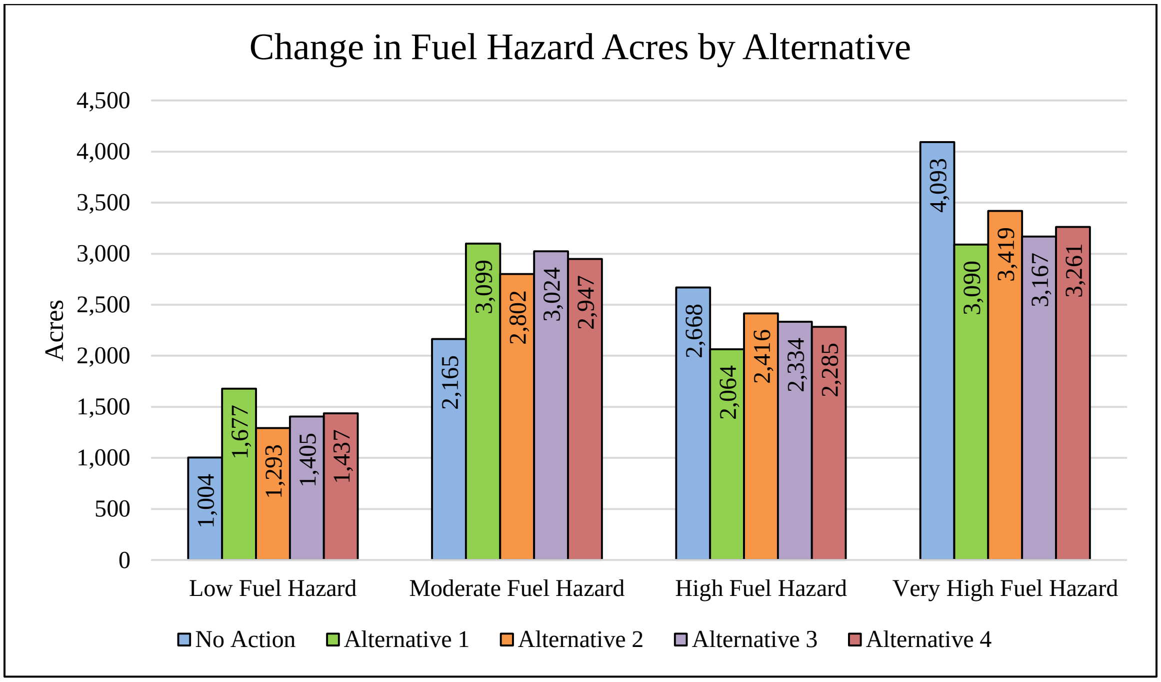
Post treatment fuel models would change based on the type of treatment (Table 13). Aspen and meadows/shrublands would not change fuel model because broadcast burning would not take place in these areas. Areas where material is piled and burned would reduce the amount of activity fuels but would not necessarily change the fuel model. Mixed conifer treatment units characterized by fuel model TU5 would change to a TU1 (Low Load Dry Climate Timber-Grass-Shrub) fuel model and those stands represented as TL5 would change to a TL3 fuel model as a result of reducing the ladder fuels, increasing the spacing between tree crowns through thinning, and piling and burning existing dead and down material.

Table 13. Pre and post treatment fuel models by treatment type.

Treatment Type	Pre-Treatment Fuel Model	Post Treatment Fuel Model
Meadow/Shrubland Restoration	GR2	GR2
	GS2	GS2
Aspen Restoration	TL6	TL6
Mixed Conifer Treatment	TL8	TL8
	TU5	TU1
	TL5	TL3
Lodgepole Pine Treatment	TL3	GR1 (until the seedlings start to grow)

The proposed treatments in all action alternatives would reduce the high and very high fuel hazard and increase the low and moderate fuel hazard across the project area. In other words, those acres treated would change from high and very high fuel hazards and be redistributed to low and moderate fuel hazards (Figure 7). The existing stands within the treatment units would change based on the type of treatment. Alternative 1 would decrease the high and very high fuel hazards the most because there would be more acres treated under this alternative.

Figure 7. Change in fuel hazard acres before treatment and after treatment, by alternative, within the project area.



Fire behavior under 90th percentile weather conditions would remain the same as the existing conditions within untreated stands, the aspen restoration units, and the meadow/shrubland restoration units. The proposed treatment within the aspen restoration units (TL6) and meadow/shrubland restoration units (GS2, GS1, GR2) is to remove the conifers within these units. Although there would be treatment in these units, the treatments would not change the fuel model so the predicted fire behavior is expected to be the same as is shown in the pre-treated stands (Table 12 or Table 14). The lodgepole pine stands that would be clearcut/patchcut would change fuel models to a GR1 until the seedlings begin to regenerate and then change to a TL3 fuel model 3-10 years post treatment. Fire behavior in these clearcut/patchcut areas would be greatly reduced as compared to the existing condition (Table 12). Over time, these regenerated lodgepole pine stands would be thinned to create and maintain space between the crowns.

Table 14. Predicted fire behavior results for the post treatment conditions under 90th percentile weather.

Fuel Model	Fire Type*		Rate of Spread (ch/hr)		Fireline Intensity (BTU&/ft/sec)		Flame Length (ft)		Torching Index (mi/hr)	Crowning Index (mi/hr)
	20-ft WS#	Gust WS	20-ft WS	Gust WS	20-ft WS	Gust WS	20-ft WS	Gust WS		
TL3	S	S	2	4	7	17	1	2	262	34
TL8	S	S	5	15	81	223	3	5	35	34 (39 for Alt. 2 only)
TU1	S	S	3	8	25	68	2	3	87	34
TL6	S	S	22	84	218	817	5	10	n/a	n/a
GR1	S	S	27	27	44	44	3	3	n/a	n/a
GR2	S	S	182	244	866	1,165	10	12	n/a	n/a
GS2	S	S	103	376	1,045	3,818	11	20	n/a	n/a
GS1	S	S	75	149	465	926	8	10	n/a	n/a

*S = surface fire
WS = wind speed
& BTU = British thermal unit

Aerial fuels separated from surface fuels by large gaps are more difficult to ignite because of the distance above the surface fuels, thus requiring higher intensity surface fires, surface fires of longer duration that dry the canopy before ignition, or mass ignition from spotting over a wide area (Graham, McCaffrey, & Jain, 2004). Thinning the mixed conifer stands would help to decrease fire behavior within those treated stands (Table 14). 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, McCaffrey, & Jain, 2004). Thinning increases the space between crowns and raises the canopy base height of the remaining trees, thus decreasing potential fire behavior from passive and active crown fires to more manageable surface fires. Forest treatments that target height to live crown and bulk density can be implemented to reduce the probability of crown fire (Graham, McCaffrey, & Jain, 2004).

The main difference between the existing conditions and post treatment fire behavior is that stands post treatment would exhibit more surface fire rather than passive as is potential in the pretreated stands. It would be very unlikely for the TL3 stands to exhibit passive fire behavior because of the wind speeds required. "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" (USDA Forest Service, 2003a). The thinning would target the trees as they relate to ladder fuels and the ability to initiate a crown fire.

The Cold Springs fire in July 2016 spread quickly under very dry conditions and tested the effectiveness of vegetation treatments. Thinning of conifers was completed on NFS lands in 2015 along Ridge Road, just north of the Forsythe II project area, where the material was piled to be burned. At the time the fire burned through the treated area, the piles had not yet been burned. Although the thinning treatment did not stop the fire, it did alter fire behavior enough to allow firefighters to use the treated area as an anchor point to suppress the fire. The Cold Springs fire did destroy eight homes, however firefighters working on the fire believed that the treated area prevented the fire from causing more spot fires across Boulder Canyon, into the Forsythe II project area, which would have put thousands more residences at risk of being destroyed by the fire. Firefighters also confirmed that the unburned piles did not increase fire spread. The proposed treatment of thinning, in conjunction with pile and burning and/or chipping, and/or masticating, and/or offsite removal of the created and existing slash, would help to disrupt the potential for a ground fire to propagate to a crown fire as demonstrated with the Cold Springs fire.

In most cases, thinning alone does not affect the surface fuels which carries the fire. Broadcast burning would be the option for reducing the surface fuels, but because of private property intermix, broadcast burning is only feasible near Gross Reservoir. Thinning units within Units 38 and 44 would increase tree crown spacing and the broadcast burning would reduce the surface fuels. The understory vegetation (shrubs/grass and ladder fuels) would be targeted for a 75% reduction in the broadcast burn. Overstory vegetation would not be targeted for reduction but up to 25% mortality of the overstory would be acceptable.

The location of the broadcast burn unit boundaries is based on control features surrounding each unit, including NFS roads and Gross Reservoir. The cutting units within broadcast burn Unit 38 would have thinning done prior to the broadcast burn and the material would be removed prior to burning. Some of the stands in Unit 44 were thinned under the 2012 Forsythe Decision and the treated material was lopped and scattered. Stands not thinned under the 2012 Forsythe Decision, within proposed cutting units, would be thinned prior to broadcast burning. Potential fire behavior during the broadcast burn is shown in Table 15. The broadcast burn would be completed when weather conditions are favorable for burning. The areas of mortality would be scattered across the burn units based on burnable material. Expected total area burned would be up to 80% of the total number of acres in the broadcast burn unit. The stands in Unit 38 would go from TL8 to TL1 post burn. The stands in Unit 44 would go from TL3/SB1 to TL1 after burning.

Table 15. Potential fire behavior during broadcast burning using typical burn weather conditions.

Fuel Model	Type of Fire	Rate of Spread (ch/hr)	Flame Length (ft)	Scorch Height (ft)	Overstory Mortality (%)
TL8	Surface	3	3	12	10
TL8/GS1	Surface	7	3	13	10
TL3/SB1	Surface	3	3	13	10

Table 16. Predicted fire behavior results for the post broadcast burn conditions under 90th percentile weather.

Fuel Model	Fire Type*		Rate of Spread (ch/hr)		Fireline Intensity (BTU&/ft/sec)		Flame Length (ft)		Torching Index (mi/hr)	Crowning Index (mi/hr)
	20-ft WS#	Gust WS	20-ft WS	Gust WS	20-ft WS	Gust WS	20-ft WS	Gust WS		
TL1	S	S	1	2	2	4	1	1	608	51

*S = surface fire
WS = wind speed
& BTU = British thermal unit

The stands after burning show a significant drop in fire behavior by thinning the ladder fuels and burning the grass/shrub components (Table 16). The wind needed to go from surface fire to passive fire is extremely high, more than hurricane speeds, which indicates passive fires would happen in the areas treated by broadcast burning. Burning these units opens the stands up, in turn allowing more wind to come to the surface. With more wind higher fire behavior could be expected once the understory vegetation began to grow back.

In summary compared to Alternative 1, Alternative 2 creates approximately 58% less and smaller openings with clearcuts/patchcuts; Alternative 3 creates approximately 48% less clearcuts/patchcuts; and Alternative 4 creates approximately 40% less openings by patchcuts. Alternative 4 limits patchcut openings to no more than 5 acres in size. More and larger openings, such as described under Alternative 1, help modify fire movement better across the landscape.

Overall, treatments proposed within the project area would change the fire behavior in those areas that would be treated helping to reduce the threat of a catastrophic wildfire. However, Alternative 1 changes fire behavior and fuel hazard more than the other action alternatives because of the number of acres treated, the percent of area clearcut/patchcut, and size of the openings. Alternatives 3 and 4 are similar in changes to fuel hazard; Alternative 3 reduces more very high fuel hazard acres whereas Alternative 4 reduces more high fuel hazard acres. Because Alternative 2 treats the fewest acres of all action alternatives and limits openings to patchcuts of up to 5 acres, it would change fire behavior and fuel hazard the least.

3.2.3 Cumulative Effects of Action Alternatives

The proposed treatments along with other fuels reduction projects in the area, such as Lump Gulch and Winiger Ridge along with treatment done on private and county lands within and surrounding the project area, would help disrupt fire behavior in the event of a wildfire in the area. The treatment units scattered across the landscape act as a barrier to large fire growth as evidenced by fuels reduction projects tested by wildfires across the western United States. Fire intensities would decrease due to these cumulative treatments not only on federal lands but also on private and county lands, allowing firefighters to suppress wildfires more readily.

3.3 Silviculture

3.3.1 Affected Environment (No Action)

The Forsythe II Project encompasses 18,954 acres of National Forest System lands near and adjacent to the community of Nederland, CO and Gross Reservoir. The land ownership pattern is complex with a mixture of National Forest System lands (52%), Boulder County Parks and Open Space (12%), and private lands (36%) within the project area. The WUI designation is across the entire project area, due to the proximity to communities as well as interspersed private land ownerships. Elevation ranges are from 6,082 to 8,945 feet.

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 majority of the project is located in the montane ecological zone. At the lower elevations where conditions are the warmest and driest, the vegetation is dominated with mixed conifer species including ponderosa pine and Douglas-fir and aspen. Patches of herbaceous and shrub vegetation mixed with ponderosa pine are scattered and located on southerly aspects. 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. Tables 17 and 18 summarize the cover type across the project area (NFS and private lands) and habitat structural stages (HSS) represented on NFS lands.

Table 17. Major cover types and their relative percentages within Forsythe II project area boundary.

Cover Type	NFS lands		Non-NFS lands		Total All Ownerships	
	Acres	% of Area	Acres	% of Area	Acres	% of Area
Grass	360	4	992	11	1,352	7
Un-vegetated (Rock or Barren)	47	<1	86	1	133	1
Shrub	10	<1	20	<1	30	<1
Quaking Aspen	361	4	666	7	1,027	5
Douglas-fir	3,321	33	1,475	16	4,796	25
Lodgepole Pine	3,183	32	2,647	29	5,830	31
Ponderosa Pine/ Rocky Mountain Juniper	7	<1	11	<1	18	<1
Ponderosa Pine	2,478	25	2,852	32	5,330	28
Spruce/Fir	15	<1	17	<1	32	<1
Water	148	1	258	3	406	2
TOTALS	**9,930**	**100**	**9,024**	**100**	**18,954**	**100**

Table 18. Acres of existing habitat structural stage of vegetation in the project area, on NFS lands.

	2T	3A	3B	3C	4A	4B	4C	No HSS	TOTAL
Aspen	31	149	109	41	9	22			**361**
Douglas-fir		259	715	1,095	286	458	508		**3,321**
Lodgepole	235	186	1,262	761	116	564	59		**3,183**
Pinyon/Juniper		7							**7**
Ponderosa	27	540	707	18	594	592			**2,478**
Spruce/fir						15			**15**
Rock/Barren/Water								**195**	**195**
Grass								**360**	**360**
Shrub								**10**	**10**
TOTAL	**293**	**1,141**	**2,793**	**1,915**	**1,005**	**1,651**	**567**	**565**	**9,930**

HSS Key: 2T = seedlings/saplings, 3 = immature, 4 = mature
A = 10-39% canopy cover, B = 40-69% canopy cover, C = 70+% canopy cover

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 dominant species. Douglas-fir is dominant on slopes with north aspects where conditions are generally cooler and moister.

Lodgepole pine

Lodgepole pine represents 31% of the cover type in the project area (NFS and non NFS lands). Lodgepole pine is generally regarded as an even-aged, single storied forest, varying in age from any specific location but uniform in age within any given stand. Most of the lodgepole pine stands are even-aged ranging from 7 to over 100 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 6 to 10 inches DBH with 500 to 900 trees per acre. Tree heights in dog-hair stands rarely exceed 30 feet. On better quality sites with deeper soils, average tree heights range from 30 to 50 feet.

In the upper montane portion of the project area where lodgepole pine is the dominant species, stand-replacing fires created stands dominated by lodgepole pine. Lodgepole pine establishes from large quantities of seed released by serotinous cones and initially grows rapidly on sites of favorable habitat.

Lodgepole pine stands have not departed from the historical fire regime. These stands are characterized by closed canopies, long fire return intervals (100+ years), and stand replacing fires that burn with high intensity and severity. Because these stands are homogenous in nature, they become susceptible to insect and disease under drought conditions. Creating a diversity of age structures between lodgepole pine stands would promote resiliency in the face of future insect and disease epidemics. Overall forest resilience to multiple disturbances can be increased when younger trees are a substantial component of the landscape (Taylor, Carroll, Alfaro, & Safranyik, 2006).

<u>Ponderosa pine/Mixed conifer</u>

The ponderosa pine cover type represents approximately 28% of the project area. Ponderosa pine is one of the most widespread tree species in the western United States. In the Front Range, ponderosa pine grows from the border of the prairie and foothills, up to around 9,000 ft. elevation. The majority of the ponderosa pine stands are mixed in age, density, and structure across the landscape.

On south aspects, ponderosa pine grows in relatively open stands and requires full sunlight to grow well. When stands are dense and trees shade one another, the shaded trees grow slowly, often develop poor form, and may die. In pure stands of ponderosa pine, there may or may not be an understory of reproduction depending on the density of the overstory.

Within the lower montane portion of the project area, it is common to see dense groups of trees (many trees growing in close proximity to each other) that have resulted from conditions favorable for tree regeneration to occur. Mature ponderosa pine in the project area generally averages 12 to 16 inches in 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.

<u>Douglas-fir/Mixed conifer</u>

The Douglas-fir cover type covers approximately 25% of the project area. The Douglas-fir series occurs exclusively on steep north-facing slopes of the foothills and montane zones of the Arapaho and Roosevelt National Forests at elevations of 5,470 to 8,530 feet (1,750 to 2,600 m) (Hess & Alexander, 1986). Where Douglas-fir and ponderosa pine co-occur in the same stand and on aspects favorable for moisture conditions, there is a tendency for the Douglas-fir to slowly, successionally replace the pine. Douglas-fir trees are more numerous in the Front Range than they were historically (Kaufmann, Regan, & Brown, 2000a).

In relatively old post fire stands, young Douglas-fir is typically present whereas juveniles of the shade intolerant ponderosa pine are scarce or absent. This successional pattern is due in part to the differences in shade tolerance of the two dominant species and because Douglas-fir is a prolific seed producer the species has a competitive advantage.

<u>Quaking Aspen</u>

Quaking aspen can be found throughout the project area in patches and stands and represents 5% of the project area. It is the most widely distributed tree species in North America. Aspen forests are a crucial component of many western landscapes, providing biological diversity, critical wildlife habitat, valuable grazing resources as well as highly desirable scenic and hydrological values (Shepperd, Rogers, Burton, & Bartos, 2006(b)). The majority of the quaking aspen stands are seral communities that would eventually be dominated by conifers in the absence of a major disturbance.

Disturbance is required to maintain the open habitat needed for survival and to stimulate suckers for regeneration. The ability of quaking aspen to grow in full sunlight and regenerate via root suckers allows it to thrive following disturbance. As a result of fire exclusion, aspen stands within the project area, for the most part, have been invaded by conifers. Over time, conifers often become established and decrease the available light, moisture, and nutrients for the aspen. As the stand grows, and shade on the site increases, conifer species eventually replace the aspen. Throughout the project area, small remnant aspen clones are found in ponderosa pine and lodgepole pine dominated stands. These trees are remnants of larger clones that deteriorated with the succession and competition from conifers.

Meadows and Shrublands

Meadows and shrublands can be found throughout the project area in small patches and represents 7% of the project area. Meadows and shrub patches can occur as small habitats within surrounding forested stands or as large meadow, shrubland, and grassland habitats. Meadows and shrublands are important habitat for a variety of wildlife species, add to the biodiversity of the project area, and provide a natural fire break.

Conifer encroachment into mountain meadows and shrublands are common in the western United States mainly because of fire suppression. Historically, meadow habitat and shrublands were maintained by natural fire. Over time, conifer encroachment can reduce meadow/shrubland, and grassland habitats as well as the habitat diversity they provide. Associated soil type changes are also resulting from vegetation community changes, due to changed soil chemistry and other factors. The size and extent of meadows is less. Meadow areas are important habitat components, and also have hydrologic significance.

Old Growth and Old Growth Development

There are approximately 3,300 acres (NFS and non-NFS lands) of existing and developing old growth within the Forsythe II project area. Old growth forests within the Forsythe II landscape are distinguished by groups of old trees and the related structural features such as snags, down logs and gaps in the canopy layers that include understory patches. Large, declining live trees are considered a necessary part of all old growth stands. Old trees were historically a major component of montane forests in the Colorado Front Range. They were an integral part of the spatial and temporal heterogeneity inherent in the ecosystem, and now they are relatively scarce. Surviving old trees are now stressed by competition from dense ingrowth of younger trees and are in danger from insect outbreaks and stand-replacing fires (Huckaby et al., 2003).

Ponderosa pine is a long-lived species. The oldest known ponderosa pines in the Front Range are a little over 600 years old. However, ponderosa pines that old are uncommon in the Front Range. Trees between 300 and 500 years old are frequent, and trees more than 200 years old are common throughout the Front Range above about 6,500 feet elevation (Huckaby et al., 2003).

There are approximately 107 acres of seral lodgepole pine old growth in the Forsythe II project area. The seral lodgepole pine condition can exhibit old-growth characteristics albeit they do not last long in one place, but overall in a landscape this old-growth condition can exist for quite some time (Mehl, 1992). In a seral condition lodgepole pine old growth would be described as having an overstory of large old trees without lower limbs, with dead or dying tops and with crowns that are sparse, open branched and somewhat flattened.

Old growth retention areas are identified within the timber suitability analysis and have specific limitations for treatment. Identified old growth development areas are estimated to become old growth stands within the next century in the absence of a stand replacing event. Management is allowed in developing old growth areas as long as the treatment objective supports old growth development. On the ARP, inventoried old growth was identified, as a minimum rule, as large live trees, some of which were old and declining; either snags or fallen trees; and greater than 20 percent overhead canopy closure (Lowry, 1992).

Defensible Space

The vegetation that is present within the defensible space is characteristic of the general forest matrix. At the lower elevations of the project area, the vegetation is dominated by a 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.

Direct and Indirect Effects of No Action

The No Action Alternative does not meet the purpose and need of this project, but was analyzed to show how the indicator measures of no action compare to action alternatives indicator measures. Under the No Action Alternative there would not be any management activities pursued. Therefore, there would be no direct effects as a result of management activities. However, the course of no action is not without effects. A direct effect of no action would be that vegetation would continue to grow, successional pathways that are already limited due to lack of an active disturbance regime would become more limited, and subsequent fuel loading would continue to accumulate. Water stress would continue to increase as vegetation and forest stands continue to accumulate more biomass. More biomass would require more water to remain viable (Grant, Tague, & Allen, 2013). It is assumed that the current trends would continue in the short term, and so this indicates that water (drought) stress would continue to be a contributing factor in vegetation stressors.

Climate change is an unknown factor in assessing potential outcomes. Average global temperatures are increasing due to increases in greenhouse gasses. In Colorado, temperatures have been rising, especially in summer, and that trend is expected to continue, along with increases in the frequency and intensity of heat waves, droughts and wildfire (Gordon & Ojima, 2015). Fires have become larger and more severe in recent decades, and these trends are projected to continue due to hydrologic changes and longer wildfire seasons (Westerling, Hidalgo, Cayan, & Swetnam, 2006). Compounded effects of “hotter droughts” and moisture stress would continue to lead to increased vulnerability to insect and disease attack, and uncharacteristically large and/or severe fire disturbances (Millar & Stephenson, 2015). With unknown effects from climate change and drought cycles, the effects of catastrophic disturbances may occur at any point in the future. There is a high level of uncertainty related to water and climate trends; less moisture is likely to result in increased risk to all catastrophic events. The choice of no action is likely to leave the project area at higher risk to a catastrophic event (or combination of events).

Generally, the No Action Alternative would result in increased canopy cover in the short term. In the long term, it is not known what the canopy would be but as trees continue to grow and stand density increases, the canopy would eventually decline. Endemic insect and disease activity would continue to occur, and may increase as density levels continue to increase. Stand densities would increase through time and critical thresholds for beetles would eventually be reached (Fettig, Borys, McKelvey, & Dabney, 2008; Oliver, 1995). As insects and disease issues become more numerous, stand conditions would further deteriorate and cause individual tree mortality. It is likely that larger, more dominant trees would die as they are more susceptible to bark beetles (Oliver, 1995). If this situation were to occur, the dead trees would eventually contribute to dead fuel loading and a higher risk for stand replacing events over time. In homogeneous stands of the same species, endemic levels may become epidemic. Epidemic occurrences of insects (specifically bark beetles) would cause higher canopy cover reductions.

There would be no means to effectively provide for ‘old forest conditions’ without active management (analogous to an active disturbance regime). Essentially, the growth system of the plant community is closed and would remain this way until some type of event disrupts the cycle. Historically, a disruption in this type of vegetation had been realized in wildfires or insect outbreaks that resulted in a mosaic of stand variation across the landscape adding to the ‘old forest condition’ arrangement.

Over time and a changing climate, old growth ponderosa pine and associated stands could lose a majority of the large tree component. In the absence of a disturbance and as the younger trees grow, competition for moisture and other resources would increase resulting in the suppression mortality of the smaller stems and gradual loss of the larger trees. Bark beetles would be the main contributor to the large tree mortality as stress makes larger trees more susceptible to successful insect attack. Old growth status of lodgepole pine is short-lived and would decline quicker than ponderosa pine old growth.

Seral stage aspen communities would continue to decline over time as they are disturbance dependent. The No Action Alternative would not provide for disturbance systems to actively work within the aspen communities, and would rely on environmental factors to continue to determine outcomes. The existing condition of aspen communities shows that conifer encroachment would continue, which would lead to continued decline of individual aspen and overall reduction of clonal viability. The lack of fire, as well as competing conifers indicates that the seral aspen communities in Forsythe II Project area could be entirely lost.

Conifer encroachment would continue to invade meadow and shrubland systems, and would result in a reduction of herbaceous plant communities over time. Loss that is currently documented would continue to occur, and may be increased. Current encroachment has allowed conifers to grow into meadow systems, which effectively provides more conifer seed source to the internal meadow. With more conifers present within and adjacent to the meadow, the water balance would also be changed and create changes to plant communities.

Continued absence of active management would further decrease meadow size now and in the long term. Meadow systems exist as a result of disturbance regimes acting within the ecosystem. Lack of disturbance would result in further conifer encroachment, and eventual conifer domination. Soil types would be changed so that meadow soils would no longer be present in the long term time frame.

When adding to past, present or future actions, by definition because there are no actions under the No Action Alternative, there will be no cumulative effects. The No Actions will not add additional improvements towards restoring the various tree species stand structure or composition. Meadow enhancement will not add cumulatively to any of the past, present or future projects. Defensible space will not cumulatively increase by this No Action Alternative.

3.3.2 Direct and Indirect Effects of Action Alternatives

The Forsythe II project proposes to restore a healthy, diverse, and fire resilient forest structure. Stand densities and fuel loadings would be reduced in a variety of vegetation types. The project seeks to increase vertical and horizontal diversity across the landscape by implementing prescriptions that are consistent with applicable management direction and consider important variables such as topography and site productivity. Restoration and fuels reduction goals can provide for the needs of wildlife and the ecosystems they depend on, and be carried out with consideration to societal values and concerns in an urban forest. The project would result in a forest ecosystem that is moving toward historic conditions and adaptable to foreseeable changes based on current and forecasted trends. The project area would be more resilient to disturbances and forest cover would be maintained over time.

The Forsythe II landscape supports a diversity of ecosystems and vegetation types consistent with the montane zone and lower subalpine zone of the northern Front Range. The interdisciplinary team identified five primary cover types (ponderosa pine, Douglas-fir, lodgepole pine, aspen, and meadows and shrublands) to use in analyzing the effects of the alternatives for the project. Dominant conifer species throughout the landscape are ponderosa pine, Douglas-fir, lodgepole pine, and limber pine with Engelmann spruce and Rocky Mountain juniper. Aspen is also common in much of the landscape, particularly in both the dry and mesic mixed-conifer forests. Each primary cover type would have appropriate prescriptions applied in order to meet the purpose of the project.

Forests are part of a dynamic system composed of many different facets, which people value over time. Forested landscapes are composed of a mosaic of forest patches, differing in terms of their structures and ecological processes. Disturbance is an important component in the forest as it affects diversity by creating different successional and habitat structural stages across the landscape both spatially and temporally. Silviculture emulates natural disturbances by attempting to mimic the same stimuli that favor certain species and the development of certain stand structures (O'Hara, 2014). The structure and function of dry forest ecosystems of the western United States have changed since European American settlement in the late 19th century, and generally these forests are currently more susceptible to large severe wildfires than they have been historically (Noss et al., 2006; Allen et al., 2002). The most limiting factor for the forests along the Front Range is soil moisture. Many climate-change scenarios predict warmer, dryer climates, which would lead to an increase in these moisture-limited forest types.

Recent research has found that the increased density of forests has reduced the number and size of canopy openings in the lower montane. The overall abundance of forested patches of Front Range's montane ponderosa forest cover has significantly increased since pre-settlement conditions. With increased forest density and the exclusion of fire, the populations and aggregations of pioneer tree species like aspen and limber pine have been reduced. Fire resilience is the ability for live vegetation to survive from fire events. Silvicultural treatments would create conditions for shade intolerant species (ponderosa pine) to become more numerous over time, in an effort to improve fire resilience across the landscape.

<u>Silvicultural Effects of Reducing Tree Density</u>

Disturbance dependent ecosystems require some type of interruption to create successional pathways, which re-organize plant communities. The body of forestry research shows how thinning stands helps reduces the incidence of damage to the stand and is perhaps the most critical silvicultural treatment available to restore individual tree health within a stand. However, increased health and vigor is usually not an immediate response. In the short term, thinning puts an additional stress on residual trees, similar to other management activities. Therefore, thinning during non-drought periods would be advocated rather than waiting until mortality is detected (Smith & Martyn, 1997).

As a forest grows, trees become spatially crowded and fewer nutritional resources are available for each individual tree, leading to a decrease in tree and overall stand vigor. Oliver and Larsen (1996) state that stand density affects cover for wildlife, fuels levels, fire potential and fire behavior, understory tree, shrub and herb density, and growth and yield of forest products. Reductions in stand density increase tree growth rates thereby enhancing the development of larger trees, and adding to the vigor of residual trees (greater crown mass for photosynthesis), which results in a proportional increase in overall stand health and stand and landscape level resiliency to fire, insects, disease, and drought. Studies have found that growth in large older trees increases significantly when high densities of adjacent small stems are removed (Latham & Tappeiner, 2002). Thinned stands would be more open, similar to historic conditions that were more resilient and sustainable against bark beetle attacks.

In all the action alternatives, canopy cover would be decreased (by removal of individual or patches of trees) under most prescriptions, and the greatest decrease would be associated with prescriptions that receive the most thinning. Canopy cover reduction would be a shorter term (varying from 20 to 50 years depending on tree species and type of treatment) decrease and would increase over the longer term. Immediately post thinning, stands would be more open and then the growing space that is made available from the various types of thinning would begin to be occupied by other vegetation, including new trees. All of the action alternatives would reduce canopy cover more than the no action alternative, but this would be a shorter term (20-50 years) reduction. Beyond the 20-50 year period, the canopy would re-grow into the open spaces and is likely to be close to the pre-treatment canopy cover.

The action alternatives would maintain stands of trees in a healthy condition, continuing to progress toward a late-seral stage where thick bark provides more protection from fire damage. Where equipment is utilized, there would be a mixing of the forest litter layer with the mineral soil. The use of machinery to complete treatments would increase the potential for broken limbs and scraped bark on residual trees making them more susceptible to disease causing pathogens.

Mortality of residual trees from windthrow or from conifers “snapping off” at mid-trunk would be possible in the short term. The occurrence of windthrow and “snap off” would decrease over time as trees become more resistant to the wind. Tree regeneration within thinned stands would be more susceptible to dwarf mistletoe if dense concentrations exist in the overstory.

In the treated stands, lodgepole pine and Douglas-fir regeneration would be expected to occur within 2 to 10 years after treatment, depending on cone crops and climatic conditions. Ponderosa pine regeneration doesn’t occur as readily as the two other species so the time interval between substantial ponderosa pine cone crops is greater than the other two conifers. Ponderosa pine establishment is more dependent on the size of the cone crop, appropriate soil conditions, and moisture in order to successfully regenerate. Douglas-fir is a prolific seeder and in many areas have outcompeted ponderosa pine regeneration on certain sites. Where aspen exists it would be released to become a major stand component. Residual conifers would be arranged singly and in clumps at a variety of densities to increase stand complexity.

<u>Ponderosa/Douglas-fir/Mixed Conifer</u>

On the treated acres, varying age and size classes of ponderosa pine stands would remain. Stand composition post-thinning would favor ponderosa pine and aspen in the lower elevations and south and east aspects. Douglas-fir would be favored on north and west aspects with varying age and size classes. Residual conifers in the ponderosa pine and Douglas-fir cover types would be arranged singly and in clumps with a diversity of ages, sizes and densities. Various size openings would be created to maintain forest stand health and meet fuel reduction objectives. 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.

The stand attributes that result from thinning ponderosa pine stands closely match what is desired for old growth. Mature, larger, live trees would primarily be retained and the ones in decline may not be treated to provide for future snags and downed woody material. Younger healthy trees that are retained would increase in diameter due to the reduced competition than would naturally occur, and the enhancement of these younger trees provide for a multi-storied canopy.

The greatest resilience and healthiest mixed conifer stand conditions would be expected under Alternative 1, followed by Alternatives 3, 2, and 4. Alternative 4 proposes to treat the same number of acres as Alternative 1, utilizing only manual labor with chainsaws, will not thin the overstory as extensively as with mechanical equipment; thus, less acres would be effectively treated to maintain stand resilience and a healthy forest condition over time.

<u>Lodgepole pine</u>

Lodgepole pine stands would be more susceptible to windthrow than ponderosa pine stands or mixed stands. Lodgepole pine trees do not have a tap root like ponderosa pine or Douglas-fir, which reaches generally straight down into the soil and provides more stability to the tree. This, in combination with shallow soils that are generally associated with lodgepole pine stands, makes lodgepole pine trees more susceptible to windthrow. Thinning lodgepole pine increases the risk of windthrow because the stand is opened up and the residual trees are vulnerable to winds that they weren’t exposed to in an untreated condition. Less damage is associated with clearcut/patchcutting where only the boundaries are vulnerable.

Clearcutting and patchcutting results in moderate to extensive disturbance of the understory vegetation, where present. Generally, within two to five years after cutting, the understory vegetation begins to grow back and dominates the ground surface. A mixture of planted conifers (ponderosa pine, limber pine, and

Douglas-fir) would compete for dominance with the anticipated lodgepole pine natural regeneration. New stands arising from clearcutting and patchcutting would exhibit a single canopy layer and uniform size and age classes until future treatments are implemented where tree stratification would occur. The thinning of these young stands would reduce tree-to-tree competition, increase tree vigor and provide an enhance ability of trees to defend against a MPB attack. Thinning these young stands would also allow the diameters of the residual trees to grow quicker and reduce the risk of snow breakage.

Alternative 1 would create the greatest heterogeneous pattern of lodgepole pine stands throughout the general forest to provide a discontinuous crown level and a greater resiliency to large disturbances followed by Alternatives 4, 3, and 2.

Quaking Aspen

Aspen restoration would increase tree heath and vigor of the species in the treated stands. Risk of loss would be decreased over time. Large older trees may become more vigorous initially but eventually they would become snags and downed wood, all contributing to a healthy habitat within the clone boundary. Sprouting is anticipated to be greater, leading to a higher survival rate for young aspen. This would result in numerous young trees that would grow rapidly and then begin stem differentiation as time passes. Aspen clones would become larger, and the overall size of the clone would be discernible within one to two years as a result of implementing these treatments.

Alternative 3 would treat the most acres to encourage and increase the landscape heterogeneity and complexity resulting in a greater variety of environments and increased diversity followed by Alternatives 1, 4, and 2.

Meadows and Shrublands

Meadow restoration efforts associated with the proposed action would effectively assist in removing the smaller size class from the identified meadows/shrublands treatment areas. Removal of these smaller size classes of trees would result in less water use in the meadows/shrublands, now and over time. Small tree removal by chainsaw would prevent equipment entry into the meadows/shrublands areas, effectively preventing soil compaction and hydrologic changes. The treatment proposal of thinning up to a maximum diameter limit would restrict removal of the largest trees. Larger tree removal would likely result in achieving greater restoration of the meadows/shrublands; however, these trees are being left for wildlife and also to avoid mechanical entry into sensitive areas. Some aggregations would increase in size as a result of removing encroaching conifers, and the overall size would begin to be noticed within three or more years after treatment.

Alternatives 1and 4 would treat the most acres to enhance and maintain larger meadows and shrublands that would play an important role for wildlife species that need open areas for foraging or nesting, and also influence disturbance processes such as crown-fire, insects, and disease followed by Alternatives 2 and 3.

Old Growth

There are currently between 695 and 890 acres (depending on the action alternative) of units that are identified as old growth or potential old growth. There would be opportunities to provide for future stand development into old growth as these stands mature by thinning to leave and create new 3B and 4B structural stages. These stands would be needed to increase the amount of late successional stands and replace existing late successional stands as they deteriorate or are lost through fire, insects or other natural events. Acres of old growth proposed for treatment would be designed to enhance old growth characteristics and promote the existence of the stand over time.

Alternatives 1, 3, and 4 would equally treat the most acres to enhance and maintain old growth conditions in ponderosa pine dominated stands followed by Alternative 2.

Prescribed Fire

All of the action alternatives would utilize a combination of mechanical equipment and hand crew labor (manual) to reduce fuel loadings within unit boundaries and reduce the potential for crown fire initiation and spread under a wildfire setting. Slash would be hand piled in manual units and burned when the piles have cured and conditions are within the burn prescription. Scorching of individual conifer crowns may occur depending on their proximity to the pile, density of crown, and wind speed during the burning operations. This would raise individual crown base heights and sometimes remove the branches on the side of residual trees; however, tree mortality from pile burning would be minimal. Machine piles created from a mechanical treatment would be located on landings and generally would not impact residual conifers during burning operations.

The effects of prescribed broadcast burning on the existing vegetation would result in a mosaic of fire intensity. Low to moderate intensity surface fire would thin (kill) 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. Secondary fire effects can result in damage and stress to trees that may become susceptible to mountain pine beetles. The effects of a broadcast burn would be highly variable ranging in areas where signs of burning are negligible to areas where torching and the loss of single and sometimes groups of overstory trees. The structural forest diversity resulting from prescribed fire may mimic the natural fire regime that occurred historically in the lower montane of Colorado's Northern Front Range.

All of the proposed action alternatives treat the same amount of acres with prescribed broadcast burning.

Roads

Maintenance of existing roads within mechanical unit boundaries would be required to implement this project. Openings of up to 12 feet (projected road width prism) would be created in the stand crown as a result of road maintenance if the condition of the road is not already set to this standard. Roads providing ingress/egress to the Big Springs Subdivision would have a clearing of trees 30 feet wide including the roadbed. This clearing would be 3.9 acres (2.6 acres along Doe Trail and 1.3 acres along Wildewood Trail). Windthrow of remaining trees is expected to be minimal given the north/south general direction of the proposed roadways as compared to the west to east predominant wind patterns.

Landings, generally up to 1 acre in size (1 landing for every 10 to 30 acres) would be created for the implementation of the mechanically treated units. Roads that are utilized to access the landings would have soil compaction until they are restored upon completion of the project. Conifer mortality may occur directly adjacent to the temporary roads and landings due to lateral soil compaction. Although minimal damage to trees adjacent to system roads that have overgrown or are not currently at the forest standards, the maintenance (including roadbed preparation and soil compaction) may damage tree roots. Tree injuries from road maintenance and landings may provide entry points for pathogens to adjacent trees.

Alternatives 1 and 2 would equally treat the greatest miles of temporary roads followed equally by Alternatives 3 and 4. All of the proposed action alternatives treat the same miles of ingress/egress administrative roadway for the Big Springs Subdivision as well as the number of miles of existing road that would be decommissioned.

Defensible Space

The direct and indirect effects for units identified with defensible space prescriptions would be similar to the effects identified for each primary forest cover type. All prescriptions would be treated manually so the effects reflective of mechanical treatments (i.e. compaction) would not be applicable.

Alternative 2 would allow the greatest amount of potential acres for private residences to complete defensible space mitigation on NFS lands followed by Alternatives 3, 1, and 4.

Habitat Structural Stage Changes by Alternative

The existing and expected post treatment cover types and the associated HSS within the treatment units are summarized for all of the action alternatives in Tables 19-22. The most dramatic change would occur in the lodgepole pine stands that are treated with clearcutting/patchcutting. Thinning primarily affects the understory but a measurable change to canopy closure and the HSS occurs. In ponderosa pine and Douglas-fir cover types, the effects of thinning would potentially change from a high to moderate closure and from 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 where aspen is present.

Table 19. Acres of habitat structural stage change pre and post treatment in Alternative 1.

Cover Type		1M	2T	3A	3B	3C	4A	4B	4C	Total Acres[8]
Grass	Pre Treatment	259								**259**
	Post Treatment	274								**274**
Lodgepole Pine	Pre Treatment		17	105	533	196	97	441	26	**1,415**
	Post Treatment		715	57	267	94	49	219	13	**1,414**
Ponderosa Pine	Pre Treatment			200	166		255	292		**913**
	Post Treatment			366			531	5		**902**
Douglas-fir	Pre Treatment			157	324	32	107	280	144	**1,044**
	Post Treatment		2	474	26	8	362	149		**1,021**
Aspen	Pre Treatment		31	106	55	36	8	7		**243**
	Post Treatment			198	45		19			**262**
Spruce/fir	Pre Treatment						3			**3**
	Post Treatment						3			**3**
Pre Treatment Total		259	48	568	1,078	264	470	1,020	170	**3,877**
% of Total Cover		6.7%	1.2%	14.7%	27.8%	6.8%	12.1%	26.3%	4.4%	
Post Treatment Total		274	717	1,095	338	102	964	373	13	**3,876**
% of Total Cover		7.1%	18.5%	28.3%	8.7%	2.6%	24.9%	9.6%	0.3%	

HSS Key: 1M = grass/forbs, 2T = seedlings/saplings, 3 = immature, 4 = mature
A = 10-39% canopy cover, B = 40-69% canopy cover, C = 70+% canopy cover

[8] Total acres are based on all acres of each cover type within treatment units. Acres could be +/- 10 acres due to rounding.

Table 20. Acres of habitat structural change pre and post treatment in Alternative 2.

Cover Type		1M	2T	3A	3B	3C	4A	4B	4C	Total Acres[8]
Grass	Pre Treatment	254								**254**
	Post Treatment	262								**262**
Lodgepole Pine	Pre Treatment		10	69	375	123	71	326	11	**985**
	Post Treatment		311	52	255	84	49	227	8	**986**
Ponderosa Pine	Pre Treatment			194	157		222	253		**826**
	Post Treatment			351			471	4		**826**
Douglas-fir	Pre Treatment			119	264	26	80	194	121	**804**
	Post Treatment		3	378	27	4	217	166		**795**
Aspen	Pre Treatment		14	90	35	29	8	3		**179**
	Post Treatment			143	32		3			**178**
Spruce/fir	Pre Treatment							1		**1**
	Post Treatment							1		**1**
Pre Treatment Total		254	24	472	831	178	381	777	132	**3,049**
% of Total Cover		8.3%	0.8%	15.5%	27.3%	5.8%	12.5%	25.5%	4.3%	
Post Treatment Total		262	314	924	314	88	740	398	8	**3,048**
% of Total Cover		8.6%	10.3%	30.3%	10.3%	2.9%	24.3%	13.1%	0.3%	

HSS Key: 1M = grass/forbs, 2T = seedlings/saplings, 3 = immature, 4 = mature
A = 10-39% canopy cover, B = 40-69% canopy cover, C = 70+% canopy cover

Table 21. Acres of habitat structural change pre and post treatment in Alternative 3.

Cover Type		1M	2T	3A	3B	3C	4A	4B	4C	Total Acres[8]
Grass	Pre Treatment	260								**260**
	Post Treatment	262								**262**
Lodgepole Pine	Pre Treatment		18	57	348	69	88	239	22	**841**
	Post Treatment		384	61	191	33	44	118	10	**841**
Ponderosa Pine	Pre Treatment			200	147		244	235		**826**
	Post Treatment			362			459			**821**
Douglas-fir	Pre Treatment			127	317	12	88	250	115	**909**
	Post Treatment		3	440	18		312	136		**909**
Aspen	Pre Treatment		31	103	64	35	8	7		**248**
	Post Treatment			200	43		5			**248**
Spruce/fir	Pre Treatment							1		**1**
	Post Treatment						0.5	0.5		**1**
Pre Treatment Total		260	49	487	876	116	428	732	137	**3,085**
% of Total Cover		8.4%	1.6%	15.8%	28.4%	3.8%	13.9%	23.7%	4.4%	
Post Treatment Total		262	387	1,063	252	33	820.5	254.5	10	**3,082**
% of Total Cover		8.5%	12.6%	34.5%	8.2%	1.1%	26.6%	8.3%	0.3%	

HSS Key: 1M = grass/forbs, 2T = seedlings/saplings, 3 = immature, 4 = mature
A = 10-39% canopy cover, B = 40-69% canopy cover, C = 70+% canopy cover

Table 22. Acres of habitat structural change pre and post treatment in Alternative 4.

Cover Type		1M	2T	3A	3B	3C	4A	4B	4C	Total Acres[8]
Grass	Pre Treatment	259								**259**
	Post Treatment	274								**274**
Lodgepole Pine	Pre Treatment		17	105	533	196	97	441	26	**1,415**
	Post Treatment		444	76	366	136	68	305	18	**1,413**
Ponderosa Pine	Pre Treatment			200	166		255	292		**913**
	Post Treatment			336	28		495	40		**899**
Douglas-fir	Pre Treatment			157	324	32	107	280	144	**1,044**
	Post Treatment		3	463	42	3	201	290	21	**1,023**
Aspen	Pre Treatment		31	106	55	36	8	7		**243**
	Post Treatment			167	62	11	25	2		**267**
Spruce/fir	Pre Treatment							3		**3**
	Post Treatment							3		**3**
Pre Treatment Total		259	48	568	1,078	264	467	1,023	170	**3,877**
% of Total Cover		6.7%	1.2%	14.7%	27.8%	6.8%	12%	26.4%	4.4%	
Post Treatment Total		274	447	1,042	498	150	789	640	39	**3,879**
% of Total Cover		7.1%	11.5%	26.9%	12.8%	3.9%	20.3%	16.5%	1%	

HSS Key: 1M = grass/forbs, 2T = seedlings/saplings, 3 = immature, 4 = mature
A = 10-39% canopy cover, B = 40-69% canopy cover, C = 70+% canopy cover

Conclusion of Direct and Indirect Effects

There are no known irreversible effects to vegetation from the action alternatives. The risk of irretrievable effects to vegetation is reduced within the proposed units in all action alternatives because of the reduced risk of crown fire. Areas outside of the treatment units on NFS lands would have an increased risk or irretrievable effect to vegetation if a stand replacing wildfire occurred in the analysis area.

All of the action alternatives accomplish ecosystem restoration objectives with the use of fire in prescribed broadcast burn units in the lower montane zone. All of the action alternatives would allow for private residents to complete defensible space mitigation on NFS lands where their private structures are within the defensible space zones identified in the Colorado State Forest Service guidelines. Aspen clones and meadows/shrublands would be enhanced and expanded in all action alternatives.

Vegetation treatments and prescribed broadcast burning would provide for effective suppression strategies in the event of a wildfire. In a wildfire scenario, large openings and thinned stands would allow for aerial resources to effectively support ground crews and possibly provide additional time for people who need to evacuate their homes.

The action alternatives, at various levels, would implement vegetation restoration and fuels management prescriptions that would allow successional pathways to become less limiting, which is likely to result in vegetation community changes within the treated stands. Shade intolerant tree species would become more numerous and large and understory vegetation communities would become more numerous. Ecosystem resilience to catastrophic events would be increased.

The direct and indirect effects of Alternative 1 best meet the purpose and need for this project and complies with applicable management direction. Alternative 2 meets, to a lesser degree, the objectives of the purpose and need for this projects, but with modified treatment intensities and quantities. Alternative 3 addressed wildlife, soils, and hydrology concerns with the number of units to be treated and incorporated public comments and additional units. Alternative 4 addresses the purpose and need objectives for this project, but all of the proposed vegetation treatments would be implemented with manual crews utilizing chainsaws which aren't as efficient or ecologically sound due to the need for increased hand piles that would be needed to address the fuels across the entire project area.

All action alternatives would be consistent with the goals, objectives, standards, and guidelines established for timber in the Forest Plan.

3.3.3 Cumulative Effects of Action Alternatives

The cumulative effects analysis for this specialist report considers projects that were within the recent past (approximately last 20 years), present, or are reasonably foreseeable future (next 1-5 years). The time frames were selected in an effort to report accurate information.

Cumulative impacts, for the purposes of this vegetation report, are those activities that specifically impact the vegetation resource. These activities would change trees per acres, basal area, canopy cover, and other associated vegetation attributes. Activities that have no measurable impacts to vegetation include grazing and motorized vehicle use. Vegetation cumulative effects are additive, meaning they accumulate and can be summarized as total changes across varying scales. At the landscape scale, anecdotal references to changes in vegetation by project are discussed when site specific information is lacking. Since vegetation is dynamic, time elapsed since treatment as well as varying treatment methods create a situation that makes site specific scientific analysis complex as well as time and labor intensive.

Changes in the coniferous forest through varying vegetation management practices (thinning regimes and fuels treatments) have the greatest potential for cumulative effects on fire severity, vegetation structure and ecological restoration. In treated mixed conifer stands, regardless of thinning regimes applied, stands would have decreased crown bulk density, higher canopy base heights, and may have reduced surface fuel loadings. There is an associated reduction in crown fire potential (Collins et al 2011, Agee and Skinner 2005). In treated lodgepole stands where patchcuts and clearcuts are prescribed, discontinuous crowns and various vertical stand structure would create a diverse mosaic of forest complexity across the landscape.

Below is a list of the past projects, events, and actions that have occurred within or adjacent to the Forsythe II analysis area that involved vegetation and ground disturbing effects:

- Forsythe Fuels Reduction Project (thinning, patchcutting, clearcutting, pile burning) – 2012
- Lump Gulch Fuel Treatment Project (thinning, patchcutting, clearcutting, pile burning) – 2009
- Residential Development
- Mining – test pits and minor operations
- Fourmile Fire (6,181 ac) – 2011; Black Tiger Fire (1,804 ac) – 1989; Cold Springs Fire (528ac) - 2016
- Winiger Ridge Ecosystem Mgmt. Project (thinning, patchcuts, pile and broadcast burning) – 2001
- Fuels treatments on private property and Boulder County lands

- Timber stand improvement (lodgepole regeneration thinning)
- Campsite and parking area construction in Winiger Ridge area – 2010
- Forest-wide Hazard Tree Removal – 2010
- Emergency Power Line Clearing Project – 2010

Within the last 20 years, there have been previous thinnings, patchcuts, clearcuts, and prescribed fire (both broadcast and pile burning). The effect of past treatments has been an increase of individual tree volume growth and increase in the wood quality. The past treatments have reduced the stocking levels in overstocked stands. The effect has been an increase in the quality of the conifer component through the removal of damaged, diseased, and poorly formed trees. There has been an increase in individual tree growth by releasing the remaining trees from competition for light, water and nutrients. Conifers have developed larger diameters due to a reduction of competition. A reduction of the hazard to the pine stands due to the reduction of basal area below the level of susceptibility to pine beetle attack has also occurred for stands which have recently been treated.

Below is a list of the current projects, events, and foreseeable actions that have occurred within or adjacent to the Forsythe II analysis area:

- Forsythe Fuels Reduction Project slash pile disposal
- Eldora Ski Area Operations and Proposed Expansion – 2015
- Denver Water/FERC – Gross Reservoir Expansion
- Boulder County Reynold's Ranch Fuels Project
- Residential and other development on private land
- Annexation of property in Town of Nederland near high school
- Timber stand improvement (lodgepole regeneration thinning) of clearcut/patchcut lodgepole pine stands
- Fuels treatments on private property and Boulder County lands

Currently, there are only a few vegetation management activities that are occurring on NFS lands within the Forsythe II Project area including slash pile disposal, removal of hazard trees along roads and trails, and sporadic fuelwood gathering. Fuel reduction work (mechanical and manual treatment and prescribed burning) will continue to be implemented in the Lump Gulch Fuels Reduction Project. Due to the intensity of planned treatments within the Lump Gulch Project (thinning, patchcuts and clearcuts), there are and would be changes to tree density and stand canopy within the units of that project. In the patchcuts and clearcuts of lodgepole pine dominated stands, conifers of mixed species were/will be planted to provide diversity for forested stands in the future.

Boulder County and private lands comprise 48 percent of the project area (9,098 acres) and most of these areas are forested. Fuel reduction mitigation conducted by Boulder County Parks and Open Space on their lands would be expected to continue on their respective land bases, and due to the intensity of their treatments, the effects of forest management practices could cumulatively affect the project area.

With an increasing interest from landowners to manage their forested land, protect their property from wildfire and clear land for home sites, acres on private lands may be treated within the next decade. These treatments could result in additional scattered openings, lower basal areas, and the reduction of both surface and aerial fuel loadings. Since the amount of silvicultural activities not connected to this analysis would be minimal, the cumulative effects of these activities under any of the alternatives would also be minimal.

Because of increased development on private lands over the years, there has been an increase in fire suppression activities, limiting the amount of stand replacing events. Wildfires would continually be suppressed to protect property and other resource values and uses. As a result of fire suppression activities and the fire size history (Armstrong 2016), vegetation structure changes would generally be unchanged except in specific areas when weather conditions are conducive for a fire that is not contained in initial attack.

The lower montane area within the Forsythe II Project has missed some fire cycles, and this has resulted in a change to the spatial distribution, composition, and density of vegetation. Shade tolerant species have become more numerous, and larger through time than would be likely if fires were ignited and allowed to burn. Effects of fire exclusion are not easily quantified because there is a complex and dynamic relationship between a variety of factors that influence fire extent, severity and overall impact. Some of these factors are season of burning, fire weather, fuel moisture, aspect, slope and vegetation structure, composition and density. Fuels in the form of live and dead vegetation are greater in scenarios where fires are continually suppressed. Therefore, a net overall effect of fire exclusion cannot be quantified, but should be considered as an effect in regards to vegetation.

The upper montane landscape within the project area is in line with the historical range of variability. The vegetation composition, spatial distribution, and density is what is expected in an upper montane forest environment. However, with expected changes in climate, fire return cycles may become shorter in the future.

The Gross Reservoir project has been proposed to raise the pool height of Gross Reservoir up to 120 feet above its current elevation. The result of this action would be the removal and subsequent inundation of vegetated areas on all ownerships adjacent to the reservoir, including those on National Forest System lands.

The area and timeframes for the cumulative effects analysis for vegetation would be the same for all of the Action Alternatives. The primary activities that contribute to vegetation cumulative effects include past fuels mitigation on NFS lands, Boulder County lands and private lands. Each Action Alternative is expected to contribute to varying levels to the overall cumulative effects, and this will be determined by the number of acres that are treated in each alternative. The greatest cumulative effects to vegetation while meeting the objectives stated in the Purpose and Need would be found in Alternative 1 followed by Alternatives 4, 3, and 2.

There are no known irreversible effects to vegetation from the action alternatives. There are no known irreversible effects to vegetation if the No Action Alternative is implemented. However, there would be an irretrievable loss in tree health, resulting in a loss in growth and vigor (when compared to the Action Alternatives) in overcrowded stands. The risk of irretrievable effects to vegetation is reduced within the proposed units in all action alternatives because of the reduced risk of crown fire. Areas outside of the treatment units on NFS lands would have an increased risk or irretrievable effect to vegetation if a stand replacing wildfire occurred in the analysis area.

3.4 Soils

3.4.1 Affected Environment (No Action)

Field visits were conducted during the summer field seasons of 2011 and 2015 to determine the existing condition of soil resources in the proposed activity areas. Ground cover, erosion (active or stabilized), residual compaction and displacement, depth of forest floor, surface layer, and general ground disturbance were monitored using the soil disturbance classification protocol. Data was collected, along with photographs and Global Positioning System (GPS) points, by a combination of qualitative and quantitative methods using transects and ocular observations.

Generally, ground cover was high (commonly above 90%) within proposed activity areas and occurrences of active uplands erosion was low except for roads and other highly disturbed sites. This is because proposed activity areas are usually in areas where tree density is high, providing adequate needle cast. Detrimental compaction was generally limited to highly disturbed sites such as roads, trails, and other previously disturbed sites. Project area soils are not highly susceptible to deep compaction because they have sandy-loam textures and sub-soils are generally rocky.

Adequate amounts of large downed wood and slash, providing for nutrient cycling, were present in most areas. A range of decay classes of large downed wood was present but highly decomposed wood was not common. Since decomposition rates are slow and soils are not highly productive, it is important to retain fine slash and large downed logs for nutrient cycling. As a result of beetle infestation and die-off, it is likely that more large woody material and fine slash would be recruited for decomposition and nutrient cycling.

The geology of the Forsythe II project area consists of rocks of igneous intrusive origin. In the project area, rock weathering and soil formation is relatively slow and uplands soils are generally shallow, coarse textured and have high rock content. In the absence of natural or human disturbance, natural rates of erosion are typically low on the project area's forested hillslopes due to high litter, duff or vegetative ground cover. Soil erosion is accelerated by ground disturbing activities or features that remove protective ground cover or alter runoff rates. Currently, most of the soil erosion in the project area appears to be occurring on roads and trails. Other infrequent and episodic natural erosion processes are landslides and debris flows. Hillslopes in the area are not generally highly susceptible to mass wasting so landslides are not common. Debris flows and rock falls are far more common than landslides, particularly following wildfire. The project area is covered by 15 different ecological land units. The most common upland soil order is Inceptisol. The central concept of the Inceptisol is minimal soil development with weak definition of soil horizons. The most common soil order within the valley bottom areas is the Mollisol. The central concept of Mollisols is a thick and dark colored surface layer.

Susceptibility to Damage from Compaction and/or Surface Layer Disturbance

Generally, soils occurring on the Forsythe II project area forested hillslopes and ridge-tops (uplands) are shallow, rocky and have sandy loam surface textures. Additionally, most have thin surface layers and low water and nutrient holding capability. These sites are not usually highly susceptible to deep compaction but surface compaction of highly traveled areas has been observed on similar soils in other project areas. The soils have high potential for erosion if protective ground cover is removed and are particularly susceptible to loss of productivity if the organic (dark) portion of the surface layer is displaced or removed. Riparian area soils and vegetation, and/or seasonally wet soils are highly susceptible to damage caused by operation of heavy equipment or other vehicular traffic. Wet soils, steep slopes, rocky soils, and rock outcrops create moderate to severe limitations for road construction, heavy equipment operation, and other forest management activities throughout the project area.

Recovery Potential

Following soil disturbance, natural revegetation and recovery of soil functions is a slow process in the project area. Revegetation is slowest where soils are shallow, sandy, rocky, and/or where soil moisture availability limits vegetative growth. Climatic variables, particularly precipitation (moisture availability) and temperature (short growing season), also limit disturbed site recovery and revegetation processes. Due to the resilient nature of uplands soils, disturbance from forestry operations may lower soil productivity and soil hydrologic function in the near and mid-terms. However, disturbance from forestry operations is not likely to permanently impact long term site productivity. Although unlikely to be severely impacted by project related activities, soils in valley bottoms and other wet areas are highly sensitive to disturbance because proper functioning condition of wetlands and riparian areas may be impacted if excessive ground and/or vegetation disturbance occurs.

Existing Runoff and Erosion Potential

Throughout most of the project area, hillslope runoff potential is moderate. High runoff potential is common within steep valley inner gorges. Slope stability hazard (potential for mass wasting) is generally low with areas of moderate within the steep valley inner gorges. Generally, undisturbed forested areas within the project area are not highly susceptible to hillslope erosion unless ground disturbance and/or removal of ground cover occurs. Roads and trails, throughout the area, ranged from relatively stable (healed over) to extremely unstable (actively eroding in response to snowmelt and/or rainstorm driven runoff events). Based on field observations, the road and trail network appears to be responsible for most of the soil erosion and sediment delivery to stream channels. Overall, the potential for wind erosion is low for the coarse textured soils within the project area. However, potential for wind scour does exist on ridgelines, particularly when exposed to the mountain peaks to the west.

Soil Survey Information

Detailed descriptions of project area soil properties, qualities and interpretations can be attained through the Web Soil Survey (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/survey/).

Prescribed Fire Limitation Ratings

Most of the area within the burn block polygons have moderate limitations for application of prescribed fire. Where severe limitation ratings occur, steep slopes and/or shallow soils are generally responsible.

Direct and Indirect Effects of No Action

Under the No Action Alternative, mechanical, hand, or combination fuel reduction treatments would not be implemented. Project related ground disturbance and direct effects to soil resources would not occur and natural recovery of previously impacted areas would continue. Litter, slash, and large downed woody material would continue to accumulate and decompose at natural rates. In areas affected by mountain pine beetle, above normal rates of accumulation of litter, slash, and large downed woody material would occur. This would not adversely affect soil function but could alter nutrient cycling processes and water retention capability in the near-term and mid-term, particularly carbon and nitrogen cycling. The potential for adverse high severity wildfire effects would not be reduced. Proposed road actions and associated positive and negative effects would not occur. The existing road and off-highway vehicle (OHV) trail network would remain on the landscape. OHV activity would likely remain at current levels or increase, which would could lead to additional erosion, compaction, and sedimentation.

Additional descriptions and maps of the affected environment are available in the affected environment section of the Forsythe II Fuels Reduction Project Soils Specialist Report in the project file.

3.4.2 Direct and Indirect Effects of Action Alternatives

Direct Effects

Potential Severe Effects on Landings and Skid trails

Development of a network of designated skid trails and landings is expected to occur in mechanically treated activity areas. Detrimental compaction, displacement, and removal of ground cover, and increased potential for erosion are expected to occur on skid trails and landings where multiple passes with heavy equipment occur. Generally, a designated landing and primary skid trail system is expected to cover between 12-25% of an activity area. These effects are considered to be short-term because they are mitigated through restoration activities such as decompaction, lopping and scattering slash and seeding. Following restoration, full natural recovery of soil function in these areas occurs over years and decades.

Potential Minor Ground Disturbance within the Unit (Off Landings and Skid trails)

Heavy equipment (skidder, feller-buncher, harvester, masticating and chipping equipment, etc.) operation off designated skid trails is necessary to get to trees within the units. In clearcut and patchcut units where tree density and/or treatment intensity is high (large proportion of trees removed), many passes and turns may cause minor ground disturbance over as much as 40-50% of the activity area. Low to moderate compaction, disturbance of the forest floor/surface layer, and increased potential for erosion commonly occurs but these areas are generally isolated and discontinuous. The degree and extent of impacts are highly dependent on treatment intensity and ground conditions during the implementation period. Natural recovery of these areas occurs through re-establishment of native, needle cast and natural accumulation of woody debris over time.

Compaction and Displacement

Soils within the activity areas are not highly susceptible to deep compaction because they are medium to coarse textured and have high rock content. However, compaction and displacement of the surface are expected to occur on temporary roads, skid trails, landings where multiple passes with heavy equipment are made. Compaction does not always extend deep into the soil profile where soils are coarse textured and/or rocky. However, shallow compaction, increased runoff, and slower natural revegetation has been observed within similar activity areas. Compacted landings, temporary roads, and compacted portions of skid trails would likely comprise less than 20% of the activity area. Compaction and/or displacement may occur in less traveled parts of the activity area if operations occur when soil is wet.

Erosion Potential

Erosion potential is based primarily on slope, rainfall intensity, ground cover and various soil properties. As described in the Affected Environment section above, project area soils are generally not highly susceptible to erosion due to high rates of ground cover within treatment units.

Erosion may occur during snowmelt or any other runoff event but storms with greatest potential to cause erosion are high intensity thundershowers. Erosion potential could increase during and following project implementation due to removal or disturbance of the litter/duff layer and/or vegetative ground cover. However, surface soil erosion is not expected to be widespread within and downslope from treatment units. If erosion occurs, it is likely to be isolated and discontinuous. As mentioned in the Affected Environment (see Section 3.4.1 Affected Environment (No Action)), hillslopes in the area are not generally highly susceptible to mass wasting so landslides are not common. Debris flows and rock falls are far more common than landslides, particularly following wildfire. Proposed mechanical vegetation management activities are unlikely to significantly increase risk for landslides and/or debris flows.

Following disturbance, needle cast and revegetation with grasses, forbs and shrubs are natural recovery processes that would occur over time to stabilize disturbed hillslopes. However, these processes take one or more growing seasons.

Potential Impacts on Nutrient Cycling

In thinning units, the proposed activities have low potential to detrimentally impact long term nutrient cycling processes because many trees would remain following treatment, providing material for recruitment of large downed wood, fine slash, or needle cast. Recruitment of material for decomposition is expected to occur naturally over time in these activity areas. The potential for nutrient cycling impacts in patchcut or clearcut areas is higher because more vegetative material is removed. However, provided retention of adequate amounts of large downed wood and fine slash occurs, effects to long term nutrient cycling would be low.

Potential Impacts on Soil Moisture Regimes and Available Water Holding Capacity (AWHC)

Proposed vegetation management activities could affect the soil moisture status as follows:

- Due to reduced water loss through evapotranspiration, soil moisture in harvested areas would likely increase in the near and mid-terms.
- Soil compaction generally reduces AWHC, particularly in medium to fine textured soils. Based on soil types and proposed activities it is unlikely proposed treatments would cause reduction of soil AWHC at the activity area scale.

- Litter and duff ground cover generally reduces loss of soil moisture through evaporation at the soil surface. This is offset, to a much lesser degree, by interception of rainfall by the canopy and litter/duff layer.

Potential Impacts Associated with Manual Treatments

Manual treatments would be implemented with hand crews and chainsaws. Boles, limbs and slash would be scattered or hand piled in the unit and burned at later date. With the exception of hand burn pile effects (discussed below), there would be minimal ground disturbance and adverse impacts to soil resources associated with these manual treatments. However, where ground cover or slash is sparse, it is important to scatter material to provide protective ground cover for erosion control and fine slash for nutrient cycling.

Potential Impacts Associated with Broadcast Burning

In units where broadcast burning is proposed, vegetative recovery would be expected to be rapid if burn intensities are low to moderate. Hillslope erosion rates would typically drop to pre-fire levels within 2-4 years. Hydrologic recovery after fuel treatments also tends to be more rapid than after wildfire because it is likely lower acreages of land and proportions of sub-watersheds would be impacted by high and/or moderate soil burn severity effects. Small areas within burned units could experience higher soil burn severity, which could increase the potential for erosion and runoff and increase recovery time following the burn. Due to steep slopes and increased risk for soil erosion following the burns, it is likely some sediment delivery to Winiger Gulch and/or Gross Reservoir would occur in response to high intensity thundershowers within 1-4 years following the burn.

Potential Impacts Associated with Using Heavy Equipment to Construct Burn Piles

In mechanically harvested units, burn piles would be located in the unit or on the landings. Operation of machinery to construct piles would likely cause ground disturbance, compaction, and removal or mixing of surface layer due to many passes and turns near piles. Machinery that lifts and places material into piles (such as a grapple piler) would minimize soil disturbance at pile locations. Machinery that pushes material into piles (such as a bulldozer or skidder with a blade) is likely to result in severe ground disturbance. Machinery that drags material into piles (such as skidder with a grapple hook) is likely to result in moderate ground disturbance.

Burn Pile Sizes and Spatial Extent (footprint) of Piles within Units

The exact spatial extent (cumulative footprint) of burn piles depends on the amount of material cut, amount of material disposed of by other methods, pile height, density and shape.

Generally, large machine piles are not likely to exceed 20 feet in either direction. Piles constructed by hand are typically less than 10 feet in diameter. On a per acres basis, creating one large machine pile impacts less ground (area) than several short/small piles. The total spatial footprint of large machine built burn piles constructed from material removed from an intensively treated densely forested acre would likely cover less than 3% of that acre. If the same acre was treated manually, the total spatial footprint of the smaller piles could potentially cover as much as 15% of that acre.

The larger piles are expected to generate more heat, burn longer and generate more severe burn effects than smaller piles. For the purposes of this analysis, it is expected that, regardless of pile size or soil type, burning machine piles with heavy fuels is most likely to create a high burn severity impact (see soil burn severity definitions in Appendix E) due to heat and residence time of the fire. Although burning hand piles is expected to result in lower burn severity and recovery times are expected to be faster, it is expected that the physical, chemical and biological fire effects, outlined below, would occur to the extent of the machine and hand burn pile sites.

Potential Effects of Broadcast and Pile Burning (Fire Effects on Soils)

Adverse fire effects on soils are proportional to the residence time of the fire and the amount of heat generated. Generally broadcast burning results in a mosaic of low and moderate soil burn severity effects. Due to longer residence time of fire, burning piles generally results in high to moderate soil burn severity effects.

- Physical Effects
    - Loss of litter layer, soil and soil organic matter
    - Loss of soil structure
    - Hydrophobicity (formation of water repellent layer)
    - In extreme cases, destruction of clay minerals

- Biological Effects
    - Direct mortality of soil organisms and loss of their habitat
    - Fire may sterilize soils although natural recovery is expected to occur over time
    - Post fire changes in soil organism populations are invertebrate and fungi

- Chemical Effects
    - Increase in pH
    - Loss of cation exchange capacity
    - Loss of nutrients by volatilization, in fly ash, or by leaching

Effects of Slash Treatment by Lopping/Scattering, Chipping and Masticating

The effects of slash disposal activities on soil resources could be beneficial or harmful, depending on the amount, size, and spatial distribution of material retained. In mechanically treated units, slash disposal and removal of material would be accomplished by one or more of the following methods: lopping and scattering, chipping, masticating, hand piling and burning, machine piling and burning, or skidding and removing. In manually treated units, slash disposal would be accomplished by lopping and scattering and/or hand piling and burning and/or chipping.

Potential Positive and Negative Effects on Soil Processes/Functions

- Erosion Control – Retention of slash/chips/chunks may benefit soil resources by providing protective ground cover.
- Soil Nutrient status – Microbes decomposing this wood (chips and chunks) could immobilize nitrogen and reduce soil nutrient availability to a small degree. When the wood becomes mostly decomposed, it would begin to release nitrogen and increase soil nutrient availability.
- Soil carbon – Slight increase in soil carbon over time
- Soil physical properties – Increased soil moisture retention and decreased diurnal and seasonal soil temperature fluctuations. Heavy equipment used for chipping or mastication may compact the soil.
- Soil biota – Woody debris provides habitat for soil insects and microbes and addition of carbon from woody debris would lead to an increase in soil biota, especially fungal species that are the primary wood decomposers.
- Fire risk or behavior – Under certain conditions, slash and chipped/masticated materials may smolder, resulting in a longer residence of fire at the soil surface

Potential Effects of Road Actions

- System Roads: Road use and improvement of current system roads would have variable effects on soil and watershed resources. The current use, condition, and stability of any particular road would determine impacts associated with maintenance, repairs and/or increased use as follows:
    - Using, repairing or maintaining roads for project implementation could generate additional minor short-term road surface erosion and sediment production. Soil erosion from the road surfaces and sedimentation would be limited or reduced by effective road drainage and other best management practices.
    - Maintaining and using roads that are currently lightly used or unused, well vegetated, and stable would generate additional watershed impacts
    - If the road is heavily used, poorly maintained and/or unstable, maintenance actions may benefit watershed functions by reducing excessive erosion of the road surface
    - Decommissioning/restoration of approximately 6.4 or more miles of roads would benefit soil and water resources
    - Converting 1.08 miles of trail to egress roads would generate additional ground disturbance. Soil erosion from the road surfaces and sedimentation could occur but would be limited by effective road drainage and other best management practices.
- Temporary Roads: Creating and using approximately 6.7 miles of temporary roads would create additional short term soil displacement and compaction within the watershed. These roads would be decommissioned and restored following vegetation management treatments.
- Unauthorized Use and Expansion of Road/Trail Network: The proposed road actions may provide opportunity for increased unauthorized use of the area by increasing access, potentially resulting in additional ground disturbance and watershed impacts. However, road decommissioning actions following fuels treatments would likely moderate the amount of increased unauthorized use and associated effects on watershed resources.

Summary of Potential Effects on Soils

The type, degree (severity) and spatial extent of potential impacts are strongly correlated with implementation methods used. Proposed fuels treatment methods, acreages, and associated environmental impacts to soil resources are summarized in Table 23.

Table 23. Potential effects on soils by alternative, treatment method and acres.

	Treatment Method[1]	Acres	Potential Effects*
Alternative 1	Manual	153	3, 5, 7
	Mechanical/Manual	2,330	1-8
	Broadcast Burn	968	9
Alternative 2	Manual	112	3, 5, 7
	Mechanical/Manual	1,545	1-8
	Broadcast Burn	968	9
Alternative 3	Manual	181	3, 5, 7
	Mechanical/Manual	1,864	1-8
	Broadcast Burn	968	9
Alternative 4	Manual	1,742	3, 5, 7
	Mechanical	445	1-8
	Broadcast Burn	968	9

[1]Vegetative treatments associated with these treatment methods can be found in Appendix A, Table 35-Table 38.

<u>Potential Effects</u>

Effects of Mechanized Treatments (Heavy Equipment Operation)

1. Moderate to severe compaction, ground disturbance, removal of ground cover, and increased potential for erosion on designated skid-trails, landings, and temporary roads. These effects are considered to be short-term because they are mitigated through restoration activities such as de-compaction, lopping and scattering slash and seeding.

2. Discontinuous ground disturbance in unit (off designated skid trails) from heavy equipment operation results in removal of ground cover and disturbance of the surface layer of soil, particularly where multiples passes or turns are made. Low to moderate compaction and increased potential for erosion commonly occurs but these areas are generally small, isolated, and discontinuous. The degree and extent of impacts are highly dependent on treatment intensity and ground conditions during the implementation period. Natural recovery of these areas occurs through re-establishment of native vegetation, needle cast and natural accumulation of woody debris over time.

Potential Effects of Manual Treatment Activities

3. There are generally few effects to soil resources associated with low intensity manual fuel reduction treatments provided adequate amounts of fine slash, litter, and duff are retained within the activity area.

Potential Effects of Slash Disposal Activities

4. Machine pile burning and piling effects.
5. Hand pile burn effects.
6. Chipping and masticating effects, both positive and negative, are variable based on amount, depth, and spatial extent of coverage.
7. Lop and scatter effects are generally positive but variable based on amount, depth and spatial extent of coverage.
8. Removal of boles (trunks) from the activity areas.

Potential Effects of Broadcast Burn Activities

9. Mosaic of low and moderate soil burn severity effects (described below) with emphasis on removal of ground cover (litter, duff and ground cover vegetation) is the primary concern. Increased erosion potential on steep and or unrecovered areas within burn for 1-3 years following the fire.

Conclusion of Direct Effects

Generally, ground disturbance and associated effects on soil resources are expected to be highest in the patchcut/clearcut treatment units because these more intensive treatments require more passes and turns with harvesting equipment. Thinning activities in the mechanically treated mixed conifer units are expected to be less intensive than the patchcut/clearcut units and, therefore, have fewer effects on soil resources. Of the mechanically treated units, the lowest rates of ground disturbance are expected to occur in the aspen restoration units. No mechanical treatments would occur within the meadow/shrubland restoration treatment units.

In the lodgepole pine treatment areas (patchcut/clearcut), Alternative 1 would cause the most effects based on the highest acreage treated. With 445 acres of treatment, Alternative 4 would generate the 2nd highest effects because of the patchcut units. The degree and extent of effects associated with Alternatives 2 and 3 are similar, but the number of acres of patchcut/clearcut on sensitive soils were reduced for Alternative 3.

Effects would be similar for Alternatives 1, 2, and 3 in mechanically treated units with prescriptions other than patchcutting/clearcutting. Alternative 4 would not generate any heavy equipment operation effects but the spatial footprint of burn piles would be higher.

In clearcuts/patchcuts, impacts on the above and below ground nutrient cycling process are influenced by retention and/or potential future recruitment of coarse and fine woody debris, disturbance of surface layers and soil properties. Retention of woody material is of primary concern in patchcut/clearcut units because potential for future recruitment is limited.

Effects of slash disposal activities are described in detail in the Soils Specialist Report in the project record. The footprint and spatial extent of machine built burn pile effects mirrors the acreage and/or intensity of mechanical treatments described in above. Implementation of Alternative 4 would likely generate fewer machine built burn pile effects but more hand built burn pile effects.

Overall, implementation of Alternative 1 would cause the most direct effects on soil resources due to the highest acreage treated mechanically. The extent and degree of potential effects associated with Alternative 2 is similar to Alternative 3. Implementation of Alternative 4 would generate the fewest effects of all the action alternatives overall.

Indirect Effects

<u>Reduced Potential for Adverse High Severity Wildfire Effects</u>

The proposed treatments may lower the potential for wildfire spread on the landscape and lower wildfire effects within treatment units.

At both watershed and treatment unit scales, the proposed treatments may indirectly lower adverse wildfire effects, listed below, on Forsythe II project area soil resources.

- Removal of large areas of protective ground cover, reduction of needle cast potential, and increase in erosion hazard.
- Consumption of litter, duff, large downed woody material and volatilization of soil humus and associated plant available nutrients.
- Formation of hydrophobic soil conditions.
- Potential for post fire debris flows.

- Other fire effects on soils described in Potential Effects of Broadcast and Pile Burning (Fire Effects on Soils) section under direct effects above.

<u>Increased Potential for Access by Recreational Forest Users</u>

Following implementation of the proposed fuels reduction activities, forest access would likely remain at current levels or increase in treated areas, which may lead to additional ground disturbance, erosion, and sedimentation.

<u>Increased Potential for Introduction of Noxious Weeds</u>

Following project implementation, there is a higher potential for introduction or spread of noxious weeds on highly disturbed sites such as skid trails, landings and burn piles.

Conclusion of Indirect Effects

Potential future indirect effects on soil resources are based primarily on future wildfire severity and size. In the event of a future wildfire, treated areas are likely to experience lower soil burn severity effects where consumption of ground cover and surface fuels is lower. If proposed treatments lower the size of a future wildfire, the spatial extent of detrimental effects to soil resources, particularly accelerated rates of erosion, would likely be lower. Based on these assumptions and discussion with the project Fire and Fuels Specialist Alternatives 1 – Proposed Action and would likely be the most effective in reducing adverse future wildfire effects on soil and water resources. Alternatives 2 and 3 would be less effective based on lower treatment intensity and Alternative 4 would be least effective based on absence of patch cuts and clear cuts.

3.4.3 Cumulative Effects of Action Alternatives

Past measurable detrimental impacts to soils, associated with wildfires, timber harvest, dispersed camping, roads and OHV use, and residential development, still exist on the landscape. Potential direct effects on soil resources associated with project implementation are erosion, compaction, and impacts to nutrient cycling. Areas that were compacted or eroded are in various stages of recovery. Based on field reconnaissance, review of aerial photography and limited management activities within the past 30 years, the extent of past detrimental impacts is estimated to be low for project activity areas. Through prevention or mitigation, the sum of past (existing) impacts and project related direct effects would be kept within 15% of any given activity area.

At the analysis area and/or watershed scale, cumulative effects include historic and ongoing activities as well as future activities. The primary activities that contribute to watershed and aquatic cumulative effects include water diversions, roads, expansion of off-highway vehicle impacts, and residential/commercial development on private lands. Road densities are high in all of the watersheds, and are a primary source of human caused sediment into streams and waterbodies. Development on private land can serve as an additional source of sediment as well as a potential source of other pollutants.

With the exception of areas impacted by ongoing activities, past ground disturbance and soil impacts are recovering naturally over time. Generally, project area soils exhibit proper hydrologic functioning condition and ability to support plant growth. Eroding road surfaces continue to deposit fine sediment into Winiger Gulch and Forsythe Creek.

3.5 Hydrology/Fisheries

3.5.1 Affected Environment (No Action)

The Forsythe project area encompasses portions of four watersheds. All the watersheds are within the Boulder Creek basin. The watersheds are listed in Table 24. Streams within the project area include South Boulder Creek, Beaver Creek, South Beaver Creek, Forsythe Canyon, Winiger Gulch, Middle Boulder

Creek and Boulder Creek. Forsythe Canyon and Winiger Gulch are entirely within the project area, while other streams flow through the project area.

Table 24. Watershed, condition class, and road density.

Watershed Name	Watershed Number	Watershed Acres	Percent of Watershed within Project Boundary	Watershed Condition Class*
Middle Boulder Creek	101900050402	28,346	18%	1
Boulder Creek Canyon	101900050404	9,787	12%	2
Upper South Boulder Creek	101900050502	26,135	13%	3
Middle South Boulder Creek	101900050503	25,647	57%	2

*Based on Watershed Condition Class ratings of USFS lands only, (USDA Forest Service, 2011a)

A watershed condition assessment of all watersheds in the Forest was completed in 2011 using a nationally developed protocol (USDA Forest Service, 2011a). The assessment considered conditions only on NFS lands within the watersheds. In that assessment, Middle Boulder Creek was rated in condition class 1 – Functioning Properly. Boulder Creek Canyon and Middle South Boulder were rated in condition class 2 – Functioning at Risk, and Upper South Boulder Creek was rated in condition class 3 – Impaired Function.

Elements of concern identified for NFS lands include: water quantity, water quality, absence of native fish, road densities, and riparian vegetation. South Boulder Creek is affected by flow augmentation from the Moffatt tunnel and Middle Boulder Creek has altered flows due to Barker Reservoir. Increased flows and channelization have adversely affected channel stability and morphology, as well as aquatic and riparian habitat. Historic mining in tributaries continues to affect 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; are suitable for direct contact recreational activities; are suitable for direct agricultural irrigation; and are suitable for potable water supplies following standard treatment. Some streams within the project area are listed on the State's 303(d) list as impaired or warranting further monitoring and evaluation (M&E). The stream segments are Middle Boulder Creek below Barker Reservoir, impaired for arsenic and aquatic life, and on the M&E list for manganese; Boulder Creek below the confluence of Middle and North Boulder for arsenic; and South Boulder Creek and all tributaries above Gross Reservoir, for copper (Colorado DPHE, 2016).

South Boulder Creek receives water from trans-basin diversions through the Moffat Tunnel, greatly augmenting its natural streamflow. The stream acts as a conduit for water from the western slope to fill Gross Reservoir, a municipal water source owned by Denver Water. Barker Reservoir and its associated pipeline also alter streamflow in Middle Boulder Creek.

Water augmentation and diversion, as well as erosion and sedimentation accumulation in streams are the greatest impacts to aquatic habitats related to management. Roads and other upland disturbance are the primary source and conduit of sediment to stream channels and other wetlands in the area. There are 114 miles of inventoried roads within the 29.6 mi^2 of the project area, creating a density of 3.85miles/mi^2 area, a comparatively high density within the Forest (Ida, 2016). Road densities are likely higher as those values do not account for private roads and driveways not mapped.

Some past vegetation management have occurred on portions of NFS land in the project area watersheds in the past 20 years. These activities include construction of roads, alteration of hydrologic pathways (culverts, ditches, diversions) and impacts to aquatic habitats.

In the past 25 years there have not been any large scale wildfires or prescribed burns in the project area, although a small prescribed burn was implemented as part of the Winiger vegetation management project in the 1990s.

Fire suppression in some of the forest types (ponderosa pine, mixed conifer) of the project area has changed fuel conditions and natural fire regimes. Wildfires burn in higher intensity and result in stand replacing events. Higher intensity and stand replacing fires create greater risk for high levels of flooding and erosion. Fire suppression has not considerably affected the timing or severity of wildfire in lodgepole pine, or changed the severity of post-fire effects. The intent of this project is to reduce fuels that would otherwise increase the risk of high intensity fires and subsequent erosion and sedimentation.

Roads, habitation, and recreation use have introduced sources of chronic disturbance and resulting erosion and sedimentation to streams and wetlands in the project area. The granitic soils of the project area are more erosive and produce high levels of sediment compared to other geology (Megahan & Ketcheson, 1996). This type of geology often gives rise to fine-textured streambeds, but recent survey data indicate an overabundance of fine sediment accumulations particularly in Winiger Gulch and Forsythe Creek (USDA Forest Service, 2011b). In those locations excess material is not being transported as it has overloaded the streams capacity to move it. Over the last 25+ years, measurements indicate that the overall size range and diversity of streambed particles have become smaller (USDA Forest Service, 1989).

The system roads of the project area were in poor condition prior to the 2012 Forsythe project implementation (Kittson, 2011). The September 2013 floods damaged the road network further and while repairs have been completed in some portions, much remain in a deteriorated state. The road network nearest Winiger Gulch and Forsythe Creek lack sufficient drainage, and are actively contributing sediment to the stream channels due to their damaged states (USDA Forest Service, 2011b). The erosion of the road surface (gullying, rills, sheet erosion, deposition) and cut/fill slopes are connected at several locations throughout the project area and in those instances, is conveying excessive amounts of sediment to streams. The primary source of the excessive sediment in project area streams is the road network. Limited sediment transport capacity in these small streams has led to much of the road sediment being stored in the stream, where it fills the interstices of the stream substrate as well as filling pools.

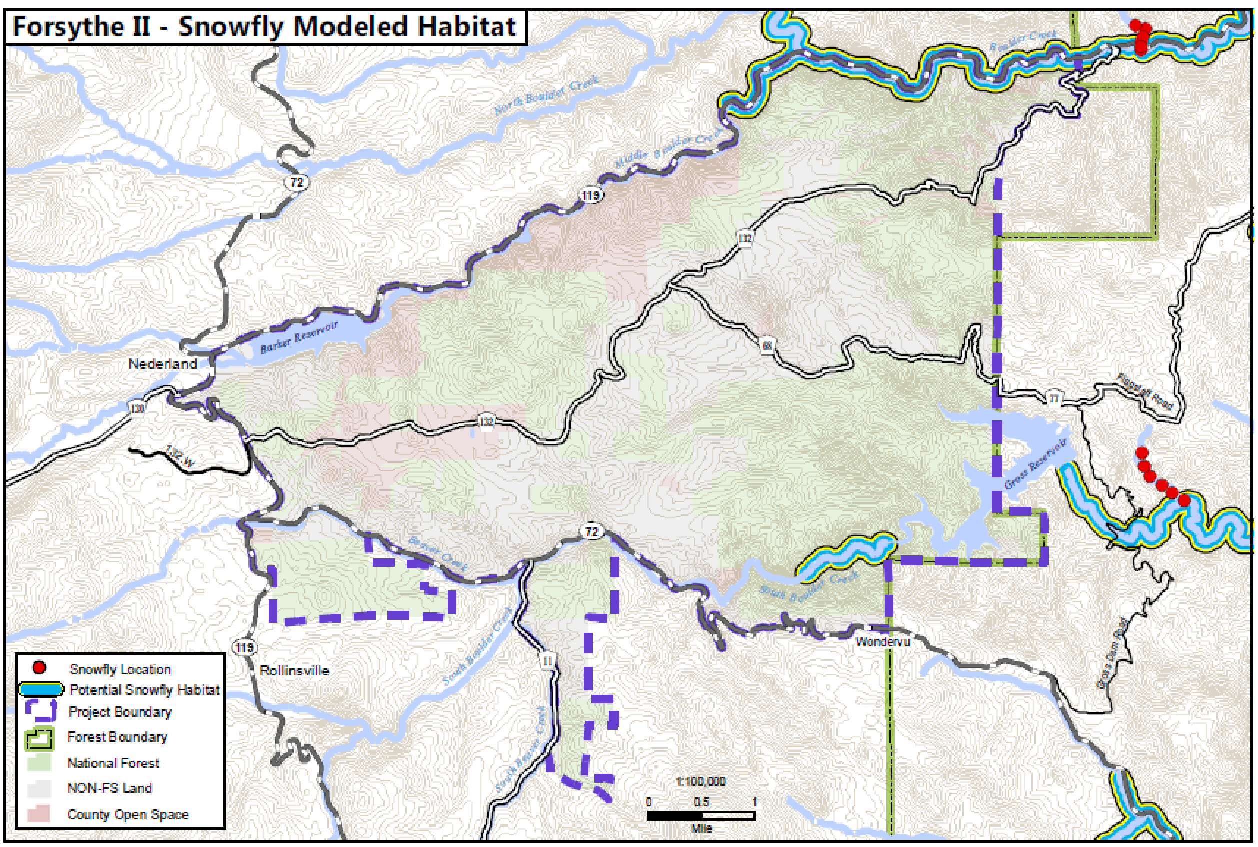
Typically, aquatic habitats of the project area would be relatively steep pool-riffle sequence streambeds comprised of sands, gravels, cobbles, boulders, and bedrock; with occasional loading of large wood (USDA Forest Service, 2011b). As previously discussed, the altered hydrographs of South and Middle Boulder Creeks and other human influences has led to low levels of large wood, a coarse/armored bedload; and a resulting low to moderate levels of habitat complexity. Sedimentation in smaller tributary streams like Winiger Gulch, Forsythe and Beaver Creeks and the intermittent and ephemeral tributaries has further limited the habitat availability for aquatic species.

Streams in the project area were historically occupied by greenback cutthroat trout, but the species has been locally extirpated. Instead the larger streams of the project area (Middle and South Boulder) support healthy populations of brook trout and brown trout, aquatic management indicator species for the Forest. Beaver Creek and Forsythe Creek likely support modest populations of brook trout similar to what is found in nearby tributaries of South and Middle Boulder Creeks (USDA Forest Service, 1998). Gross Reservoir hosts populations of native longnose and white suckers as well as an assortment of non-native game species (Swigle, 2010).

While fish may not be present in some of the named tributaries and higher order ephemeral channels, macroinvertebrate species like plecoptera (stoneflies), trichoptera (caddisflies), and ephemeroptera (mayflies) do occur (Colorado Parks and Wildlife [CPW], 1989; USDA Forest Service, 2011b) and indicate at least some year round habitat (Thorp & Covich, 2001). Macroinvertebrates were not observed in upper reaches of Forsythe Creek where several road erosion sediment had embedded the gravels and cobbles of the channel with finer material (< 2mm). Because of the excess sediment loading in Forsythe and Winiger macroinvertebrate communities are already limited. Further disturbance could further deplete aquatic species. These streams do have potential for supporting forest sensitive species such as Arapahoe snowfly and Hudsonian Emerald dragonfly.

The Arapahoe snowfly is currently known to inhabit intermittent, ephemeral, and perennial channels that are tributaries to larger streams across low to mid elevations of the Front Range up to elevations of 6,719 ft. (Belcher, 2015). The stream reaches within the project area occur at 6,100 ft. elevation along lower portions of Middle Boulder Creek, 7,300 ft. elevation at Gross Reservoir for South Boulder and Forsythe Canyon Creeks and top out at approximately 8,400 ft. elevation at upper reaches. The species is known to occur in tributaries to Middle and South Boulder Creeks at lower elevations including: Tom Davis Gulch (6,717 ft.), Bummers Gulch (6,007 ft.), Keystone Gulch (6,970 ft.), and Martin Gulch (6,446 ft.) (Heinhold, Gill, Belcher, & Verdone, 2014). Its presence within the project area is not known, but is possible as the extent of distribution is not entirely established. The streams flowing into Gross Reservoir (Forsythe Canyon Creek, Winiger Gulch, South Boulder Creek, Beaver Creek) occur at elevations higher than the currently known occurrences of Arapahoe snowfly and may be less likely to harbor snowfly. Preliminary observations of the species composition found in the project area in 2016 would not necessarily seem to indicate Arapahoe snowfly presence (USDA Forest Service, 2016a). The ARP has modeled potential snowfly habitat along the Front Range and for the project. A few tangential points that may contain the species are detailed in Figure 8 (USDA Forest Service, 2016b).

Figure 8. Map of modeled potential Arapahoe Snowfly habitat near the project area.



The Hudsonian Emerald dragonfly is known to inhabit primarily lentic systems, like bog lakes, but also occurs in some stream corridors above 5,000 ft. (Packauskas, 2005). At that elevation the project area could certainly hold viable habitat for the dragonfly. While there are no known habitats in the project area, there is suitable unsurveyed habitat and there are known habitats near the project area (5-10+ miles) and within the 40 mile radius of Boulder, CO which is described as the native range in the species conservation assessment.

Direct and Indirect Effects of No Action

If the No Action Alternative is selected under the project proposal, no vegetation management activities to reduce hazardous fuels in the Forsythe II project area would occur and no road construction would occur, which would result in no additional impacts to water or fisheries resources in the short term. Because no ground disturbing activities would be implemented (including any new road construction or road reconstruction, skid trails or landings), there would be no additional risk of increased runoff and sedimentation. Organic material would continue to accumulate and decompose at natural rates. Recovery in previously and currently impacted areas would continue at a natural rate. Erosion, watershed impacts, and ensuing effects on aquatic habitat would not occur as a result. However, excessive sedimentation from existing roads would continue to impact streams and aquatic habitats. Reduction in road erosion and stream sedimentation through natural recovery is unlikely to occur. Over longer periods of time, the risk of sedimentation due to high intensity wildfire and poorly maintained road network would increase which could impact water and aquatic resources.

Effects to hydrology, fish and soil resources as a result of existing uses and management activities in the project area, including streamflow augmentation, recreational use, residential development and travel on existing roads and trails would continue. Streams within the project area would continue to receive sediment loading of fine material from erosion generated by these activities. Aquatic habitat, fish populations (South Boulder Creek & Gross Reservoir), and macroinvertebrates within the project area (Winiger Gulch, Forsythe Creek, and South Beaver Creek) would continue to remain relatively stable. Self-sustaining populations of management indicator species, brook trout and brown trout, would persist in areas where they currently exist.

3.5.2 Direct and Indirect Effects of Action Alternatives

The desired watershed condition for the analysis area following management activities includes stable soils capable of supporting appropriate vegetation and limiting erosion to natural background levels, streams with stable channels, a healthy riparian community, appropriate assemblages of aquatic fauna in each aquatic habitat, and the ability for the watersheds to transmit the expected range of water and sediment. Streams should provide the physical habitat necessary to support populations of native and desirable non-native fish and macro invertebrates. Where floodplains are present, they should be connected to the stream channels. Pathways that connect upslope disturbed areas to the stream channels should be minimized.

The proposed action and each of the alternatives propose a variety of mechanical and hand vegetation treatment, burn piles, broadcast burning, defensible space, temporary road construction and road decommissioning. These treatments may affect water resources and aquatic habitats as described below.

Mechanical treatment of units has the potential to increase surface disturbance by compaction, vegetation loss, and erosion and sedimentation to stream channels. Roads, temporary roads and skid trails would increase risk of sediment conveyance directly to stream channels. These impacts would be most likely in units containing stream and riparian features or those that have connections via roads. Where riparian buffers are present, sediments would likely be captured and help limit effects. Steep draws and other terrain in units may increase potential sediment transport.

Hand treatment units have generally fewer effects to watershed and aquatic resources due to the reduction of ground disturbance created in mechanical units. However hand treated units are almost always accompanied by greater densities of burn piles.

Burn piles leave patches of bare disturbed soils that act as sources of erosion that can take several years to recover. Hand treated units would require smaller piles (6 ft. x 6 ft.) but larger number of piles (up to 40-

50/acre). Mechanical units would have larger piles (12 ft. x 20 ft.) but fewer in number. Piles are typically surrounded by less disturbed areas and more intact ground cover and thus erosion from burn scars is usually intercepted and stored, reducing the potential for conveyance to streams. Burn piles located in greater disturbed areas like landings or skid trails may increase potential for conveyance to stream channels where connections, such as roads or skid trails, are present.

Broadcast burning can increase risks to watershed and aquatic resources as it removes ground cover which can lead to increased runoff, and erosion and sedimentation. Recovery can be rapid (2-4 years) if low to moderate intensity with erosion rates returning to background levels as vegetation recovers. Prescribed burns offer faster recovery than wildfire because of the smaller proportion of ground cover burned at low intensities (Robichaud, MacDonald, & Foltz, 2006). Areas within burn units with high fuel loading could experience higher soil burn severity and thus have an increased potential for erosion. Winiger Gulch has coarse textured soils and therefore a moderate risk of increase sediment yield along its corridor to Gross Reservoir and the reservoir itself.

Roads and skid trails that accompany fuels treatment are sources of compacted, bare soil subject to erosion that can also act to connect upland disturbances to streams. There is an already extensive existing road network, as described in Section 3.5.1 in the Affected Environment. New road construction would be kept to approximately 0.4 miles on NFS lands for an egress route(s) for Big Springs subdivision. Temporary road construction would primarily be mid-slope or near ridges with few connections to streams, but would nonetheless create higher rates of erosion within a year and declining in subsequent years (Megahan, Wilson, & Monsen, 2001). Temporary roads would be obliterated at the end of the project, but would remain for several years (1-5). Approximately 19 miles of existing road network would be reconstructed and would experience increased erosion following maintenance, but should decline in subsequent years (Megahan, Wilson, & Monsen, 2001; Luce & Black, 2001). Risk of sedimentation to stream channels is greatest where roads cross or parallel streams. If reconstruction and maintenance improve drainage and reduce erosion from the road surface, sedimentation rates should decline in the midterm (2-10 years) (Burroughs & King, 1989).

Doe Trail is one of the locations that may be considered for emergency access for the Big Springs subdivision. If a road were constructed here, a stream crossing would be required. The riparian zone along either side of the stream channel is likely a wetland. Some wetlands, less than 0.01 acre, would be lost to the road-stream crossing. The road would also closely parallel the stream channel for some distance. There would be risk of impacts to the stream from the road construction, but the impacts could be reduced by the appropriate application of best management practices.

Proposed decommissioning of NFSRs in the project area would reduce the road network by about 6 miles. Obliteration of the roads would reduce erosion and sedimentation, revegetate road surfaces, disconnect disturbance areas, and improve watershed condition and aquatic habitat. Each alternative proposes this activity.

Erosion and stream sedimentation from timber harvest activities and associated infrastructure have the potential to create negative impacts to aquatic species. Sedimentation is known to reduce habitat diversity and productivity for aquatic life by filling pools (Bjornn et al., 1977), filling interstitial space in the streambed (Bjornn & Reiser, 1991; Waters, 1995), and reducing streambed diversity (Waters, 1995). These alterations may lead to a loss of macroinvertebrate diversity (Erman & Erman, 1984; Beisel, Usseglio-Polatera, & Moreteau, 2000), abundance (Richards & Bacon, 1994; Kaller & Hartman, 2004), and stream productivity (Cardindale et al., 2002).

Design criteria utilized for the project should limit the erosion and sedimentation potential for the fuels treatment portions of the action alternatives. Those criteria, including buffers around streams and wetlands, limitations on mechanical treatment on steep slopes, and requirements for obliteration and restoration of skid trails and temporary roads can effectively limit erosion and sediment from harvest activities and greatly reduce impacts to water and fisheries resources. Design criteria for protection of water and fisheries resources are common for all alternatives.

Brook trout and brown trout populations would remain stable with the implementation of the Forsythe II project within the project area and across the Forest under each action alternative.

Through study on Arapahoe snowfly, new localities have been identified for the species as well as expanded understanding of its sensitivities to sedimentation brought on by disturbances like fire and flood (Belcher, 2013; Heinhold, Gill, Belcher, & Verdone, 2014; Belcher, 2015). The expansion of the species' geographic distribution beyond what was previously known presents the potential for its presence in the project area. It is found in several tributaries near the project area, but has not been located within project area streams as of 2016 (USDA Forest Service, 2016a). Current understanding of distribution and field observations would not place the species within the project area streams most affected by proposed activity. However, knowledge of species distribution is incomplete, and providing a design criterion of 300 foot buffers along certain stream corridors to protect potential habitat within the project area is a conservative approach. Sedimentation from roads or other disturbances, recognized as detrimental to stream insects, is not currently considered a threat by the U.S. Fish and Wildlife Service. If present, increased sediment loads would pose an unknown but assessable risk. The implementation of the Forsythe II project *may affect, not likely to adversely affect* (a candidate species under the Endangered Species Act) for Arapahoe snowfly.

Hudsonian Emerald dragonfly is known to inhabit lentic systems. There is no known occuppied habitats in the project area, but the species is known to occur in waters within a few miles of the project boundary. Like many macroinvertebrates, it displays sensitivity to disturbances that result in sedimentation. The project would likely create minor changes in the sediment levels of waters in the project area. The implementation of the Forsythe II project *may impact individuals but is not likely to cause a trend to federal listing or loss of viability on the plannning area for Hudsonian Emerald dragonfly*.

The degree and duration of watershed and aquatic impacts is dependent upon the area of mechanical disturbance, mileage of new or reconstructed permenant and temporary roads, acres of broadcast burn, acres where burn piles would be used, and miles of road decommissioning (Table 25). The indicators used to compare effects of alternatives are:

- Acres of mechanical fuels treatment
- Miles of permanent road construction
- Miles of temporary road construction
- Acres of broadcast burn
- Acres of treatment where burn piles would be constructed to treat slash
- Miles of road decommissioned/obliterated

Table 25. Hydrology/Fisheries effects indicator values by alternative.

Indicator*	No Action Alternative	Alternative 1 Proposed Action	Alternative 2 Prescription Change	Alternative 3 Reduced Treatment	Alternative 4 Treatment Method Change
Acres of mechanical fuels treatment	-	2,330	1,545	1,864	445
Miles of temporary road construction	-	7.0	7.0	5.4	5.4
Acres of treatment where burn piles would be constructed to treat slash	-	2,483	1,657	2,044	2,186

* Miles of permanent road construction (0.4), acres of broadcast burn (968), and miles of road decommissioned (6.0) are not included here as they do not vary among action alternatives.

Risk of adverse effects increases with mechanical treatment acres, road mileage(s), acres of burn, acres of treatment with burn piles. Risk declines with miles of road decommissioning. Table 25 displays the values of each indicator by action alternative.

Alternative 1 presents the greatest risk of adverse effects to water resources and aquatic habitats. It would have the largest acreage of mechanical fuels treatment, most miles of temporary road construction, and most acres where burn piles would be used to treat slash.

Alternatives 2 and 3 would have overall similar intermediate risks, but the risks would be slightly different. Temporary road construction would be greater for Alternative 2 than Alternative 3, but Alternative 3 would have more mechanical treatment and acres of burn pile slash treatment.

Alternatives 4 poses the lowest risks. Alternative 4 would have by far the least mechanical fuels treatment and the fewest miles of temporary road (the same as Alternative 3), but would have nearly as much burn pile slash treatment as Alternative 1.

Although the alternatives pose different levels of risk to water and aquatic resources, with the application of design criteria, all alternatives would be consistent with Forest Plan standards and guidelines for water and fisheries resources (USDA Forest Service, 1997a).

Refer to the Hydrology and Aquatic Resources Report in the project record for detailed analysis of each action alternative and for the full list of aquatic species considered and evaluated for this project.

3.5.3 Cumulative Effects of Action Alternatives

Past and current projects near or overlapping the project area or downstream have the potential to create some impacts to water and aquatic resources. Those projects include several fuels projects, a ski area expansion, hazard tree mitigation, and increased management of adjacent non-federal county lands. Other activities that contribute to watershed and aquatic cumulative effects include water conveyance and storage (Moffat Tunnel, Gross and Barker Reservoirs), roads, residential and commercial development on private lands, and recreational use. Road densities are high in all project watersheds and are a primary source of sediment. Road sanding along paved county and state roads also contribute sediment and other pollutants. Other surface disturbances may also contribute sedimentation to streams. This project may contribute to cumulative effects for stream sedimentation because of ground disturbance associated with harvest activites, prescribed fire and burn piles, as well as road construction and reconstruction.

The expected impacts to sensitive or MIS species are related to increases in disturbance to uplands that increase erosion and sedimentation to waterbodies. The expected cumulative impacts of increased sediment are largely mitigated through design criteria of the projects and the discrete nature of the populations of the sensitive species in question. In the case of this project there is little overlap of cumulative impacts in time and space of the project area. Management indicator species, brook trout and brown trout, would remain stable in the project area and the unit. Potential populations of snowfly and emerald dragonfly would be located in such a manner that impacts would not likely overlap and therefore cumulative impacts would be minimal or not likely.

3.6 Terrestrial Wildlife

3.6.1 Affected Environment (No Action)

Vegetation across the project area includes meadows, shrublands, riparian vegetation, aspen stands, open ponderosa pine woodlands, and forested areas dominated by conifers. Mixed conifer stands include ponderosa pine, Douglas-fir, limber pine, and lodgepole pine, and usually interspersed quaking aspen. Some lodgepole pine stands are nearly pure lodgepole, established following large wildfires decades or centuries ago. Depending on elevation and aspect, others are mixtures of lodgepole pine associated with ponderosa pine, Douglas-fir, limber pine, Engelmann spruce, subalpine fir, and aspen. Topography is variable, with drainages leading into Gross Reservoir and into the larger and more developed drainages of South Boulder Creek and Middle Boulder Creek. Elevation ranges from about 6,082 feet to 8,945 feet.

The majority of the project area is within Management Area (MA) 3.5, Forested Flora and Fauna Habitats. The emphasis in MA 3.5 is on providing adequate amounts of quality forage, cover, escape terrain, solitude, breeding habitat, and protection for a wide variety of wildlife species and associated plant communities.

Lodgepole pine represents 31% of the cover type in the project area. Lodgepole pine is generally a prolific seed producer and good crops are expected at one to three year intervals (Anderson, 2003). As confirmed by USFS field surveys completed between 2010 and 2012 in the project area, lodgepole tends to be homogenous with little understory vegetation or down wood (Anderson, 2003), and wildlife species diversity is therefore relatively low compared to other cover types in the project area. However, lodgepole pine is highly valued as hiding cover for deer and elk, and provides important breeding habitat for USFS Sensitive species such as northern goshawk. Red squirrels, prey for species including Canada lynx and northern goshawk, use lodgepole heavily as secondary habitat.

The ponderosa pine cover type represents approximately 28% of the project area. Stands of open-grown ponderosa with a grassy understory are interspersed throughout the project area, with the largest concentrations located near Gross Reservoir. Mixed conifer stands dominated by ponderosa pine also include Rocky Mountain juniper and limber pine in some areas. Colorado Front Range ponderosa pine produces good seed crops every 4 to 6 years, with almost no viable seed produced in intervening years (Shepperd, Edminster, & Mata, 2006a). Ponderosa pine provides important habitat for many wildlife species, particularly for reproduction and winter habitat. Many species harvest and cache the pine nuts, use the large and open branch structure for roosting and hunting, and some species such as Abert's squirrel are almost entirely dependent on ponderosa pine trees for their survival.

The Douglas-fir cover type covers approximately 25% of the project area. Douglas-fir produces abundant crops of seed approximately every 2 to 11 years; seed is produced annually except for about one year in any 4- to 5-year period (Steinberg, 2002). There are many large and old individuals and groups of Douglas-fir mixed throughout stands of old-growth ponderosa in the project area. Douglas-fir is an important species for wildlife, providing a more continuous source of cones and seeds than pines. The thick branches are used by multiple bird species for nesting and roosting.

Quaking aspen can be found throughout the project area in patches and stands, and aspen-dominated stands represent 5% of the project area. It is the most widely distributed tree species in North America. Despite its wide distribution, quaking aspen is declining throughout the west, due in large part to fire suppression, conifer encroachment and browsing by domestic and native ungulates (Bartos & Campbell, 1998). Aspen forests are a crucial component of many western landscapes, providing biological diversity, important wildlife habitat, valuable grazing resources as well as highly desirable scenic and hydrological values (Shepperd, Rogers, Burton, & Bartos, 2006b). Quaking aspen forests provide breeding, foraging, and resting habitat for a wide variety of birds and mammals. Mammals from small rodents to ungulates feed on various parts of aspen trees, while other mammals such as bears find food in lush understories of some aspen stands. Bird species including hummingbirds, many songbird species, grouse, and woodpeckers use different seral stages of aspen for nesting, and these and numerous other bird species find cover and food in aspen stands. Generally, moist to mesic quaking aspen sites have greater avian species diversity than quaking aspen stands on dry sites (Howard, 1996). Stands of larger diameter aspen are important for cavity-nesting bird species, including several USFS Sensitive species and MIS. Larger diameter aspen stands in the project area are relatively scarce (Table 18), and some are in heavy decay and towards the end of their lifecycle.

Limber pine is not dominant in project area stands therefore, the species is not represented as a cover type in the project area. Limber pine trees are interspersed with other tree species, typically in drier, rocky areas.

Minimum seed-bearing age is 20 to 40 years, and seeds are dispersed by small mammals and birds, particularly Clark's nutcracker. Limber pine seeds, or pine "nuts" are large and have high energy content, providing critical food for rodents and birds, which cache the seeds for later use. Other small mammals and birds, as well as bears, benefit from these caches (Johnson, 2001a).

Limber pine is susceptible to various native insects and diseases, as well as the non-native white pine blister rust. Damage includes mortality, top kill, branch dieback, and predisposition to attack by other agents, including bark beetles. The pathogen is exotic and has not co-evolved with its hosts; consequently, the five-needle pines have all but been eliminated in some areas and their numbers seriously reduced in others. Although there are currently no white pine blister rust detections in the Forsythe II Project area, the disease has been identified near the town of Ward (Zimlinghaus, 2016).

Dwarf mistletoe is a parasitic plant that affects ponderosa pine, lodgepole pine, and limber pine in the project area. Generally the infected areas are at low to moderate levels, but there are locations of higher severity infections, specifically near and surrounding Gross Reservoir. Damage to trees include a reduced growth rate, diminished wood quality, poor tree form, reduction in seed production, predisposition to insect and disease infestations, and increased mortality due to drought (Zimlinghaus, 2016). Larger mistletoe brooms are often used as wildlife nest structures and weakened limbs can provide an entry point for rot, which creates cavities in live trees. Cavities in live trees are generally availably longer for wildlife use than cavities in dead trees, as dead trees would tend to weaken and fall sooner.

Mountain pine beetle and the pine engraver beetle are evident in pockets throughout the analysis area, but not in epidemic proportions at this time. Mountain pine beetle is the most prolific insect pest in Colorado and often kills large numbers of trees during annual outbreaks (Leatherman & Cranshaw, 1998). Mountain pine beetle larvae provide a great resource of food for many species of birds and mammals. Concentrations of dead trees killed by mountain pine beetle also provide an increase in suitable openings, hunting perches, and down wood necessary as habitat components for many wildlife species.

Species Considered and Evaluated

The ARP obtained a project-specific proposed, threatened and endangered species list dated December 7, 2015 from the USFWS Information for Planning and Conservation (IPAC) on-line tool (www.fws.gov/ipac). The ARP received the Region 2 USFS Sensitive species list effective August 29, 2015 from the Regional Forester. The complete list of MIS of the ARP are listed in the Forest Plan (pp. 28-29). This list was amended by Forest Supervisor decision (USDA Forest Service, 2005). Table 26 below lists PTES species selected for analysis for this project. A complete list of proposed, threatened, endangered, and sensitive species considered for this analysis, but excluded from detailed analysis, is included in the Wildlife Specialist Report in the project record.

Table 26. Wildlife species included in project analysis.

Federally Threatened Species	Project Management Indicator Species	USFS Sensitive Species		
		Birds	**Mammals**	**Amphibians**
Mexican spotted owl	Elk	American peregrine falcon	American marten	Boreal toad
Preble's meadow jumping mouse	Mule deer	Bald eagle	Fringed myotis	Northern leopard frog
	Golden-crowned kinglet	Flammulated owl	Hoary bat	
	Hairy woodpecker	Lewis's woodpecker	River otter	
	Mountain bluebird	Northern goshawk	Townsend's big-eared bat	
	Pygmy nuthatch	Olive-sided flycatcher		
	Warbling vireo			
	Wilson's warbler			
	Boreal toad			

Management Indicator Communities (MIC)

There are Management Indicator Communities (MIC) across the project area that represent habitat for each of the project MIS analyzed in the Forsythe II project (Table 26). These communities include aspen, interior forest, montane riparian/wetlands, old growth, openings (1M), and young (2T, 3A, 3B, 3C) to mature (4A, 4B, 4C) forest (habitat) structural stages.

The warbling vireo relies on the Aspen MIC which occurs throughout the project area. See Table 17 where the exiting condition for aspen in the protect area is 5% the Forest-wide desired condition is between 10 and 20%.

The golden-crowned kinglet is associated with interior forest MIC. 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 (USDA Forest Service, 1997a). Interior forest areas occur entirely within effective habitat (see below for definition). Quantitative data and updated interior forest mapping are not available for the existing condition.

Wilson's warbler and boreal toad are linked with montane riparian/wetlands MIC. Riparian corridors, ponds and wetlands occur throughout the project area including some willow habitat.

The pygmy nuthatch relies on the old growth MIC. The Forest Plan divides old growth into three distinct categories: old growth retention, old growth development, and existing old growth. Old growth retention areas are identified within the timber suitability analysis in the Forest Plan and are generally excluded from management activity, with exceptions such as wildlife habitat improvement. Old growth development areas are estimated to become old growth stands within the next century in the absence of catastrophic change; management activity is allowed in these areas as long as the treatment objective supports old growth development. Existing old growth areas are those that have been inventoried and meet the definition used in the Forest Plan. Management is generally allowed, depending on the designated Management Area, but often retains the character of these inventoried stands. There are 1,444 acres within the project area identified as old growth. An additional 1,909 acres in the project area are identified as old growth development emphasis areas in the Forest Plan.

Elk, mule deer, and hairy woodpecker are associated with the young to mature forest structural stages MIC. Young forest stages include 2T, 3A, 3B, and 3C; whereas mature stages are 4A, 4B, and 4C. The acres of each habitat structural stage within the project area on NFS lands are shown in Table 18.

Mountain bluebird, elk, and mule deer rely on the openings MIC. Forest-wide, 15% of all NFS lands are in natural openings and 2% of forested types are in natural or created openings of grasses, forbs, shrubs or seedlings (USDA Forest Service, 1997a).

Effective Habitat

Effective habitat, as defined in the Forest Plan, is mostly undisturbed habitat, which is buffered from regularly used roads and trails, both motorized and non-motorized travel. Buffer distances vary based on vegetation cover and topography. For purposes of effective habitat mapping, all system roads and trails on the ARP are considered to be regularly used. Table 27 below displays total NFS acres by Forest Plan Geographic Area (GA), with effective habitat percentages as of the 1997 Forest Plan (USDA Forest Service, 1997b).

Table 27. Effective habitat percentages by geographic area.

Geographic Area	Total NFS Acres in Geographic Area	% Effective Habitat*
Lump Gulch	15,130	49
Sugarloaf	15,187	41
Thorodin	5,821	59

***As defined in the 1997 Forest Plan.

Quantitative data and updated effective habitat mapping are not available for the existing condition and thus are not available for quantifying changes to effective habitat based on implementation of the action alternatives. Therefore, this analysis is based on qualitative assessments using the effective habitat mapped in the Forest Plan, the proposed action alternatives, and known changes since the 1997 Forest Plan.

Based on data used for the Forest Plan, mapped effective habitat occurred in the project area as of the 1997 Forest Plan. However, current effective habitat in all four geographic areas is estimated to be lower than Forest Plan percentages due to changes in the project area since 1997. These changes on NFS lands are due to increased private home development (construction of roads accessing private lands); increasing recreation use (development of unauthorized social trails); changed vegetation conditions (including hazardous fuels vegetation treatments, natural and human caused fires, etc.). Fuels treatments, particularly patchcuts and clearcuts, can reduce effective habitat when they are located near roads or trails.

Effective habitat in the area between Magnolia Road and the Big Springs neighborhood and in the vicinity of Kelly Dahl campground has been reduced by a combination of social trails and openings created by fuels treatments. It is likely that incremental impacts to effective habitat have occurred in other areas from forest thinning since 1997, including south of Winiger Gulch, the Front Range/Boy Scout trails area, and portions of the Winiger Ridge area.

Patchcuts, clearcuts, and overstory removal have occurred on approx. 600 acres in the Lump Gulch GA, 7 acres in the Sugarloaf GA, and 33 acres in the Thorodin GA. Effective habitat has likely been incrementally reduced where forest thinning has occurred on approximately 200 acres in the Lump Gulch GA, 2,000 acres in the Sugarloaf GA, and 900 acres in the Thorodin GA. In comparison, patchcuts, clearcuts, and overstory removal are likely to have reduced effective habitat in treated areas more than thinning treatments.

Two wildfires (not including small fires extinguished during initial attack) have occurred since 1997 in the Sugarloaf GA. The Fourmile Fire in 2010 included 306 acres of NFS lands, about half of which is mapped effective habitat in a relatively steep, inaccessible area. This area may still function as effective habitat if human activity is low. The Cold Springs fire in 2016 included 98 acres of NFS lands, which included some areas thinned in the last ten years. As trees grow back over time, effective habitat criteria may again be met in timber, fuels treatment, and wildfire areas, depending on human activity. This area is surrounded by mountain subdivisions and 1997 mapped effective habitat consisted of a few parcels less than five acres in size.

The largest blocks of mapped effective habitat in the project area, based on the 1997 Forest Plan mapping, are south of Winiger Gulch, west of Gross Reservoir, in the Twin Sisters area, in the Front Range/Boy Scout trails area, east of Kelly Dahl campground, and north-facing slopes of Boulder Canyon. Of these areas, Twin Sisters and the north-facing slopes of Boulder Canyon are the most likely to still function as effective habitat, based on topography, land ownership, and generally less human activity than other parts of the project area.

Approximately 1.5 miles of NFS roads in the project area have been closed since the Forest Plan, consisting of five separate segments west and southwest of Gross Reservoir (0.4 miles in the Sugarloaf GA and 1.1 miles in the Thorodin GA). Due to the proximity of most of these segments to other NFS roads, effective habitat would not have increased as a result of their closure. For two of the segments, effective habitat may have increased by a small increment at the edge of mapped effective habitat areas. No NFS trails have been added to the project area since the Forest Plan. Social trails have proliferated across the project area and most are not mapped, except for areas included in the Magnolia Trails project that overlap with this project. These areas are generally located between Front Range Trailhead and Highway 72/119, north of Magnolia Road and south and east of Barker Reservoir, and a network of non-NFS trails was identified and mapped for Magnolia Trails. Many social trails begin on private land and extend onto adjacent NFS land, and are not mapped. Any of these may have reduced effective habitat from that mapped in 1997.

Listed below is the Forest Plan direction for effective habitat. For a definition of goals, standards and guidelines, refer to Appendix E Glossary of Terms.

<u>Forest-wide Direction</u>

Goal (GO) 95. *Retain the integrity of effective habitat areas.* This is a wildlife goal for the entire 2 million acres of ARP lands. As stated above the current effective habitat in all four geographic areas is estimated to be lower than Forest Plan percentages due to changes in the project area since 1997.

GL 107. *Avoid disconnecting or severing intact areas of effective habitat with new open roads and trails. Favor seasonal use during non-critical times for wildlife when this cannot be avoided.* No new open roads or trails would be created in the short or long term under No Action.

GL 108. *When developing new open roads and trails, do not reduce contiguous areas of effective habitat to less than 250 acres or further reduce effective habitat of 20 to 250 acres in size, except where access is required by law.* No new open roads or trails would be created in the short or long term under No Action.

GL 109. *Additional open roads and trails should not reduce effective habitat below 50% by Geographic Area, or further reduce effective habitat in Geographic Areas that are already at or below 50% on NFS lands.* No new open roads or trails would be created in the short or long term under No Action.

<u>Management Area 3.5 Forested Flora and Fauna Habitats</u>

Standard (ST) 2. *Maintain or increase habitat effectiveness, except where new access is required by law.* As discussed above, based on qualitative analysis using Forest Plan effective habitat mapping and maps of existing social trails in MA 3.5, the existing situation's (No Action) base level is less than the percentages of effective habitat that existed in 1997.

ST 3. *Discourage or prohibit human activities and travel, where needed, to allow effective habitat use during season of primary use by elk, deer and bighorn sheep (at least the minimum periods of May 15 through June 30 for elk calving, June 1 through June 30 for deer fawning, May 15 through June 30 for bighorn lambing, and December 1 through March 31 for wintering deer, elk and bighorn).* Per CPW data there are no known elk calving areas in the project area. Key winter range for elk (severe winter range and winter concentration areas as defined and mapped by CPW) occurs throughout most of the project area, and a mule deer winter concentration area overlaps about the eastern 2/3 of the project area. The project area is nearly all within an elk migration corridor. Bighorn sheep do not occur in the project area. There are currently no seasonal closures to non-motorized use in the project area based on key elk or deer winter range, and no such need has been identified by CPW or USFS biologists to date. The Winiger Ridge area, which is within key winter range for elk and mule deer, is closed to motorized use in the winter.

ST 4. *Discourage or prohibit human activities and travel, where needed, to allow effective habitat use by other wildlife species, especially during the seasons of birthing and rearing of young.* As discussed under Standard 3 above, there is no mapped elk or mule deer production in the project area, and bighorn sheep do not occur. Raptor nesting is documented in portions of the project area, and is discussed further in the Sensitive Species analysis for specific raptor species. Seasonal closures can be implemented under No Action if and when needed.

Forested and Open Corridors

Forested corridors in the project area are important for a variety of wildlife species, especially larger mammals including elk, mule deer, moose, mountain lions, and black bears. Defined in the Forest Plan (USDA Forest Service, 1997a) by a combination of forest (habitat) structural stages, minimum area of 20 acres, minimum width of 100 meters, and maximum width of gaps or interruptions of 100 meters, mapped forested corridors are abundant Forest-wide. Available forested corridor mapping does not include updates for vegetation treatments on NFS, county, private, or other lands. Openings created by past vegetation treatments have reduced forested corridors locally in some areas, until trees regrow sufficiently to provide forested corridors again. Mapped forested corridors occur on most NFS lands in the project area.

Open corridors are defined in the Forest Plan as areas dominated by grass, shrubs and/or rocks. A few small openings are mapped as open corridors in the project area. Open corridors are primarily mapped for bighorn sheep and pronghorn, neither of which occur in the project area.

Direct and Indirect Effects of No Action

Under No Action, current management plans would continue to guide management of the project area, and no vegetation management or other actions from this analysis would be performed. Under this scenario, one or more wildfires could impact USFS Sensitive species and MIS habitat within the project area, but the scale and intensity of wildfires are unpredictable and outcomes are uncertain. If the No Action Alternative is selected, species that occur in the project area would be expected to continue to use available habitat. Insects and pathogens currently occur at endemic levels, with potential for increasing susceptibility of forests to insects and disease in a changing climate (Zimlinghaus, 2016).

If future insect outbreaks or wildfires occur in the project area, changes to wildlife species distribution, density, and diversity could occur locally, depending on habitat changes resulting from such events. For instance, more woodpeckers may be attracted to areas of dead trees, but cone-dependent species such as red squirrels and pygmy nuthatches may begin to abandon large areas of dead trees. However, many cone-dependent species can survive on stored seeds and the seed remaining in cones on dead/burned trees. Some areas of dead trees may provide new forage for elk and deer as the understory regenerates, and may become unsuitable as thermal and hiding cover for a period of time. New tree growth and stand development after insect infestations or wildfires depend on stand history, soils, topography, slope, aspect, elevation, weather, extent of the infestation/fire and other natural features.

Because the scale and intensity of future wildfires and insect infestations are unpredictable, the amount and locations of habitat that may be altered in the future by these natural processes under No Action is unknown, and effects cannot be predicted with accuracy. Therefore, No Action would maintain current and future habitat conditions as they relate to current existing conditions, and there would be no direct, indirect or cumulative effects as a result of No Action. For MIS, a neutral influence is expected to populations and habitat.

The determination of effects for No Action for USFS Sensitive species, listed in Table 26, is *no impact*. The No Action is expected to result in *no change* to populations of project MIS locally or on the planning area (Arapaho and Roosevelt National Forests). See Table 30 of this EA for a summary of determinations of effects for each of the alternatives.

3.6.2 Direct and Indirect Effects of Action Alternatives

This section discloses the likely effects of the alternatives to federally listed species, USFS Sensitive species, MIS, and other species and habitats pertinent to this project. The effects analysis for terrestrial wildlife presented here are summarized. See Table 30 of this EA for a summary of determinations of effects for each of the alternatives. Detailed analysis is available in the Terrestrial Wildlife Specialist Report in the project record.

Federally Threatened Species

Mexican spotted owl

Proposed treatment units do not provide the necessary components for nesting habitat. However, treatment units, particularly mixed conifer, provide potential foraging habitat. Proposed mixed conifer treatment acres are highest under Alternatives 1 and 4 (1,449 acres), slightly lower under Alternative 3 (1,358 acres), and lowest under Alternative 2 (1,141). Home range size can be up to several square miles. If suitable nesting habitat occurs within foraging range of proposed treatment units, it is possible that individual owls could use the project area incidentally for foraging, especially mixed conifer stands. If individual foraging owls occur in the area during vegetation management or road closure activities, owls would be able to avoid activity areas. Treatment activity is likely to occur across one or several units at any one time, not across the entire project area. Habitat changes may influence foraging use by individual owls. Design criteria provide for retention of key owl habitat elements (large live and dead trees, large down logs, riparian hardwoods) discussed in USFWS (2012). These owls use managed forests for foraging. Based on these factors and the lack of nesting habitat in treatment units, effects are expected to be similar, and immeasurable and discountable, for Alternatives 1, 2, 3, and 4.

As discussed above, the project area includes potential foraging habitat, but no nesting habitat occurs in proposed treatment units. Based on the above discussion of direct and indirect effects and the discussion of cumulative effects in Section 3.6.3, the determination of effects for Alternatives 1, 2, 3, and 4 for Mexican spotted owl is *may affect, not likely to adversely affect.* Because no critical habitat has been designated in the project area or on the ARP, there would be *no effect* to critical habitat under any alternative.

Preble's meadow jumping mouse

Portions of prescribed burn Units 38 and 44 and small portions of cutting Units 40 and 74 are within and adjacent to potential habitat in Winiger Gulch and an unnamed tributary. Alternative 3 does not include Unit 74. No other units are located within or adjacent to potential Preble's habitat, and none of the proposed defensible space activities or road actions are located within or adjacent to Preble's habitat. There are no known Preble's meadow jumping mice within or adjacent to any treatment units.

Based on the action alternatives with design criteria, fuels reduction activities are not expected to reduce habitat suitability in or near Winiger Gulch and the unnamed tributary, which are considered potential habitat based on ARP mapping and the habitat evaluation discussed in the Terrestrial Wildlife Specialist Report (U.S. Army Corps of Engineers (ACE), 2014). Mapped potential habitat in the project area is near the upper elevational limit for Preble's in Colorado, and Gross Reservoir effectively blocks immigration of Preble's from below the reservoir to Winiger Gulch above the reservoir. The USFWS concurred in 2006 for the Moffat Collection System Project that Preble's populations are not likely to occur in Forsythe Gulch, Winiger Gulch, or the South Boulder Creek inlet to Gross Reservoir, and concluded that project activities impacting these sites should not have direct adverse effects to Preble's or its habitat (Linner, 2006).

Indirectly, treatment activities such as fuels treatment and road improvements could affect Preble's by increasing sediment runoff that could lower stream quality and/or bury streamside. Based on the scale and location of proposed cutting and prescribed burning and project design criteria, protection of riparian areas during project implementation should maintain existing stream water quality and any potential habitat that occurs, and is not expected to impact habitat downstream from Gross Reservoir. Design criteria also provide for protection of potential habitat from mechanical equipment impacts and burning of hand piles during Preble's hibernation period.

Road actions include several short sections, totaling approximately 600 feet, within potential Preble's habitat. These sections are primarily in upland areas adjacent to Winiger Gulch. Decommissioning would occur in the existing road prism and would generally avoid impacts to adjacent vegetation. Because Preble's are not known or likely to occur in the area and decommissioning would occur within areas not currently providing habitat, the possibility of a mouse being impacted during road decommissioning is discountable. Areas currently providing habitat would not be affected by this activity, and potential habitat within the decommissioned roads would improve over the long term as vegetation recovers.

Direct and indirect effects discussed above are similar and are considered immeasurable and discountable for all four action alternatives.

Based on the above discussion of direct and indirect effects and the discussion of cumulative effects in Section 3.6.3, it is determined that the Alternatives 1, 2, 3, and 4 *may affect, are not likely to adversely affect,* the Preble's meadow jumping mouse. Because no designated critical habitat occurs in the project area, the action alternatives would have *no effect* to critical habitat.

USFS Sensitive Species

American marten

Direct impacts to individual marten may occur if trees are cut while occupied. An increase in heavy equipment and traffic may also lead to direct impacts from vehicle strikes. Indirect effects may occur from the rearrangement of fuels from the canopy to the ground. In general, marten avoid habitats with less than 40% canopy cover (Ruggiero et al., 1994) and with more than 25% openings (Hargis, Bissonette, & Turner, 1999) and it is unknown how chipping and mastication would impact their hunting strategies and consequently their use of an area in the future. Additionally, the reduction of dense forest, potentially including interior forest, including canopy cover reduction in Douglas-fir forests and clearcuts and patchcuts in lodgepole pine, may reduce the amount of security cover available during travel, or cause displacement from occupied territories. Hargis, Bissonette, & Turner (1999) discusses the overall influence of fragmentation on American martens. This study concludes that progressive cutting is the most preferred forest management method to maintain marten on a landscape, and discusses that narrow corridors (less than 100 meters) are not used by marten and that high amounts of large down woody debris remaining after harvest is one of the largest predictive factors of marten's use of an open area. Untreated buffers of 100 feet between patchcuts and clearcuts in lodgepole pine under all alternatives are too narrow to be used by marten. Additionally, Franklin & Forman (1987) had also described the benefits to clustering cuts or doing one large progressive cut. Both papers concluded that retention of large undisturbed stands was more important than dispersing the effects of smaller cuts across the landscape. Based on average home range size of about four square miles and a total project area of about 30 square miles, a few marten territories at most may occur in the project area, and each treatment unit would be unlikely to overlap more than one marten home range. Design criteria under the four action alternatives provide for retention of down logs and snags, which would help to maintain some of these features on the landscape for marten. Prescribed broadcast burn units are in some of the lowest elevation portions of the project area and primarily in open stands which do not provide marten habitat.

Based on HSS of 4B and 4C providing potential denning habitat, potential marten denning habitat may be reduced in lodgepole pine, Douglas-fir, and aspen as shown in Table 28 below.

Table 28. Pre and post treatment acres of American Marten potential denning habitat.

*Habitat Structural Stage 4B and 4C	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Pre-treatment acres	898	656	634	901
Post-treatment acres	388	402	265	639
Reduction	510	254	369	262

***** Lodgepole pine, Douglas-fir, and Aspen

Based on the above table, Alternative 1 would potentially reduce marten denning habitat by the highest number of acres, followed by Alternative 3, then Alternatives 4 and 2.

In summary, project activities may disturb or displace individual marten, and some habitat changes may reduce foraging and travel habitat in the short term. For these reasons and above discussion, it is determined that Alternatives 1, 2, 3, and 4 *may adversely impact individuals, but are not likely to result in a loss of viability in the Planning area, nor cause a trend toward federal listing.*

<u>Fringed myotis</u>

Direct impacts may occur to individuals if a day or night roost tree occupied by a solitary bat is removed. Snags and mature trees may be felled for safety reasons and in clearcuts and patchcuts. Loss of large snags with peeling bark could reduce the amount of suitable habitat on the landscape. Design criteria of leaving at least five of the largest snags per acre is intended to lessen the impact of this short-term habitat loss, and snags would remain outside of treatment units in the project area. It is unknown whether snags left after treatment would be able to withstand windthrow after surrounding trees have been removed, especially in clearcuts and patchcuts. Retaining larger trees (16” DBH and larger under Alternatives 1 and 3, 14” DBH and larger under Alternative 2, and 12” DBH and larger under Alternative 4) would help provide for future decadent live trees and snags.

The use of heavy equipment, chippers, chainsaws and other related equipment may disturb roosting bats during project implementation, which is expected to occur over 10-15 years. Disturbance to bats during the day makes them vulnerable to predation and exhaustion. Direct impacts may occur if an occupied maternity colony or winter hibernaculum is disturbed. These types of roosts are most likely to occur in abandoned mines in the project area, if they occur. There are no documented bat occurrences in the broadcast burn units. Nearby noise or the presence of smoke in hibernacula or maternity roosts of Townsend’s big-eared bat may cause temporary abandonment of a site, which can lead to starvation and abandonment of young (CBWG, 2011; Gruver & Keinath, 2006). It is likely that effects would be similar for hibernacula or maternity roosts for fringed myotis. Design criteria provide for protection of known bat roosts during treatment activities, which would include maternity colonies and winter hibernacula, and potentially additional bat habitat assessment and/or surveys if abandoned mine adits or shafts are discovered in treatment units, which would reduce the potential for impacts. It is possible that unknown roost sites could be impacted, if they occur in or near treatment units. Since roost sites are restricted to specific habitat conditions including abandoned mines, and various crews have spent extensive field time in most proposed treatment units since 2010, the probability of additional roost sites occurring in treatment units is low.

Indirect impacts of treatments could include removal of future roost trees; and a reduction in stand density and canopy closure with a short-term decrease in understory plants that may decrease insect abundance, but likely a long-term increase in insect abundance as understory plants regrow. Tree roost loss can also be caused by modification of the canopy surrounding roost snags that changes cavity thermal regimes by altering exposure to sunlight. The amount of edge habitat is expected to increase with harvest and with skid trails and temporary roads, which can benefit foraging bats. Slash and chipped woody material would increase. This increase of woody material to the forest floor may benefit some insect prey species. Slash and chips can become thick and suppress understory regeneration. Design criteria are designed to limit understory suppression by providing for maximum depths of slash and chips, with higher depths allowed over a small percentage of treatment units.

Treatment, including broadcast burning, would occur in existing and developing old growth under all action alternatives: 890 acres under Alternatives 1 and 4, 787 acres under Alternative 2, and 694 acres under Alternative 3. One of the four project objectives includes restoring ponderosa pine stands to increase resistance and resiliency to future natural disturbances. Desired conditions for this project for ponderosa pine include recruitment of old growth. Existing old growth stands would have basal area reduced by up to 30%, while old growth development and other ponderosa pine stands would have basal area reduced by up to 40%. Treatments are designed to help reduce risk of stand-replacing fire in ponderosa pine stands by reducing stand density, and to help move stands toward old growth conditions more quickly by reducing competition for water and nutrients. Design criteria for prescribed broadcast burn units provide for removing ladder fuels around large trees in old growth and developing old growth areas prior to burning, which should reduce mortality to larger trees from burning. Based on these factors, it is expected that old growth habitat, which provides current and future trees for roosting fringed myotis bats, would be improved in the long term in portions of the project area.

Potential impacts of the action alternatives to individual fringed myotis bats are expected to be greatest under Alternatives 1, 3, and 4 based on higher acres of ponderosa pine treatment (392 acres under Alternatives 1 and 4 and 370 acres under Alternative 3) and Douglas-fir treatment (971 acres under Alternatives 1 and 4 and 885 acres under Alternative 3), and therefore a higher probability of disturbance of individual bats during project activities. Alternative 2 proposes 293 acres of ponderosa pine, approximately 25% lower than the other alternatives, and 796 acres of Douglas-fir, approximately 10% less than Alternative 3 and 19% less than Alternatives 1 and 4. Therefore Alternative 2 poses a somewhat lower risk of disturbance to bats.

Alternatives 1, 2, 3, and 4 would treat approximately 7%, 5%, 7%, and 7% of total ponderosa pine in the project area and approximately 20%, 17%, 18%, and 20% of Douglas-fir respectively; therefore Alternative 2 would treat the smallest percentage of potential habitat in the project area. However, Alternative 4 treatments would leave all trees 12” DBH and above in ponderosa pine and Douglas-fir treatment areas, resulting in lower potential for removing an occupied roost tree than Alternatives 1, 2, and 3; Alternative 2 would have the next lowest potential for occupied roost tree removal, leaving trees 14” DBH and above. Roost habitat impacts would be greater under Alternatives 1 and 3 within treatment units, next highest under Alternative 2, and lowest under Alternative 4, based on DBH of trees to be left in ponderosa pine treatment areas that would provide for future snag roosting habitat. Based on this discussion, Alternative 2 is expected to have the lowest overall potential impacts to fringed myotis bats and their roosting habitat, because of fewer acres of ponderosa pine and Douglas-fir treated, and leaving trees 14” DBH and above, as opposed to 16” DBH under Alternatives 1 and 3.

In summary, action alternatives may disturb individual roosting bats and reduce roost sites, over a relatively small percentage of the project area and a small percentage of overall range for fringed myotis. Snags occur on the landscape, though not all are suitable for roosting, and design criteria provide for retention of snags and larger live trees. Long-term habitat improvement is anticipated in portions of the project area. Based on these reasons and the above discussion, the determination for Alternatives 1, 2, 3, and 4 for fringed myotis is *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.*

<u>Hoary bat</u>

Direct impacts may occur if an occupied roost tree is removed. Snags and mature trees may be felled for safety reasons and in clearcuts and patchcuts. Loss of large snags with peeling bark could reduce the amount of suitable habitat on the landscape. Design criteria of leaving at least five of the largest snags per acre is intended to lessen the impact of this short-term habitat loss, and snags would remain outside of treatment units in the project area. It is unknown whether snags left after treatment would be able to withstand windthrow after surrounding trees have been removed, especially in clearcuts and patchcuts. Retaining larger trees (16" DBH and larger under Alternatives 1 and 3, 14" DBH and larger under Alternative 2, and 12" DBH and larger under Alternative 4) would help provide for future decadent live trees and snags.

Indirect impacts of treatments could include removal of future roost trees; the potential for bats to be disturbed or displaced by project activities; and a reduction in stand density and canopy closure with a short-term decrease in understory plants that may decrease insect abundance, but likely a long-term increase in insect abundance as understory plants regrow. The use of heavy equipment, chippers, chainsaws and other related equipment may disturb roosting bats during project implementation, which is expected to occur over 10-15 years. Disturbance to bats during the day makes them vulnerable to predation and exhaustion. Prescribed broadcast burning during spring and fall may disturb roosting hoary bats if burning is conducted between April and November, when they occur in Colorado. There are no documented bat occurrences in the burn units. Prescribed broadcast burning would be broken up into six operational burn blocks ranging from 72-340 acres in size and implemented over three to five years. Each burning episode would be expected to last up to several days. The amount of edge habitat is expected to increase with harvest and with skid trails and temporary roads, which can benefit foraging bats. Slash and chipped woody material would increase. This increase of woody material to the forest floor may benefit some insect prey species. Slash and chips can become thick and suppress understory regeneration. Design criteria are designed to limit understory suppression by providing for maximum depths of slash and chips, with higher depths allowed over a small percentage of treatment units.

Potential impacts of the action alternatives to individual hoary bats from disturbance during project activities are expected to be greatest under Alternatives 1, 3, and 4 based on higher acres of treatment of ponderosa pine (392 acres under Alternatives 1 and 4 and 370 acres under Alternative 3), Douglas-fir (971 acres under Alternatives 1 and 4 and 885 acres under Alternative 3), and lodgepole pine (758 acres under Alternative 1, 461 acres under Alternative 4, and 399 acres under Alternative 3). Alternative 2 proposes 293 acres of ponderosa pine, approximately 25% lower than the other alternatives; 796 acres of Douglas-fir, approximately 10% less than Alternative 3 and 19% less than Alternatives 1 and 4; and 316 acres of lodgepole pine, approximately 58% less than Alternative 1, 31% less than Alternative 4, and 21% less than Alternative 3. Based on fewer treatment acres in suitable habitat, Alternative 2 poses a lower risk of disturbance to hoary bats.

Alternatives 1, 2, 3, and 4 would treat approximately 7%, 5%, 7%, and 7% of total ponderosa pine in the project area; 20%, 17%, 18%, and 20% of Douglas-fir; and 13%, 5%, 7%, and 8%, respectively; therefore Alternative 2 would treat the smallest percentage of potential habitat in the project area. However, Alternative 4 treatments would leave all trees 12" DBH and above in ponderosa pine and Douglas-fir treatment areas, resulting in lower potential for removing an occupied roost tree than Alternatives 1, 2, and 3; Alternative 2 would have the next lowest potential for occupied roost tree removal, leaving trees 14" DBH and above. Roost habitat impacts would be greater under Alternatives 1 and 3 within treatment units, next highest under Alternative 2, and lowest under Alternative 4, based on DBH of trees to be left in ponderosa pine treatment areas that would provide for future snag roosting habitat. Based on this discussion, Alternative 2 is expected to have the lowest overall potential impacts to hoary bats and their roosting habitat, because of fewer acres of ponderosa pine, Douglas-fir, and lodgepole pine treated, and leaving trees 14" DBH and above, as opposed to 16" under Alternatives 1 and 3.

In summary, action alternatives may disturb individual roosting bats and reduce roost sites, over a relatively small percentage of the project area and a small portion of overall range for hoary bats. Snags occur on the landscape, though not all are suitable for roosting, and design criteria provide for retention of snags and larger live trees. Therefore, the determination for all Alternatives 1, 2, 3, and 4 for hoary bat is *may* *adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.*

River otter

Potential habitat for river otters is limited in the project area under all action alternatives, and potential use of the project area would be incidental and transitory at most. Otters would not be expected to occur in treatment units. Riparian habitat within treatment units is associated with small streams that do not provide suitable otter habitat. Design criteria provide for protection of water bodies during mechanical treatment activities; however according to Carroll and Chambers (2016), the action alternatives pose different levels of risk to water and aquatic resources, which could result in some short-term risk to otter prey from temporary introduction of sediment into streams and rivers. Based on activities proposed under the action alternatives, lack of otter habitat in treatment units, and lack of known otter occurrence in or downstream from the project area, minimal impacts, at most, are expected to river otter or its habitat.

In summary, because river otters are not known to occur within or near any treatment units, potential use of the entire project area is likely transitory at most, and because design criteria are expected to reduce impacts to water resources that may affect potential river otter habitat and prey, the determination for Alternatives 1, 2, 3, and 4 for river otter is *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.*

Townsend's big-eared bat

Unlike fringed myotis and hoary bats, Townsend's big-eared bats do not roost in trees. Direct impacts may occur if an occupied roost site, such as a maternity colony or hibernaculum is disturbed. These types of roosts are most likely to occur in abandoned mines in the project area, if they occur. Direct impacts to roosts could also include vibration and noise from the use of heavy equipment, chippers, chainsaws and other related equipment during project implementation, which is expected to occur over 10-15 years. Impacts could include disturbance to winter or maternity roosts if smoke from prescribed fire or pile burning penetrates the roosts. There are no documented bat occurrences in the broadcast burn units. Disturbance to bats while roosting or hibernating makes them vulnerable to predation and exhaustion. Nearby noise or the presence of smoke in hibernacula or maternity roosts may cause temporary abandonment of a site, which can lead to starvation and abandonment of young (CBWG, 2011; Gruver & Keinath, 2006). Design criteria provide for protection of known bat roosts, which include hibernacula and maternity colonies, during treatment activities, and potentially additional bat habitat assessment and/or surveys if abandoned mine adits or shafts are discovered in treatment units, which would reduce the potential for impacts. It is possible that unknown roost sites could be impacted, if they occur in or near treatment units. Since roost sites are restricted to specific habitat conditions including abandoned mines, and various crews have spent extensive field time in most proposed treatment units since 2010, the probability of additional roost sites in treatment units is low.

All action alternatives include design criteria to protect streams, wetlands and other water bodies, which are important for foraging bats. An increase in forest edge under all four action alternatives could benefit foraging bats. Indirect impacts of treatments designed to reduce stand density and canopy closure could mean a short-term decrease in understory plants that may decrease insect abundance, but likely a long-term increase in insect abundance as understory plants regrow. The amount of edge habitat is expected to increase with harvest and with skid trails and temporary roads, which can benefit foraging bats. Slash and chipped woody material would increase. This increase of woody material to the forest floor may benefit some insect prey species. Slash and chips can become thick and suppress understory regeneration. Design criteria are designed to limit understory suppression by providing for maximum depths of slash and chips, with higher depths allowed over a small percentage of treatment units.

Based on the low probability of important roost disturbance under the four action alternatives and potential for foraging benefits from an increase in edge habitat, effects to Townsend's big-eared bat under Alternative 1, 2, 3, and 4 are expected to be similar.

Because design criteria provide for protection of Townsend's big-eared bat roosts, there is a low potential for disturbance to individual bats from project activities, and important habitat features would be maintained. Therefore, the determination for all Alternatives 1, 2, 3, and 4 for Townsend's big-eared bat is *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.*

American peregrine falcon

Primary foraging habitat is in open areas and meadow/shrubland treatment is proposed on few acres (45 acres at most under Alternatives 1 and 4) and by manual means. Design criteria provide for protection of riparian habitat. Prescribed broadcast burn units are mostly relatively open stands where foraging could occur. Based on staged burning of limited areas, with each burn lasting up to a few days, burning activities are not expected to impact peregrines if they incidentally hunt in the area. For these reasons, project activities are not expected to impact incident foraging use of the project area by peregrine falcons, if such use occurs, and would not impact existing foraging habitat. No impacts are expected to ducks or shorebirds based on minimal to no habitat in treatment units, and project impacts to songbirds would primarily occur in forested areas that are not foraging habitat. It is possible that peregrine falcons may temporarily forage in openings created by fuels treatments, until trees begin to regrow. No nesting or nesting habitat occurs in units or would be impacted.

Based on the discussion of effects above, determination of project effects for the peregrine falcon for Alternatives 1, 2, 3, and 4 is *no impact.*

Bald eagle

Activities could indirectly affect bald eagle prey by temporarily introducing higher sediment concentrations into streams and rivers. Design criteria included in all action alternatives should reduce these potential effects to bald eagle prey and their habitats. According to Carroll and Chambers (2016), the action alternatives pose different levels of risk to water and aquatic resources, but with the application of design criteria, all action alternatives would be consistent with Forest Plan standards and guidelines for water and fisheries resources.

Because bald eagles are not known to occur within or near any treatment units, potential use of the entire project area is likely incidental at most for foraging, and because design criteria are expected to reduce impacts to water resources that may affect occupied bald eagle habitat, the determination for Alternatives 1, 2, 3, and 4 for bald eagle is *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.*

Flammulated owl

Direct impacts may occur if a nest or roost tree is removed while occupied. Design criteria provide for timing restrictions in flammulated owl territories, which should reduce the chances of removing an occupied tree. However owls may occur in units and remain undetected, in which case timing restrictions would not be applied. Snags and mature trees may be felled for safety reasons. Loss of large snags could reduce the amount of suitable habitat on the landscape. Design criteria of leaving at least five of the largest snags per acre across all treatment units is intended to lessen the impact of this potential short-term habitat loss, and snags would remain outside of treatment units in the project area. It is unknown whether snags left after treatment would be able to withstand windthrow after surrounding trees have been removed. Design criteria specific to flammulated owl territories provide for retaining live trees 12" DBH and larger, and in riparian habitat, retaining conifers 8" DBH and above and all conifers with existing cavities. These measures are intended to retain important flammulated owl nesting habitat components.

Treatment, including broadcast burning, would occur in existing and developing old growth under all action alternatives: 890 acres under Alternatives 1 and 4, 787 acres under Alternative 2, and 694 acres under Alternative 3. The action alternatives include treatment of 352 acres of old growth and 538 acres of old growth development (total 890 acres) under Alternatives 1 and 4; 288 acres of old growth and 499 acres of old growth development (total 787 acres) under Alternative 2; and 247 acres of old growth and 447 acres of old growth development (total 694 acres) under Alternative 3. Under all action alternatives, slash and chipped woody material would increase. This increase of woody material to the forest floor may benefit some insect prey species. Slash and chips can become thick and suppress understory regeneration. Design criteria are designed to limit understory suppression by providing for maximum depths of slash and chips, with higher depths allowed over a small percentage of treatment units.

The majority of flammulated owl detections in the project area have occurred in or near existing old growth or old growth development areas. One of the four project objectives includes restoring ponderosa pine stands to increase resistance and resiliency to future natural disturbances. Desired conditions for this project for ponderosa pine include recruitment of old growth. Existing old growth stands would have basal area reduced by up to 30%, while old growth development and other ponderosa pine stands would have basal area reduced by up to 40%. Treatments are designed to help reduce risk of stand-replacing fire in ponderosa pine stands by reducing stand density, and to help move stands toward old growth conditions more quickly by reducing competition for water and nutrients. Design criteria for prescribed broadcast burn units provide for removing ladder fuels around large trees in old growth and developing old growth areas prior to burning, which should reduce mortality to larger trees from burning. Based on these factors, it is expected that habitat for flammulated owls may be improved in the long term in portions of the project area. Overall, treated stands are expected to continue to provide nesting and foraging habitat.

Potential direct impacts to flammulated owls are expected to be least under Alternative 3, followed by Alternative 2, and Alternatives 1 and 4 have higher potential for direct impacts as more existing old growth and old growth development acres would be treated. This difference is expected to be minimal with design criteria to protect known owl territories under all action alternatives. In the long term, habitat maintenance and improvement are expected to be greatest under Alternatives 1 and 4, followed by Alternative 3, then Alternative 2. This is based on stated project objectives and desired conditions for ponderosa pine and old growth forest.

Based on a combination of short- and long-term habitat impacts discussed above and design criteria to minimize impacts to nesting flammulated owls, the determination of effects for Alternatives 1, 2, 3, and 4 for flammulated owl is *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.*

Lewis's woodpecker

Direct impacts may occur if a nest tree is removed while occupied, or if continuous human presence near a nest causes abandonment. These impacts are unlikely because occurrence of Lewis's woodpecker is not known or suspected in the project area. Snags and mature trees may be felled for safety reasons. Loss of large snags could reduce the amount of suitable habitat on the landscape. Design criteria of leaving at least five of the largest snags per acre is intended to lessen the impact of this short-term habitat loss, and snags would remain outside of treatment units in the project area. It is unknown whether snags left after treatment would be able to withstand windthrow after surrounding trees have been removed.

The removal of large trees and snags may decrease habitat suitability in the short term for Lewis's woodpeckers. Much of the potential Lewis's woodpecker habitat in the project area is occupied by flammulated owls, and design criteria provide for retaining live trees 12" DBH and larger in flammulated owl territories. Opening the canopy cover in denser ponderosa pine stands, while maintaining large trees and snags on the landscape, may improve habitat in the long term and help attract Lewis's woodpeckers. Slash and chipped woody material would increase, which may benefit some insect prey species. Slash and chips can become thick and suppress understory regeneration. Design criteria are designed to limit understory suppression by providing for maximum depths of slash and chips, with higher depths allowed over a small percentage of treatment units. Prescribed broadcast burn units are some of the more open stands in the project area and include areas of large and old growth ponderosa pine. Burning these units may improve habitat for Lewis's woodpecker, since they are attracted to open stands and burned areas, as long as suitable snags are available for nesting.

In summary, the likelihood of occurrence of this species in the project area is low, therefore potential for direct impacts to individuals is also low. In the long term, habitat is expected to be improved for this species based on more ponderosa pine acres in HSS 3A and 4A. Based on these reasons and the above discussion, the determination of effects for Alternatives 1, 2, 3, and 4 for Lewis's woodpecker is *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.*

Northern goshawk

Direct impacts may occur if a nest or roost tree is removed while occupied. Project activities may also interfere with or displace foraging activities due to increased traffic and human presence. Design criteria provide for protection of known raptor nests, which includes any new nests discovered prior to or during implementation. Protection measures include limited operating periods within a ¼ mile buffer of active goshawk nests, and excluding treatment in approximately a 30-acre area surrounding known nest sites, to maintain the preferred microclimate. However, buffering known or new nest sites may not completely eliminate direct impacts if persistent disturbance occurs during the breeding season to a nearby but unobserved nest. Direct impacts could occur at an unobserved nest if disturbance during the breeding season causes nest abandonment and mortality of young nestlings or eggs. Frequent disturbance within a few hundred meters of the nest can cause the parents to spend more time away from the nest defending it, which can reduce incubation of young, reduce prey deliveries, and attract predators to the area, all of which can result in mortality of nestlings (Kennedy, 2003; NatureServe, 2016).

Fuels treatment activities can impact goshawk habitat structure in various ways. Edges of larger openings are often used by hunting goshawks if they support prey species; however an increase in edge and open habitat could also favor goshawk predators including great horned owls and red-tailed hawks. Lodgepole pine units in the project area support red squirrels, an important prey species for goshawks (Kennedy, 2003). Since treatment in these units includes clearcuts and patchcuts, the treatments are expected to cause a decrease in red squirrels in lodgepole units. It is uncertain how long it would take alternative goshawk prey such as rabbits and grouse to move into patchcuts and clearcuts; timing likely depends on the ability of the site to regenerate, and the amounts of snags, large woody debris, slash, and chips left behind. High densities of chips or slash can suppress understory regeneration, delaying habitat recovery. Design criteria provide for maximum depths of slash and chips, with higher depths allowed over a small percentage of treatment units; these measures should limit understory suppression. The prescribed broadcast burn units include primarily relatively open stands, not suitable for goshawk nesting, although foraging may occur. A short-term increase in some prey species could occur after burning, as grasses, forbs, and shrubs regenerate which may increase plant and/or insect food sources for prey species.

Based on the large home range size for goshawks of two square miles or more, their use of a variety of habitats within a home range, and the combination of potential adverse and beneficial effects to goshawks and their habitats, overall effects of the action alternatives are expected to be similar. Activities under Alternatives 1, 2, and 4 have a greater potential of impacting a known nest territory than Alternative 3 based on proximity of several treatment units to known nests; however design criteria would help to minimize this potential. With protection of goshawk nests and nest stands, overall effects of the action alternatives should benefit goshawks in the long term by maintaining and enhancing open habitat for foraging and increasing heterogeneity of stand ages on the landscape, supporting a diversity of goshawk prey.

In summary, there would be habitat disturbance and a short term loss of habitat for existing goshawk prey; however, project design criteria are designed to reduce impacts to breeding goshawks and maintain current nesting habitat, and fuels treatments may provide more diversity of foraging habitat in the long term. For these reasons and based on the above discussion, the determination of effects for northern goshawk for Alternatives 1, 2, 3, and 4 is, *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.*

Olive-sided flycatcher

Direct impacts may occur if an occupied nest tree is removed. Nest trees are often on the edges of clearings and can be targeted for removal to enlarge openings. Limited information is available regarding impacts of human presence on nesting; however, the potential exists for treatment activity to directly impact these birds by disturbing foraging activity or from loss of nests due to abandonment.

Tree cutting activities could impact habitat structure for olive-sided flycatcher by reducing canopy cover adjacent to nesting trees, increasing sunlight and wind penetration. Hunting and perching snags may be reduced. Although large, older snags are not targeted for removal, some may be removed if they pose a hazard to workers or to reduce risk of fire adjacent to private land. Removal of hunting/perching snags from occupied habitat may degrade suitability of the habitat. However, to the extent that large, older snags are retained on the landscape, especially adjacent to openings, other project impacts such as thinning dense understory and enhancing openings and edge habitat may benefit the olive-sided flycatcher. Design criteria of leaving at least five of the largest snags per acre is intended to lessen the impact of this potential short-term habitat loss, and snags would remain outside of treatment units in the project area. It is unknown whether snags left after treatment would be able to withstand windthrow after surrounding trees have been removed. Design criteria require retention of large down logs, which may benefit some insect prey species. Slash and chips would increase in some areas depending on site-specific slash treatment, which may also benefit some insect prey species, but can become thick and suppress understory regeneration. Design criteria provide for maximum depths of slash and chips, with higher depths allowed over a small percentage of treatment units; these measures should limit understory suppression. Olive-sided flycatchers were not observed in the prescribed broadcast burn units, but could occur. Burning is likely to occur outside of nesting season, and may increase insects in the short term as understory grasses, forbs, and shrubs regenerate.

The action alternatives would increase meadows in treatment units from 259 acres to either 274 acres (Alternatives 1 and 4) or 262 acres (Alternatives 2 and 3). When considered over the project area and the treatment units, this amount is negligible for olive-sided flycatchers, but could benefit individual birds if a territory is nearby and wind-firm snags occur at the edge of the meadows. Alternative 3 does not include several lodgepole pine units near an area where olive-sided flycatchers were observed during field surveys; these units are included in Alternatives 1, 2, and 4. Based on this, potential impacts to individual nesting olive-sided flycatchers and their snag habitat are somewhat less under Alternative 3 than under Alternatives 1, 2, and 4.

Because there is the possibility that an occupied nest tree may be removed, and disturbance from project activities may impact foraging or nesting, individual olive-sided flycatchers may be impacted. Long-term habitat impacts are a mix of potential adverse impacts if snags adjacent to openings are removed, and potential beneficial impacts of enhancing opens and increasing the amount of edge. For these reasons and based on the above discussion, the determination of effects for olive-sided flycatcher for Alternatives 1, 2, 3, and 4 is, *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.*

Boreal toad

Historical records and 2010 field surveys indicate that boreal toads do not occur in or adjacent to any of the treatment units. However, potential habitat on adjacent private lands was not surveyed. Design criteria restrict mechanical activities within 100 feet of perennial streams, intermittent streams, lakes, ponds, wetlands, fens, or wet meadows, and design criteria are consistent with Forest Plan standards and guidelines to protect and improve the condition of riparian areas and wetlands (Carroll & Chambers, 2016). However, because adult boreal toads can travel up to several miles and use uplands for most of the year, if any individual toads travel through the project area, which is unlikely, mechanical equipment or other vehicles associated with project activities could crush or kill toads. Prescribed broadcast burn units are at or below elevational range for boreal toads, except for one rocky knob, therefore toads are not expected to occur in the burn units or be affected by the prescribed broadcast burning.

Boreal toad potential habitat may be impacted by the fragmentation and creation of edge habitat adjacent to stream corridors which may increase light and wind penetration causing an overall drying effect and reducing habitat quality. However, many insects and small mammals are known to respond positively to openings which may increase available prey for toads. Design criteria provide for leaving large dead and down woody material which contributes a critical component of upland habitat (cool shady micro-sites) and winter refugia. Because potential breeding habitat is buffered in the same way under all action alternatives, toad habitat impacts are expected to be similar under Alternatives 1, 2, 3, and 4. The remote possibility of crushing individual toads with project equipment or vehicles is similar under Alternatives 1, 2, and 3, and less under Alternative 4 due to mixed conifer treatments being conducted manually and therefore substantially less area that would have mechanical equipment operations.

In summary, potential breeding habitat is buffered from mechanical activity under all action alternatives; however if individual toads occur in the project area, which is unlikely, they could be crushed by equipment or vehicles associated with project activities. For these reasons and based on the above discussion, the determination of effects for boreal toad for Alternatives 1, 2, 3, and 4 is, *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.*

<u>Northern leopard frog</u>

Historical records and 2010 surveys indicate no occurrences of northern leopard frog in any of the treatment units. However, suitable habitat adjacent to units was not surveyed due to private land boundaries. Design criteria restrict mechanical activities within 100 feet of perennial streams, intermittent streams, lakes, ponds, wetlands, fens, or wet meadows, and design criteria are consistent with Forest Plan standards and guidelines to protect and improve the condition of riparian areas and wetlands (Carroll & Chambers, 2016). However, because adult northern leopard frogs travel through uplands, if any individual frogs travel through the project area, which is unlikely, mechanical equipment or other vehicles associated with project activities, including prescribed broadcast burning, could crush or kill them. Indirectly, habitat may be impacted by the fragmentation and creation of edge habitat adjacent to stream corridors which may increase light and wind penetration causing an overall drying effect and reducing habitat quality. However, many insects and small mammals are known to respond positively to openings which may increase available prey for frogs. Because potential breeding habitat is buffered in the same way under all action alternatives, frog habitat impacts are expected to be similar under Alternatives 1, 2, 3, and 4. The remote possibility of crushing individual frogs with project equipment or vehicles is similar under Alternatives 1, 2, and 3, and less under Alternative 4 due to mixed conifer treatments being conducted manually and therefore substantially less area that would have mechanical equipment operations.

In summary, potential breeding habitat is buffered from mechanical activity under all action alternatives; however if individual frogs occur in the project area, which is unlikely, they could be crushed by equipment or vehicles associated with project activities. For these reasons and based on the above discussion, the determination of effects for northern leopard frog for Alternatives 1, 2, 3, and 4 is, *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.*

Management Indicator Species

Elk

All action alternatives would increase natural meadow openings by a small amount: 15 acres for Alternatives 1 and 4, 6 acres under Alternative 2, and 2 acres under Alternative 3. Several dozen acres of existing meadows would have conifers removed under each alternative. Short-term increases in forage for elk are expected across the project area in thinned ponderosa pine and Douglas-fir stands, patchcuts and clearcuts in lodgepole pine stands, and prescribed broadcast burn units. Table 29 displays total acres of mixed conifer (ponderosa pine and Douglas-fir), lodgepole pine, aspen, and meadow treatments by action alternative. Aspen and meadow treatments consist of conifer removal.

Table 29. Treatment acres by alternative and cover type.

Alternative	Mixed Conifer	Lodgepole	Aspen	Meadow	Total Treatment Acres for Alternative
1	1,449	758	231	45	2,483
2	1,141	316	163	37	1,657
3	1,358	399	255	32	2,044
4	1,449	461	231	45	2,186

The majority of treatment in mixed conifer would occur as thinning in the 3B and 4B habitat structural stages of ponderosa pine and Douglas-fir, with canopy cover of 40-70%, and change stands to 3A and 4A habitat structural stages, with canopy cover of 40% or less. Douglas-fir stands currently categorized as HSS 3C or 4C (over 70% canopy cover) would be thinned to HSS 3B, 4B, 3A, or 4A. There are no ponderosa pine stands in treatments units currently categorized as HSS 3C or 4C. Changes in lodgepole pine HSS would occur from patchcuts and clearcuts. All of these treatments are expected to increase available forage for elk in the short-term and incrementally during and beyond the expected 10-15 years of implementation.

Aspen are expected to increase with treatments, both within mapped aspen units and in conifer-dominated units with small (1/2 – 5 acres), unmapped aspen aggregations. Overall, increasing aspen is expected to help spread out browse pressure from elk and deer across the project area and allow more aspen to grow into larger and older stands, where site conditions are suitable.

Treatments to dense forest cover areas, especially north-facing slopes oriented east-west that provide forested corridors for travel, vary somewhat among the action alternatives. Loss or compromise of these corridors can result in changes in elk movement and use of available forage, which can have unpredictable results including negative effects to habitat for other species. In particular, Alternative 3 does not include some east-west oriented densely forested north-facing slopes in the Front Range Trailhead area and south of Winiger Gulch. As compared to the proposed action during the scoping period, Units 2, 26, 27, and 28 were reduced in size in Alternative 3 to leave more travel corridors for elk and other animals, and Unit 29 was eliminated. Units 17, 59, and 60 were eliminated from Alternative 3 to leave important cover for elk adjacent to large open areas of winter forage on private land, within key winter range. Alternative 1 has the highest potential for negative impacts to forested corridors for elk, followed by Alternatives 4, 2, and 3. Alternative 3 proposes to treat slightly more lodgepole pine acres than Alternative 2, however as described above, Alternative 3 would retain forested corridors in strategic areas important to elk, especially during migration and/or winter.

Direct impacts to elk may occur if they are present when harvest or burning is occurring. The project area includes key winter range for elk, which consists of winter concentration areas and severe winter range areas as defined and mapped by CPW. Design criteria provide for excluding treatment activities from key winter range from December 1 through March 30 unless a site-specific exception is determined to be appropriate by a USFS Wildlife Biologist. This would minimize short-term project impacts to elk during the stressful winter period. Elk are known to move away from harvest disturbance. Typically, displacement is temporary and elk return to logged areas within a few days or weeks, with return time likely longer the further elk move to find security (Innes, 2011). Because design criteria provide for protection of elk during winter, and no elk production areas are known to occur in the project area, short-term direct impacts to elk are estimated to be similar among the action alternatives, particularly considering that implementation would occur over relatively small areas at any one time, and the expected 10-15 year time frame for implementation.

Large patchcuts in dense forest adjacent to open meadows, aspen or other grassy areas may compromise the suitability of these open areas as winter habitat. Elimination of Units 17, 59, and 60 under Alternative 3 addresses this concern in one specific area considered important by CPW (CPW, personal communication, 2016). In general, summer habitat in open ponderosa and aspen should be improved and increased through the action alternatives. Mixed conifer thinning, clearcuts and patchcuts in lodgepole pine, and aspen enhancement/expansion are all expected to improve forage conditions for elk since they would facilitate increased light and nutrients to the forest floor. Surveys conducted in 2010 and 2011 indicated that past treatments within aspen and ponderosa pine (approximately 5-10 years post-treatment), have regenerated to grass with scattered conifer trees or aspen and are being heavily and preferentially used by elk.

Thomas et al. (1988) showed that the highest forage and cover use in winter range occurs within 100 yards of edges. Generally, forage area use starts to decline about 200 feet from edge and declines rapidly at 400 to 600 feet from edge, especially with high human use. Design criteria provide for retention of forested islands in 25% of clearcuts or patchcuts greater than five acres. This measure is expected to increase availability of forage in larger clearcuts, depending on the shape and size of each cut and placement and sizes of forested islands retained. Design criteria also provide for USFS Wildlife Biologist involvement in layout of patchcuts and clearcuts, which would assist in optimizing island placement for elk and other wildlife.

Overall, the potential for increasing elk forage is greatest under Alternative 1, followed by Alternatives 4, 3, and 2, based on total treatment acres. As described above, potential negative effects to forested corridors for elk are expected to be highest under Alternative 1, followed by Alternatives 4, 2, and 3. The difference in total treatment acres, and therefore potentially increased forage, between Alternatives 1, 3, and 4 is relatively small compared to total treatment acres. For these reasons, and based on nearby openings created from previous USFS and Boulder County fuels treatments, which are providing forage for elk; the importance of retaining forested travel corridors especially with the high human activity in the project area; and the length of time it would take for forested corridors to return to functioning as such if they are cut, Alternative 1 is overall estimated to be the least favorable for elk, followed by Alternatives 4, 2, and 3.

A *positive habitat influence* for elk is expected because of the forage increase anticipated as a result of all treatments proposed; however, some of this benefit would be offset by a *negative habitat influence* based on anticipated negative effects to forested corridors, which is estimated to be greatest under Alternative 1, followed by Alternatives 4, 2, and 3. As discussed above, the four action alternatives may influence elk movement and forage use which can result in various impacts to elk and other species, however elk population impacts are not expected in the foreseeable future. Therefore, Alternatives 1, 2, 3, and 4 are expected to result in *no change to elk populations locally or on the planning area.*

<u>Mule deer</u>

All action alternatives would increase natural meadow openings by a small amount: 15 acres for Alternatives 1 and 4, 6 acres under Alternative 2, and 2 acres under Alternative 3. Several dozen acres of existing meadows would have conifers removed under each alternative. Short-term increases in forage for mule deer are expected across the project area in thinned ponderosa pine and Douglas-fir stands, patchcuts and clearcuts in lodgepole pine stands, and prescribed broadcast burn units. Because shrubs are a significant browse source for mule deer, especially in fall, winter, and spring, broadcast burning, which would target consuming up to 75% of the understory including shrubs, is expected to temporarily decrease shrub availability until shrubs begin to recover. The extent of this would be limited as design criteria limit the amount of unrecovered burn at any one time to 340 acres. Table 29 displays total acres of mixed conifer (ponderosa pine and Douglas-fir), lodgepole pine, aspen, and meadow treatments by alternative. Aspen and meadow treatments consist of conifer removal.

The majority of treatment in mixed conifer would occur as thinning in the 3B and 4B habitat structural stages of ponderosa pine and Douglas-fir, with canopy cover of 40-70%, and change stands to 3A and 4A habitat structural stages, with canopy cover of 40% or less. Douglas-fir stands currently categorized as HSS 3C or 4C (over 70% canopy cover) would be thinned to HSS 3B, 4B, 3A, or 4A. There are no ponderosa pine stands in treatments units currently categorized as HSS 3C or 4C. Changes in lodgepole pine HSS would occur from patchcuts and clearcuts, not thinning. All of these treatments are expected to increase available forage for mule deer in the short term and incrementally during and beyond the expected 10-15 years of implementation.

Aspen are expected to increase with treatments, both within mapped aspen units and in conifer-dominated units with small (1/2 – 5 acres), unmapped aspen aggregations. Overall, increasing aspen is expected to help spread out browse pressure from elk and deer across the project area and allow more aspen to grow into larger and older stands, where site conditions are suitable.

Treatments to dense forest cover areas, especially north-facing slopes oriented east-west that provide forested corridors for travel, vary somewhat among the action alternatives. Loss or compromise of these corridors can result in changes in mule deer movement and use of available forage. In particular, Alternative 3 does not include some east-west oriented densely forested north-facing slopes in the Front Range Trailhead area and south of Winiger Gulch. As compared to the proposed action during the scoping period, Units 2, 26, 27, and 28 were reduced in size under Alternative 3 to leave more travel corridors for elk and other animals, including mule deer, and these units are in the vicinity of the mapped mule deer migration pattern. Unit 29 was eliminated under Alternative 3 and Units 17, 59, and 60 were eliminated from Alternative 3 to leave important cover for elk adjacent to large open areas of winter forage on private land, within key winter range, and this would also benefit mule deer. Alternative 1 is expected to have the highest potential for negative impacts to forested corridors for mule deer, followed by Alternatives 4, 2, and 3. Alternative 3 proposes to treat slightly more lodgepole pine acres than Alternative 2, however as described above, Alternative 3 would retain forested corridors in strategic areas important to elk and mule deer, especially during migration and/or winter.

Direct impacts to mule deer may occur if they are present when harvest or burning is occurring. Displacement is expected to be temporary, affecting relatively small portions of the project area at any one time as implementation occurs over 10-15 years, and mule deer would be expected to return as forage recovers. Design criteria provide for excluding treatment activities from elk key winter range from December 1 through March 30 unless a site-specific exception is determined to be appropriate by a USFS Wildlife Biologist. The mule deer severe winter range mapped in the project area overlaps elk key winter range; therefore, implementation of this design criteria would serve to protect mule deer during harsh winter conditions. Short-term direct impacts to mule deer are estimated to be similar among the action alternatives, particularly considering that implementation would occur over relatively small areas at any one time during the expected 10-15 year time frame for implementation.

Large patchcuts in dense forest adjacent to open meadows, aspen or other grassy areas may compromise the suitability of some open areas as winter habitat where portions of openings with suitable deer forage are too far from forest cover. Elimination of Units 17, 59, and 60 under Alternative 3 addresses this concern in one specific area considered important by CPW (CPW, personal communication, 2016). In general, summer habitat in open ponderosa and aspen should be improved and increased through the action alternatives. Mixed conifer thinning, clearcuts and patchcuts in lodgepole pine, and aspen enhancement/expansion are all expected to improve forage conditions for mule deer since they would facilitate increased light and nutrients to the forest floor. Unit surveys in 2010 and 2011 indicated that past treatments that have regenerated to grass and scattered conifer trees or aspen are being heavily and preferentially used by mule deer, approximately 5-10 years post-treatment. Design criteria provide for retention of forested islands in 25% of clearcuts or patchcuts greater than five acres. This measure is expected to increase availability of forage in larger clearcuts, depending on the shape and size of each cut and placement and sizes of forested islands retained. Design criteria also provide for USFS Wildlife Biologist involvement in layout of patchcuts and clearcuts, which would assist in optimizing island placement for mule deer and other wildlife.

Overall, the potential for increasing mule deer forage is greatest under Alternative 1, followed by Alternatives 4, 3, and 2, based on total treatment acres. As described above, potential negative effects to forested corridors for mule deer are expected to be highest under Alternative 1, followed by Alternatives 4, 2, and 3. The difference in total treatment acres, and therefore potentially increased forage, between Alternatives 1, 3, and 4 is relatively small compared to total treatment acres. For these reasons, and based on nearby openings created from previous USFS and Boulder County fuels treatments, which are providing forage for mule deer; the importance of retaining forested travel corridors especially with the high human activity in the project area; and the length of time it would take for forested corridors to return to functioning as such if they are cut, Alternative 1 is overall estimated to be the least favorable for mule deer, followed by Alternatives 4, 2, and 3.

A *positive habitat influence* for mule deer is expected because of the forage increase anticipated as a result of all treatments proposed; however some of this benefit would be offset by a *negative habitat influence* based on negative effects to forested corridors, which is estimated to be greatest under Alternative 1, followed by Alternatives 4, 2, and 3. As discussed above, the four action alternatives may influence mule deer movement and forage use, however mule deer population impacts are not expected in the foreseeable future. Therefore, Alternatives 1, 2, 3, and 4 are expected to result in *no change to mule deer populations locally or on the planning area.*

<u>Golden-crowned kinglet</u>

Habitat changes are a primary concern for this species. Meta-analyses of partial harvesting of forests across North America suggest that golden-crowned kinglet abundance is maintained with light-intensity forest thinning (> 70% forest retention), but decreases at higher thinning levels. Various forest harvest treatments and experimental thinning have resulted in local kinglet population declines of as much as 82% (Swanson, Ingold, & Galati, 2012).

Spruce/fir is the primary habitat used by golden-crowned kinglets. Alternatives 1 (3 acres), 2 (1 acre), 3 (1 acre), and 4 (3 acres) include mapped spruce-fir in treatment units; the only proposed spruce/fir treatment is 0.5 acres under Alternative 3. Of the 508 acres of HSS 4C Douglas-fir on NFS lands in the project area, Alternatives 1, 2, 3, and 4 would thin 144, 121, 115, and 123 acres respectively. Of the 59 acres of HSS 4C lodgepole pine on NFS lands in the project area, Alternatives 1, 2, 3, and 4 would treat 13 acres, 3 acres, 12 acres, and 8 acres, respectively, with patchcuts and clearcuts.

Large trees may be removed to create canopy gaps. In mixed conifer treatments, all trees 16" DBH, 14" DBH, 16" DBH, and 12" DBH and above would be retained under Alternatives 1, 2, 3, and 4 respectively. Per Forest Plan standard, old growth lodgepole pine would not be treated in Management Area 3.5. Design criteria include riparian protection measures for prescribed broadcast burning. These aspects of the action alternatives would help to maintain potential golden-crowned kinglet secondary habitat. Up to 0.5 acres of mapped primary habitat may be affected under Alternative 3, and no spruce/fir treatment is planned under Alternative 1, 2, and 4. Although not specifically targeted for removal, some spruce and/or fir trees could be cut in riparian areas. A maximum of 144 acres of Douglas-fir and 13 acres of lodgepole pine currently in HSS 4C would be reduced in density.

The forest edge habitat created as a result of the action alternatives may be detrimental to the kinglet, due to the potential for increased penetration of nest predators into interior habitat and the drying and windthrow that may occur if cutting occurs in or adjacent to spruce/fir habitat. An unknown amount of interior forest habitat may occur in the project area and it is possible that some would be affected by proposed treatments. However, mapped spruce/fir in the project area is minimal and only Alternative 3 includes any proposed treatment (up to 0.5 acres). This project should have minimal influence to primary breeding habitat for the golden-crowned kinglet, to a similar degree among the action alternatives. Based on field surveys, the project area contains numerous small pockets of suitable habitat; and golden-crowned kinglets were found in a number of drainages in the project area with a spruce/fir component during field surveys. However, because current interior forest mapping is not available, it is unknown whether spruce/fir occurs within habitat currently functioning as interior forest. If it does, the amount would be small based on total spruce/fir mapped in the project area and small amounts occurring in riparian areas that may not be mapped separately. The action alternatives may degrade an unknown amount of interior forest, if it still occurs in proposed treatment units and if canopy cover is reduced below 40%.

Because locations, extent, and cover types of areas currently functioning as interior forest are not known, the best estimate of relative risk of potential habitat impacts is based on total acres proposed for treatment: Alternative 1 treats the highest number of acres and therefore has the highest potential risk of habitat impacts, followed by Alternatives 4, 3, and 2.

All the action alternatives are expected to impact a minimal amount of golden-crowned kinglet primary habitat. However, because interior forest is estimated to have decreased since the Forest Plan, and an unknown amount of interior forest could be affected by treatments, Alternatives 1, 2, 3, and 4 are estimated to result in a *negative habitat influence* in the project area. This potential change to interior forest, if it still occurs in treatment units and if canopy cover is reduced below 40%, may result in a *negative influence to local populations*; however based on the small amount of primary breeding habitat compared to the rest of the Boulder Ranger District (BRD) and the ARP, Alternatives 1, 2, 3, and 4 are expected to result in *no change to golden-crowned kinglet populations on the planning area.*

<u>Hairy woodpecker</u>

Conifer treatments, including ponderosa pine, Douglas-fir, and lodgepole pine, would occur on 2,207 acres; 1,457 acres; 1,757 acres; and 1,910 acres under Alternatives 1, 2, 3, and 4, respectively. Hairy woodpeckers may be displaced in the short-term during project activities, including the potential for cutting of occupied nest trees, in a limited area in any given season as project activities are implemented over 10-15 years. Snags and mature trees may be felled for safety reasons and in clearcuts and patchcuts. Design criteria of leaving at least five of the largest snags per acre is intended to lessen the impact of this short-term habitat loss, and snags would remain outside of treatment units in the project area. It is unknown whether snags left after treatment would be able to withstand windthrow after surrounding trees have been removed. Removal and/or blowdown of some large snags may temporarily reduce suitable breeding habitat in the project area. Retaining larger trees (16" DBH and larger under Alternatives 1 and 3; 14" DBH and larger under Alternative 2; and 12" DBH and larger under Alternative 4) would help provide for future decadent live trees and snags. Alternative 4 would leave more large live trees on the landscape to provide for future snags.

Two of the four project objectives include treatments to increase resistance and resiliency of mixed conifer and lodgepole pine stands to future natural disturbances. To the extent that this is effective, large live and dead trees remaining after treatment would remain on the landscape and continue to be recruited over time. If severity of future wildfires and/or insect outbreaks is reduced, future recruitment of dead and diseased trees from those events may also be reduced. Because wildfires and insect outbreaks are unpredictable with or without vegetation treatments, these potential habitat effects are estimated to be neutral overall.

Based on the above discussion, Alternatives 1, 2, 3, and 4 are expected to have similar habitat effects in the long-term. In the short term, based on total conifer acres to be treated, Alternative 1 is expected to result in loss of more snags, followed by Alternatives 4, 3, and 2. As mentioned above, Alternative 4 would leave more large live trees in treated areas to provide for future snags. Based on the potential short-term reduction in suitable nesting snags, a *short-term negative habitat influence* is estimated under Alternatives 1, 2, 3, and 4. Based on the above discussion, all four action alternatives are expected to result overall in a *long-term neutral habitat influence* and in *no change to hairy woodpecker populations locally or on the planning area*.

Mountain bluebird

Mountain bluebirds may be displaced in the short term during project activities, including the potential for cutting of occupied nest trees, in a limited area in any given season as project activities are implemented over 10-15 years. Snags and mature trees may be felled for safety reasons and in clearcuts and patch cuts. Clearcuts and patchcuts would occur in lodgepole pine stands, which are not primary habitat for mountain bluebirds but may be used if suitable snags are available. Design criteria of leaving at least five of the largest snags per acre is intended to lessen the impact of this short-term habitat loss, and snags would remain outside of treatment units in the project area. It is unknown whether snags left after treatment would be able to withstand windthrow after surrounding trees have been removed. Removal and/or blowdown of some large snags may temporarily reduce suitable breeding habitat in the project area. Retaining larger trees (16" DBH and larger under Alternatives 1 and 3, 14" DBH and larger under Alternative 2, and 12" DBH and larger under Alternative 4) would help provide for future decadent live trees and snags. Alternative 4 would leave more large live trees on the landscape to provide for future snags.

Mountain bluebirds use openings and edges of forested habitats. The treatments proposed under all action alternatives would create and enhance openings of varying sizes and would create greater amounts of edge habitat. The action alternatives would increase meadows in treatment units from 259 acres to either 274 acres (Alternatives 1 and 4) or 262 acres (Alternatives 2 and 3). Under all action alternatives, small aggregations of aspen (1/2 – 5 acres) would be promoted in conifer-dominated units; because these are not mapped, it is not possible to quantify these acres.

Conifer treatments, including ponderosa pine, Douglas-fir, and lodgepole pine, would occur on 2,207 acres; 1,457 acres; 1,757 acres; and 1,910 acres under Alternatives 1, 2, 3, and 4, respectively. Treatment of more acres would result in more acres of openings and more edge habitat; therefore habitat benefits for mountain bluebird would be greatest under Alternative 1, followed by Alternatives 4, 3, and 2. These habitat benefits would be effective to the extent that sufficient snags suitable for nesting remain near openings, and would occur incrementally over the 10-15 year implementation period. Habitat benefits would lessen over the long-term as trees grow back into openings.

Based on the above discussion, Alternatives 1, 2, 3, and 4 are expected to increase suitable habitat in the short-term by increasing openings and edge habitat while retaining larger current and future snags and therefore in the short-term have a *positive habitat influence* for mountain bluebird. In the long-term a *neutral habitat influence* is expected from Alternatives 1, 2, 3, and 4, and all four action alternatives are expected to result in *no change to populations locally or on the planning area.*

Pygmy nuthatch

Treatment, including broadcast burning, would occur in existing and developing old growth under all action alternatives – 890 acres under Alternatives 1 and 4, 787 acres under Alternative 2, and 694 acres under Alternative 3. One of the four project objectives includes restoring ponderosa pine stands to increase resistance and resiliency to future natural disturbances. Desired conditions for this project for ponderosa pine include recruitment of old growth. Existing old growth stands would have basal area reduced by up to 30%, while old growth development and other ponderosa pine stands would have basal area reduced by up to 40%. Treatments are designed to help reduce risk of stand-replacing fire in ponderosa pine stands by reducing stand density, and to help move stands toward old growth conditions more quickly by reducing competition for water and nutrients. Design criteria for prescribed broadcast burn units provide for removing ladder fuels around large trees in old growth and developing old growth areas prior to burning, which should reduce mortality to larger trees from burning. Based on these factors, it is expected that habitat for pygmy nuthatch would be improved in the long-term in portions of the project area. Overall, treated stands are expected to continue to provide nesting and foraging habitat.

Pygmy nuthatches may be displaced in the short-term during project activities, including the potential for cutting of occupied nest trees, in a limited area in any given season as project activities are implemented over 10-15 years. Snags and mature trees may be felled for safety reasons and in clearcuts and patchcuts. Clearcuts and patchcuts would occur in lodgepole pine stands, which are not primary habitat for pygmy nuthatch but may be used if suitable snags are available. Design criteria of leaving at least five of the largest snags per acre is intended to lessen the impact of this short-term habitat loss, and snags would remain outside of treatment units in the project area. It is unknown whether snags left after treatment would be able to withstand windthrow after surrounding trees have been removed. Removal and/or blowdown of some large snags may temporarily reduce suitable breeding habitat in the project area.

Retaining larger trees (16” DBH and larger under Alternatives 1 and 3, 14” DBH and larger under Alternative 2, and 12” DBH and larger under Alternative 4) would help provide for future decadent live trees and snags. Alternative 4 would leave more large live trees on the landscape to provide for future snags. In the long term, habitat maintenance and improvement are expected to be greatest under Alternatives 1 and 4, followed by Alternative 3, then Alternative 2. This is based on stated project objectives and desired conditions for ponderosa pine and old growth forest.

Based on the above discussion, Alternatives 1, 2, 3, and 4 are expected to result in a *neutral habitat influence* based on potential long-term habitat improvement in portions of the project area, offset by potential loss of some suitable nesting snags. Alternatives 1, 2, 3, and 4 are expected to result in *no change to pygmy nuthatch populations locally or on the planning area.*

Warbling vireo

The removal of conifers from within and around aspen stands is expected to improve both nesting and foraging habitat for warbling vireos by removing competing conifers and promoting increased growth and expansion of existing aspen stands. Aspen trees, live and dead, are not proposed for cutting, although incidental aspen could be cut if they pose a danger to workers, or knocked down by felling of conifers. Prescribed broadcast burn units are primarily open ponderosa pine, and any aspen, if they occur in the burn units, could be promoted by burning. Design criteria provide for not cutting riparian deciduous vegetation, and for protection of riparian habitat during burning.

Warbling vireos may be displaced in the short-term during project activities, which could occur over a small area in any given season as proposed treatments are implemented over 10-15 years. After implementation of any action alternative, they would be expected to use the area at or above previous levels. There is sufficient habitat in the area to support local populations while implementation is ongoing. Treatments proposed under all action alternatives are intended to maintain existing aspen and deciduous riparian vegetation, providing current breeding habitat, and encourage sprouting of new aspen, which would provide future breeding and foraging habitat. Overall, increasing aspen is expected to help spread out browse pressure from elk and deer across the project area and allow more aspen to grow into larger and older stands, where site conditions are suitable, contributing to increased warbling vireo habitat.

Alternative 4 would increase aspen in aspen-dominated units by 24 acres; Alternative 1 by 19 acres; and Alternatives 2 and 3 would change HSS but not increase overall acres in aspen units. Under all action alternatives, small aggregations of aspen (1/2 – 5 acres) would be promoted in conifer-dominated units; because these are not mapped, it is not possible to quantify these acres.

Based on the small number of acres of quantifiable aspen treatment and the species territory size, no change to local populations are expected in the short-term; however in the long-term if aspen successfully expand with aspen and mixed conifer treatments and proliferate in clearcuts and patchcuts, local warbling vireo populations could increase, as long as increased aspen are not being offset by decreases in aspen in other local areas. If there is a local warbling vireo population increase, it would not be expected to be enough to cause increased populations on the planning area.

Based on the above discussion, Alternatives 1, 2, 3, and 4 are expected to increase suitable aspen habitat in the long-term by promoting aspen and therefore result in a *positive habitat influence* for warbling vireo. Increased suitable habitat may result in a *positive influence to warbling vireo populations locally*; however all four alternatives are expected to result in *no change to warbling vireo populations on the planning area.*

<u>Wilson's warbler</u>

Design criteria require buffering streams, wetlands and other water bodies from mechanical equipment, no cutting of deciduous riparian vegetation, and protection of riparian habitat in prescribed broadcast burn units. These measures would sufficiently buffer and protect Wilson's warbler habitat from impacts due to the action alternatives. Openings created by clearcuts and patchcuts, where they occur adjacent to riparian habitat, could cause drying of riparian vegetation due to increased light and wind, however these changes may benefit some riparian vegetation including willows that may die out if shaded by adjacent conifer trees. These minimal potential long-term habitat effects are expected to differ immeasurably among Alternatives 1, 2, 3, and 4.

Based on the above discussion, Alternatives 1, 2, 3, and 4 are expected to have a *neutral habitat influence*, and result in *no change to Wilson's warbler populations locally or on the planning area*.

<u>Boreal toad</u>

Direct and indirect effects are discussed under USFS Sensitive species above. Available information about MIS populations and trends was considered for this project; however, monitoring and evaluation are carried out at broader scales to address populations across the entire Forest and Grassland and does not consider project level impacts. Changes to potential boreal toad breeding habitat under all action alternatives are expected to be minimal. When taken into consideration with other cumulative effects to the boreal toad and its habitat, Alternatives 1, 2, 3, and 4 are expected to result in a *neutral habitat influence* and *no change to boreal toad populations locally or on the planning area*.

Road Action Effects on USFS Sensitive Species and MIS

Proposed road actions are roughly similar under Alternatives 1, 2, 3, and 4. Impacts from the road actions (temporary roads, skid trails and landings; Big Springs ingress/egress; maintenance/reconstruction of existing roads; and road closure/obliteration) for all USFS Sensitive species and MIS analyzed for this project are expected to be similar.

<u>Sensitive Species</u>

Because temporary roads would facilitate human access for some period of time, generally up to five years after vegetation treatment, and locations are unknown, and because of permanent habitat impacts from the proposed Big Springs ingress/egress, a determination of *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing* is made for all USFS Sensitive species analyzed for this project, except American peregrine falcon, for road actions included in Alternatives 1, 2, 3, and 4. For American peregrine falcon, based on limited potential use of the project area and other factors discussed under the analysis for peregrine above, a determination of *no impact* is made for road actions.

MIS

Because temporary roads would facilitate human access for some period of time, generally up to five years after vegetation treatment, likely decreasing effective habitat, and locations of temporary roads are unknown; because of increased sediment runoff in localized areas; and because of permanent habitat impacts from the proposed Big Springs ingress/egress, negative habitat impacts are expected for MIS. Habitat impacts would be long-term and occur in a small, localized area for the Big Springs ingress/egress routes; and short-term for temporary roads, assuming they are effectively closed and obliterated and human use does not continue. Because temporary roads would be obliterated within one year of project completion, generally up to five years after vegetation treatment allowing for machine pile burning, and approximately six miles of roads would be closed during project implementation, negative habitat impacts from road activities are not expected to be extensive enough to influence populations of any project MIS; therefore the estimation of influence for the nine project MIS is *no change to populations locally or on the planning area.*

Summary of Road Actions Effects

Road actions effects for USFS Sensitive species and MIS are expected to be somewhat greater under Alternatives 1 and 2 based on seven miles of temporary road construction, and less under Alternatives 3 and 4 based on five miles of temporary road construction. Impacts from the Big Springs ingress/egress and road closure/obliteration are expected to be similar under all action alternatives.

Defensible Space Effects on USFS Sensitive Species and MIS

Defensible space mitigation work by private landowners would be allowed under all action alternatives. Alternatives 1, 2, and 3 provide for three zones, and Alternative 4 provides for two zones. Total acres analyzed and net acres expected to be treated are displayed in Table 2 and Table 3. Up to 10% of analyzed acres are expected to be treated.

Defensible space treatments would occur adjacent to private land. Treatment could occur up to 300 feet from a structure under Alternatives 1, 2, and 3, and up to 100 feet from a structure under Alternative 4. Because locations of defensible space treatments are unknown, and would only become known as landowners apply for permits, it is not possible to know quantities of different habitats that would be affected by the treatments.

Based on the relatively low number of acres that could be treated for defensible space and proximity to private land and structures, minimal impacts to USFS Sensitive species and MIS are expected, and separate discussions regarding defensible space activities by species are not needed. Separate determinations of effects for USFS Sensitive species and estimations of influence for MIS are also not needed for defensible space activities. Effects would be least under Alternative 4 and greatest under Alternative 2, based on the maximum acres that may be treated.

Management Indicator Communities

Aspen

There are 231 acres of aspen in Alternative 1, 163 acres in Alternative 2, 255 acres in Alternative 3, and 231 acres in Alternative 4. Additionally, aggregations of ½ to 5 acres may occur within treatment units dominated by conifers. Aspen clones within treatment units would be retained and enhanced. Conifers within aspen clones would be cut and/or girdled to maintain clones. Aspen is expected to regenerate across many proposed units, based on removal of conifers. There is an anticipated positive influence to this MIC and long-term increase in local populations of the representative MIS, warbling vireo, from Alternatives 1, 2, 3, and 4; therefore, the four action alternatives are consistent with Forest Plan direction for these habitats and species.

Interior forest

As discussed under the golden-crowned kinglet analysis above, because effective habitat is estimated to have decreased since the Forest Plan (see the Effective Habitat discussion below) and interior forest is contained within effective habitat, it is estimated that interior forest has likely also decreased since the Forest Plan, by an unknown amount. Quantitative data and updated interior forest mapping are not available for the action alternatives; therefore, this analysis is based on qualitative assessments using the existing Forest Plan interior forest mapping and the action alternatives proposed.

Based on Forest Plan data, mapped interior forest occurs in multiple units in the project area; however, some of this is known or estimated to be incorrect (reduced since the Forest Plan mapping) based on existing vegetation conditions and increased human use in the project area since the Forest Plan.

As discussed under the analysis above for golden-crowned kinglet, an unknown amount of interior forest habitat may currently occur in the project area and it is possible that some would be affected by proposed treatments if canopy cover is reduced below 40%. However, Forest Plan direction does not specifically prohibit reduction of interior forest from Forest Plan levels, and no change to golden-crowned kinglet populations are expected on the planning area from this project; therefore, all four action alternatives are consistent with Forest Plan guidance for this MIC and its associated MIS.

Montane riparian/wetlands

Design criteria included in all four action alternatives provide protection to riparian and wetland habitats. Effects to this MIC and respective MIS for all alternatives are consistent with Forest Plan direction for these habitats and species.

Old growth

The action alternatives include treatment of 352 acres of old growth and 538 acres of old growth development (total 890 acres) under Alternatives 1 and 4, 288 acres of old growth and 499 acres of old growth development (total 787 acres) under Alternative 2, and 247 acres of old growth and 447 acres of old growth development (total 694 acres) under Alternative 3. Generally, larger live trees would be retained – including all trees 16" and larger under Alternatives 1 and 3, 14" and larger under Alternative 2, and 12" and larger under Alternative 4. Design criteria provide for retention of snags and large downed woody material, which are also important components of old growth forest. One of the four project objectives includes restoring ponderosa pine stands to increase resistance and resiliency to future natural disturbances. Desired conditions for this project for ponderosa pine include recruitment of old growth. Existing old growth stands would have basal area reduced by up to 30%, while old growth development and other ponderosa pine stands would have basal area reduced by up to 40%. Treatments are designed to help reduce risk of stand-replacing fire in ponderosa pine stands by reducing stand density, and to help move stands toward old growth conditions more quickly by reducing competition for water and nutrients. Design criteria for prescribed broadcast burn units provide for removing ladder fuels around large trees in old growth and developing old growth areas prior to burning, which should reduce mortality to larger trees from burning. Effects to this MIC and respective MIS for all alternatives are consistent with Forest Plan direction for these habitats and species.

Openings

The action alternatives would increase mapped meadows in treatment units from 259 acres to either 274 acres (Alternatives 1 and 4) or 262 acres (Alternatives 2 and 3). The treatments proposed under all action alternatives would create and enhance openings of varying sizes through mixed conifer thinning, Openings and lodgepole seedling areas (HSS 2T) would increase in the short-term in lodgepole pine, incrementally over the 10-15 year implementation where clearcuts and patchcuts would occur. Effects to this MIC and respective MIS for all alternatives are consistent with Forest Plan direction for these habitats and species.

Young to mature forest structural stages

Refer to Table 18 for existing HSS by cover type on NFS lands in the project area, and Table 19-22 for pre- and post-treatment HSS by cover type for Alternatives 1, 2, 3, and 4. All action alternatives would increase HSS 2T, which currently occurs on relatively few acres on NFS lands in the project area and in proposed treatment units. Effects to this MIC and its representative MIS elk, mule deer, and hairy woodpecker are consistent with Forest Plan direction for these habitats and species under all action alternatives.

Migratory Birds

An evaluation of the effects of the four action alternatives to bird species and habitats of management concern is included in the above sections, and further details are included in the Terrestrial Wildlife Specialist Report in the project record. The four action alternatives have been designed, to the extent practicable, to minimize incidental take through the implementation of design criteria. These criteria protect known raptor breeding sites, retain snag and down woody material and plan for future forests.

Effective Habitat

Based on 1997 Forest Plan data, mapped effective habitat occurs in the project area, including in many proposed treatment units. Design criteria provide for potentially modifying fuels treatments during implementation to maintain effective habitat, which would help to maintain functionality of some remaining effective habitat in treatment units.

Forest-wide Direction:

GO 95. *Retain the integrity of effective habitat areas.* Alternatives 1, 2, 3, and 4 are not consistent with this goal, and all have the potential to further reduce effective habitat, in the short-term by opening the forest canopy in many areas and creation of temporary roads, skid trails, and landings. In the long-term, some treated areas may return to functioning as effective habitat, depending on human use. Effective habitat could be reduced in the long-term if temporary roads or skid trails receive continued use after closure. Design criteria provide for obliteration of temporary roads and skid trails within one year after completion of use which should help to minimize the potential for continued human use. The Forsythe II project area at 18,954 acres is a small portion of the ARP. This is a wildlife goal for the entire 2 million acres of ARP lands. Because Alternatives 1, 2, 3, and 4 are not consistent with this goal, a Forest Plan Amendment is needed to remove the applicability of this goal for any of the four action alternatives. See Appendix C.

GL 107. *Avoid disconnecting or severing intact areas of effective habitat with new open roads and trails. Favor seasonal use during non-critical times for wildlife when this cannot be avoided.* Non-critical times for wildlife vary by species and area. In general, critical times include reproduction – for example bird nesting, elk calving, and deer fawning. No calving or fawning areas have been mapped by CPW in the project area. Critical times for elk in the project area are primarily migration and winter, because both an elk migration corridor and key winter range encompass most of the project area. Mule deer migration also occurs throughout the project area. Migration occurs in spring, generally April through June, and fall, from late August to as late as December in some years to the lowest elevations of winter range. Migration timing varies by year and depends on snowfall and other factors (CPW 2005, Hallock 1991). In the long-term, no new open roads or trails would be created by Alternatives 1, 2, 3, or 4. Temporary roads and skid trails do not constitute new open roads or trails for the long-term and would be obliterated after completion of project activities. However, they may receive use in the short-term and therefore could result in this guideline not being met in the short-term under Alternatives 1, 2, 3, and 4. In the long-term, Alternatives 1, 2, 3, and 4 are consistent with this guideline.

GL 108. *When developing new open roads and trails, do not reduce contiguous areas of effective habitat to less than 250 acres or further reduce effective habitat of 20 to 250 acres in size, except where access is required by law.* In the long-term, no new open roads or trails would be created by Alternatives

1, 2, 3, or 4. Temporary roads and skid trails do not constitute new open roads or trails for the long-term and would be obliterated after completion of project activities. However, they may receive use in the short-term and therefore could result in this guideline not being met in the short-term under Alternatives 1, 2, 3, and 4. In the long-term, Alternatives 1, 2, 3, and 4 are consistent with this guideline.

GL 109. *Additional open roads and trails should not reduce effective habitat below 50% by Geographic Area, or further reduce effective habitat in Geographic Areas that are already at or below 50% on NFS lands.* In the long-term, no new open roads or trails would be created by Alternatives 1, 2, 3, or 4. Temporary roads and skid trails do not constitute new open roads or trails for the long-term and would be obliterated after completion of project activities. However, they may receive use in the short-term and therefore could result in this guideline not being met in the short-term under Alternatives 1, 2, 3, and 4. In the long-term, Alternatives 1, 2, 3, and 4 are consistent with this guideline.

Management Area 3.5 – Forested Flora and Fauna Habitats

Forest-wide Direction:

ST 2. *Maintain or increase habitat effectiveness, except where new access is required by law.* Alternatives 1, 2, 3, and 4 are likely to reduce effective habitat compared to the No Action Alternative based on reduction in canopy closure from thinning, patchcuts, and clearcuts where they are in proximity to roads or trails. Some effective habitat reductions from fuels treatments would be expected to return to functioning as effective habitat in the long-term as trees grow back, depending on human activity. Because Alternatives 1, 2, 3, and 4 are not consistent with this standard a Forest Plan Amendment is needed to remove the applicability of this Standard for any of the four action alternatives. See Appendix C.

ST 3. *Discourage or prohibit human activities and travel, where needed, to allow effective habitat use during season of primary use by elk, deer and bighorn sheep (at least the minimum periods of May 15 through June 30 for elk calving, June 1 through June 30 for deer fawning, May 15 through June 30 for bighorn lambing, and December 1 through March 31 for wintering deer, elk and bighorn).* CPW has not identified any known elk calving areas in the project area. Key winter range for elk (severe winter range and winter concentration areas as defined and mapped by CPW) occurs throughout most of the project area, and a mule deer winter concentration area overlaps about the eastern 2/3 of the project area. The project area is nearly all within an elk migration corridor. Bighorn sheep do not occur in the project area.

There are currently no seasonal closures to non-motorized use in the project area based on key elk or deer winter range, and no such need has been identified by CPW or USFS biologists to date. The Winiger Ridge area, which is within key winter range for elk and mule deer, is closed to motorized use in the winter. Design criteria provide for excluding treatment activities under Alternatives 1, 2, 3, and 4 from key winter range for elk from December 1 through March 30 unless a site-specific exception is determined to be appropriate by a USFS Wildlife Biologist. The mule deer severe winter range mapped in the project area overlaps elk key winter range; therefore, implementation of this design criteria will serve to protect mule deer during harsh winter conditions. Based on this discussion, Alternatives 1, 2, 3, and 4 are consistent with this standard.

ST 4. *Discourage or prohibit human activities and travel, where needed, to allow effective habitat use by other wildlife species, especially during the seasons of birthing and rearing of young.* As discussed under ST 3 above, there is no mapped elk or mule deer production in the project area, and bighorn sheep do not occur. Raptor nesting is documented in portions of the project area, and is discussed further in the USFS Sensitive species analysis for specific raptor species. Design criteria provide for protection of known raptor nests, including timing restrictions for vegetation treatment activities where needed, therefore Alternatives 1, 2, 3, and 4 are consistent with this standard.

Forested Corridors

In the project area, mapped forested corridors occur on most NFS lands in the project area, including in and surrounding treatment units. All four action alternatives are expected to reduce forested corridors to some extent, which cannot be quantified with existing information. Alternative 3 would retain the most forested corridors due to some lodgepole pine treatment units being eliminated or reduced relative to Alternatives 1, 2, and 4. Refer also to the discussion under MIS above for elk and mule deer for forested corridors as they pertain to those species.

3.6.3 Cumulative Effects of Action Alternatives

Federally Threatened Species

<u>Mexican spotted owl</u>

A number of factors affecting Mexican spotted owls in the U.S. are discussed in USFWS (2012). Within the Southern Rocky Mountains (SRM) Ecological Management Unit (EMU), 50% of lands are federal, administered by the USFS, Bureau of Land Management (BLM), and National Park Service (NPS). Potential threats to owls in the SRM EMU include recreation, ecological restoration, firewood cutting, livestock production, mining, forest fuels management, energy development, transportation, and urban development. In particular, urban development along the Colorado Front Range may threaten owl wintering habitat (USFWS, 2012).

Hazardous fuel reduction treatments have been completed and are being planned on City, County, and private lands within the ponderosa pine/Douglas fir zone along the Front Range to reduce the risk of stand replacing crown fires. Development of private lands along the eastern border of the Forest boundary may impact potential winter habitat for Mexican spotted owls. In Boulder County, residential development adjacent to the eastern Forest boundary, the eastern limit of the project area, is limited in many areas by City and County Open Space lands in the foothills.

ESA cumulative effects include fuels treatments, cutting of mountain pine beetle-killed trees, and residential development that are likely to continue on non-federal lands in the action area. There are no cumulative effects to critical habitat because no critical habitat has been designated in the project area or on the ARP.

Because effects of the action alternatives are expected to be immeasurable and discountable, Alternatives 1, 2, 3, and 4 are expected to add immeasurably to cumulative effects.

<u>Preble's meadow jumping mouse</u>

The main threat to Preble's is human land uses causing decline in extent and quality of its habitat. Expansion of Gross Reservoir would inundate small amounts of potential habitat in several drainages. To the east and downstream of the project area, ongoing human uses and increasing Front Range human population are expected to continue Preble's habitat loss and fragmentation from recreational, commercial, and residential uses and associated infrastructure that supports those uses. Because effects from all of the action alternatives are considered immeasurable and discountable, Alternatives 1, 2, 3, and 4 are expected to contribute immeasurably to cumulative effects.

USFS Sensitive Species

<u>American peregrine falcon</u>

No impacts are expected for this species under Alternatives 1, 2, 3, and 4; therefore, these alternatives would not add to cumulative impacts for American peregrine falcon.

Bald eagle

The cumulative effects analysis area for bald eagle is Boulder County, because multiple nesting territories occur east of the project area in Boulder County and no nesting is documented in Gilpin County. Cumulative effects to bald eagles in Boulder County include development of outstanding water rights (effects to foraging habitat), expansion of transmission and distribution lines (collision and electrocution hazard), and increasing recreational use near nests and winter habitat (disturbance). This project would not contribute to those effects. The reason for the determination of *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing* for Alternatives 1, 2, 3, and 4 is the potential to temporarily introduce higher sediment concentrations into streams and rivers which could have short-term effects to bald eagle prey. Other project area activities with potential to introduce sediment into waterways include private land development; road construction, use, and maintenance; and fuels treatments across ownerships. Alternatives 1, 2, 3, and 4 are expected to contribute immeasurably to these effects.

American marten, fringed myotis, hoary bat, Townsend's big-eared bat, flammulated owl, Lewis's woodpecker, and olive-sided flycatcher

For all of these species, fuels treatments across ownerships and private land development have the greatest potential to impact denning, nesting, and/or roosting habitat, by clearing land and removing snags. Past USFS fuels treatment projects, as well as the current project, are generally designed to maintain or enhance ponderosa pine old growth (flammulated owl nesting, roosting and foraging habitat; bat foraging and roosting habitat); protect wetlands, riparian areas, and known bat roosts (foraging and roosting habitat for bats); retain a minimum number of snags (flammulated owl and Lewis's woodpecker nesting habitat, olive-sided flycatcher foraging habitat, fringed myotis and hoary bat roost habitat, and American marten denning habitat); and retain minimums of downed large woody material (American marten foraging and denning habitat, future insect prey for bats and birds). Human disturbance from recreation use is generally not a concern for these species, with specific exceptions such as cave roosts of bats, which are not known to occur in the project area. Relatively small-scale habitat changes have occurred and continue to occur from creation and use of unauthorized roads and trails. Alternatives 1, 2, 3, and 4 are expected to contribute minimally to cumulative impacts for these seven USFS Sensitive species, on a short-term basis and over an insignificant part of their ranges.

Northern goshawk

Fuels treatments across ownerships and private land development can remove goshawk nest trees as well as nesting and foraging habitat. On NFS lands, goshawk surveys are conducted and known nests are protected by leaving nest stands intact and avoiding fuels treatment activities during goshawk nesting season. Ongoing monitoring by the USFS and Boulder County continues to find successful goshawk nesting in the project area as well as other areas in Boulder and Gilpin Counties. Human use, on and off of system trails, which is high on most NFS lands in the project area, is not known to cause nest abandonment but can be detrimental to nesting in other ways. Alternatives 1, 2, 3, and 4 include measures to protect known goshawk nests and nest stands, and goshawk foraging habitat is expected to be enhanced. For these reasons, Alternatives 1, 2, 3, and 4 are expected to contribute minimally to cumulative effects for northern goshawk.

River otter

The reason for the may impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing (MAII) determination for Alternatives 1, 2, 3, and 4 is the potential to temporarily introduce higher sediment concentrations into streams and rivers which could have short-term effects to river otter prey. Other project area activities with potential to introduce sediment into waterways include private land development; road construction, use, and maintenance; and fuels treatments across ownerships. Alternatives 1, 2, 3, and 4 are expected to contribute immeasurably to these effects.

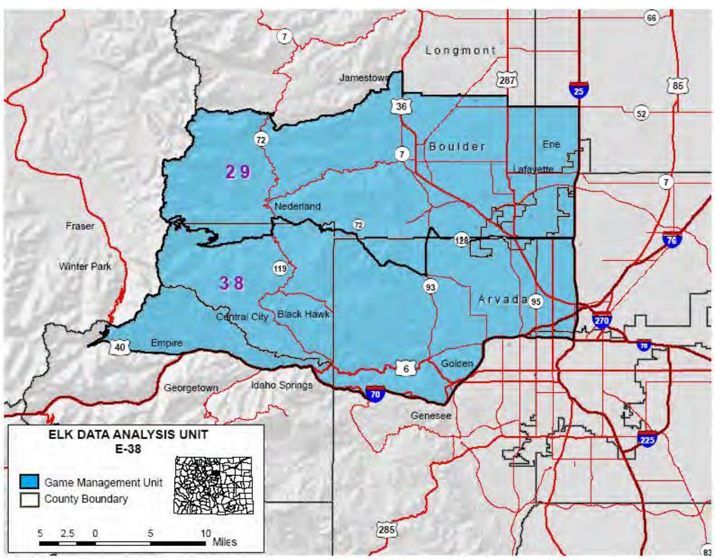
Boreal toad and northern leopard frog

Fuels treatments across ownerships and private land development can degrade amphibian habitat by changing habitat or introducing non-native organisms that can harm amphibians. Much of the private land in the project area is below known elevations for boreal toad, but within historic elevations of northern leopard frog. Other actions listed above, including smaller-scale vegetation treatments and motor vehicle use, may incrementally impact amphibians and their habitat. Wetlands are protected in USFS fuels treatment projects, therefore amphibian breeding habitat is generally protected. There is no known breeding of either species in the project area. Therefore, Alternatives 1, 2, 3, and 4 are expected to contribute minimally to cumulative effects for boreal toad and northern leopard frog.

Project Management Indicator Species

Elk

The cumulative effects analysis area for elk is the area occupied by the subherd of the Clear Creek elk herd that uses Game Management Unit (GMU) 29, which encompasses the northern portion of CPW Data Analysis Unit E-38, ranging from the Continental Divide east to the cities of Erie and Lafayette and displayed on the map below (CPW, 2005).



Most or all of the past, present, and reasonably foreseeable actions are impacting or have potential to impact the local elk herd and their habitats to some extent. Opportunities for elk movement have become more restricted over time, with the variety of human-associated development and use across the project area. Elk movement is limited by both physical barriers (roads, reservoirs, residences, and other structures) and barriers created by heavy and increasing human use on roads and trails in the area for residential use and a variety of recreational pursuits.

Past fuels treatments have increased available forage for elk, and proposed fuels treatment in the current project would further increase forage in portions of the project area. Some trails proposed to be constructed or adopted as system trails in the Magnolia Trails project are within areas of clearcuts and patchcuts from past fuels treatments, and other trails are within potential future fuels treatment units in the current project, including areas proposed for patchcuts. This combination of human use and fuels treatments can limit or change elk movements spatially and temporally, as well as limit use of available forage.

As discussed under the elk MIS analysis in Section 3.3.2, changes in elk movement can result in habitat degradation for elk and other species, increased vehicle collisions as elk move more at night, increased exposure of elk to disease, and increased negative interactions with landowners. The combination of habitat changes to date has created narrow areas where elk move between barriers to and from production areas and winter range. Examples of this include a narrow east-west forested area south of the Big Springs subdivision and north of Magnolia Road and several clearcuts, and a small area south of Eldora Road/County Road 130 between Nederland High School and the proposed Evans Annexation.

Observations by CPW and local residents suggest that elk movements and use of some areas may be changing, but there are no recent studies attempting to document or quantify changes. It is difficult to predict when changes in elk movement and forage use would result in any or all of the impacts previously discussed. Population changes to the local herd are not anticipated in the foreseeable future; however, it is also difficult to predict when cumulative effects may begin to cause population changes. Alternatives 1, 2, 3, and 4 are expected to contribute to cumulative effects for elk, but not enough to cause population changes locally or on the planning area. Alternative 1 is expected to contribute the most to cumulative effects for elk, followed by Alternatives 4, 2, and 3. This is based primarily on changes to forested travel corridors using during migration and winter.

<u>Mule deer</u>

The cumulative effects analysis area for mule deer is GMU 29, which is the northern portion of the area used by the Boulder Creek mule deer herd, and the same as the cumulative effects analysis area displayed above for elk.

Most or all of the past, present, and reasonably foreseeable actions are impacting the local mule deer herd and their habitats to some extent. Opportunities for mule deer movement have become more restricted over time, with the variety of human-associated development and use across the project area. Mule deer movement is limited by both physical barriers (roads, reservoirs, residences, and other structures) and barriers created by heavy and increasing human use on roads and trails in the area for residential use and a variety of recreational pursuits.

Past fuels treatments have increased available forage for mule deer, and proposed fuels treatment in the current project would further increase forage in portions of the project area. Some trails proposed to be constructed or adopted as system trails in the Magnolia Trails project are within areas of clearcuts and patchcuts from past fuels treatments, and other trails are within potential future fuels treatment units in the current project, including areas proposed for patchcuts. This combination of human use and fuels treatments can limit or change mule deer movements spatially and temporally, as well as limit use of available forage.

It is difficult to predict when changes in mule deer movement and forage use would result in changes to movement or negative habitat impacts. Population changes to the local herd are not anticipated in the foreseeable future; however, it is also difficult to predict when cumulative effects may begin to cause population changes. Similar to elk, Alternatives 1, 2, 3, and 4 are expected to contribute to cumulative effects for mule deer, but not enough to cause population changes locally or on the planning area. Alternative 1 is expected to contribute the most to cumulative effects for mule deer, followed by Alternatives 4, 2, and 3. This is based primarily on changes to forested travel corridors using during migration and winter.

<u>Golden-crowned kinglet</u>

Based on no planned treatment of spruce-fir (except for under Alternative 3, up to 0.5 acres could be treated), which is primarily habitat for this species, and minimal potential impacts to spruce-fir habitat from fuels treatment in adjacent areas, Alternatives 1, 2, 3, and 4 are expected to contribute minimally to cumulative effects to golden-crowned kinglet primary breeding habitat. However, because interior forest is estimated to have decreased since the Forest Plan, cumulatively a negative habitat trend is estimated to have occurred in the project area and on the planning area. Because the action alternatives could impact an unknown amount of interior forest, Alternatives 1, 2, 3, and 4 may contribute an unknown amount to this negative habitat trend, which in the treatment units would occur mostly in secondary breeding habitat.

Hairy woodpecker and pygmy nuthatch

Fuels treatments across ownerships and private land development have the greatest potential to impact nesting habitat in the project area. Past USFS fuels treatment projects and the current project are generally designed to maintain or enhance ponderosa old growth, which provides primary pygmy nuthatch habitat, and retain a minimum number of the largest available snags, which provides nesting habitat for both of these species. Overall, Alternatives 1, 2, 3, and 4 are expected to contribute minimally to cumulative effects for hairy woodpecker and pygmy nuthatch.

Mountain bluebird

Fuels treatments across ownerships and private land development have the greatest potential to impact nesting habitat in the project area. Private land development can remove habitat. Fuels treatments can improve habitat by creating and enlarging openings needed for foraging, and as long as suitable nesting snags remain available with implementation of design criteria, this could result in a short-term population increase at the local level. In the long-term, openings would fill in and become less favorable for foraging. Overall, Alternatives 1, 2, 3, and 4 are expected to contribute positively in the short-term to cumulative effects for mountain bluebirds, but not enough to result in population changes locally or on the planning area. In the long-term, a neutral contribution to cumulative effects is expected as openings and forest edge fill in over time as trees grow back.

Warbling vireo

While some habitat may be destroyed or degraded by private land development, fuels treatments across ownerships are expected to increase suitable habitat by providing for increased aspen growth in the long term. Alternatives 1, 2, 3, and 4 are expected to contribute positively to a potential long-term increase in local populations, and minimally to cumulative effects to planning area populations.

Wilson's warbler

Fuels treatments across ownerships and private land development have the greatest potential to impact nesting habitat in the project area by removing habitat, or degrading habitat in ways such as increasing sediment. Project design criteria provide for protection of wetlands, streams, other water bodies and riparian habitat. As discussed under the MIS analysis in Section 3.3.2 above for Wilson's warbler, most of the project area is below breeding habitat elevation for the species, and none were observed in the project area. Based on the low probability of occurrence and protection of habitat provided by design criteria, Alternatives 1, 2, 3, and 4 are expected to contribute negligibly to cumulative effects for Wilson's warbler.

Boreal toad

Fuels treatments and private land development can degrade amphibian habitat by changing habitat or introducing non-native organisms that can harm amphibians. Much of the private land in the project area is below known elevations for boreal toad. Smaller-scale vegetation treatments and motor vehicle use, may incrementally impact amphibian habitat. Wetlands are protected in USFS fuels treatment projects, therefore amphibian breeding habitat is generally protected. There is no known breeding in the project area. Alternatives 1, 2, 3, and 4 are not expected to contribute measurably to cumulative effects for boreal toad.

Conclusion of Cumulative Effects for USFS Sensitive Species and MIS

Based on the above cumulative effects analysis, determinations of effects for USFS Sensitive species and estimations of influence for project MIS did not change from the direct and indirect effects analyses above for individual species.

Summary of Determinations

Table 30. Summary of determinations of effects and estimations of influence on threatened and endangered species, USFS Sensitive species, and MIS.

Species	Status	No Action	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Mexican spotted owl	Threatened	NE[1]	NLAA[2]	NLAA	NLAA	NLAA
Preble's meadow jumping mouse	Threatened	NE	NLAA	NLAA	NLAA	NLAA
American marten	Sensitive	NI[3]	MAII[4]	MAII	MAII	MAII
Fringed myotis	Sensitive	NI	MAII	MAII	MAII	MAII
Hoary bat	Sensitive	NI	MAII	MAII	MAII	MAII
River otter	Sensitive	NI	MAII	MAII	MAII	MAII
Townsend's big-eared bat	Sensitive	NI	MAII	MAII	MAII	MAII
American peregrine falcon	Sensitive	NI	NI	NI	NI	NI
Bald eagle	Sensitive	NI	MAII	MAII	MAII	MAII
Flammulated owl	Sensitive	NI	MAII	MAII	MAII	MAII
Lewis's woodpecker	Sensitive	NI	MAII	MAII	MAII	MAII
Northern goshawk	Sensitive	NI	MAII	MAII	MAII	MAII
Olive-sided flycatcher	Sensitive	NI	MAII	MAII	MAII	MAII
Boreal toad	Sensitive	NI	MAII	MAII	MAII	MAII
	Project MIS	NC[5]	NC	NC	NC	NC
Northern leopard frog	Sensitive	NI	MAII	MAII	MAII	MAII
Elk	Project MIS	NC	NC	NC	NC	NC
Mule deer	Project MIS	NC	NC	NC	NC	NC
Golden-crowned kinglet	Project MIS	NC	Neg/NC*	Neg/NC*	Neg/NC*	Neg/NC*
Hairy woodpecker	Project MIS	NC	NC	NC	NC	NC
Mountain bluebird	Project MIS	NC	NC	NC	NC	NC
Pygmy nuthatch	Project MIS	NC	NC	NC	NC	NC
Warbling vireo	Project MIS	NC	Pos/NC**	Pos/NC**	Pos/NC**	Pos/NC**
Wilson's warbler	Project MIS	NC	NC	NC	NC	NC

[1]NE = No effect; [2]NLAA = May affect, not likely to adversely affect; [3]NI = No impact; [4]MAII = May impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing; [5]NC = No change to populations locally or on the planning area.
*Negative influence to local populations, no change to planning area populations.
**Positive influence to local populations, no change to planning area populations.

3.7 Recreation

3.7.1 Affected Environment (No Action)

The Forsythe II project area has a high density of roads, mining impacts, and a very fragmented landownership pattern with a significant amount of private land intermixed with public land. The area contains numerous NFSRs and trails that cross both NFS land and private land. The area is in close proximity to Denver, and consequently receives a large number of recreational visitors during summer months. The project area is accessible from Hwy 119, Hwy 72 and several well-maintained county roads that provide opportunities for viewing scenery and driving for pleasure.

Recreation use in the project area occurs to varying degrees on all NFS lands. The area is open year-round, with most use occurring between spring and late fall. Ninety-five percent of all recreation uses are non-motorized and mechanized dispersed recreation activities that include hiking, mountain biking, hunting, fishing, camping and horseback riding, and incidental winter sport activities. Motorized access is centric to private landowner ingress/egress, except on weekends when recreation enthusiasts visiting from outside the local area park along roads where public land is legally accessible. Areas known to have the highest recreation use include: NFS lands just south and east of the town of Nederland and popular destination sites within and around the Gross Reservoir Recreation Area. Areas within the project area with the lowest use are generally found in the Beaver Creek community, the southernmost section of the planning area. NFS trails and roads are recognized as important recreational infrastructure as they either provide the primary access to recreational opportunities or serve as the recreational opportunity. Unauthorized trails that are not on the NFS system, known as "social trails, are not actively managed and therefore not recognized recreational opportunities.

Generally, users have been observed recreating in what appears to be a safe and compliant manner. The issuance of recreation-related violation notices (citations) is low compared to other areas on the Boulder Ranger District that have similar recreation use dynamics. Common problems include but are not limited to dumping residential trash, vegetation removal, motor vehicles off-road and/or parked in undisturbed areas, soil compaction, randomly placed campfire rings, creation of unauthorized social trails, entering a closed area, and undesirable trespass through private property with intent to access NFS or other public lands managed in the project area. In particular, fuels treatment burn piles and areas that have not been reforested after fuels treatment and located along roads and trails become an attractive nuisance that further exacerbate these issues and perpetuate problems associated with target shooting.

Past travel management projects (roads and trails) implemented throughout the project area have been successful in achieving regulatory compliance. Fencing, route obliteration and signing projects implemented over the past decade have minimized issues associated with illegal motor vehicle use and trail building. Projects in the vicinity of Nederland and Gross Reservoir have been much less effective, compliance is less than desirable. USFS employees continuously replace "No Motor Vehicle" signs and repair wood barriers that are damaged, vandalized and/or stolen. This problem is not uncommon in urban forests, nor is it solely the result of any one user group desiring access to engage in any number of recreation opportunities.

Similar to other areas across the Front Range, there is a lack of regulatory/operational consistency between land management agencies, public utilities and private landowners which creates confusion among recreation enthusiasts and perpetuates a number of unresolved access issues. These problems are more evident when large scale projects are conducted on public land.

Direct and Indirect Effects of No Action

Short term effects on the recreation resource would continue as observed in the past at the same frequency and intensity under the No Action. Short-term temporary impacts to the recreation opportunities would continue as in the past. Recreational displacement and general recreation use dynamics have already adapted to the existing situation (past fuels treatment projects). Predictable displacement norms would remain the same.

3.7.2 Direct and Indirect Effects of Action Alternatives

The issuance of recreation-related violation notices (citations) is low compared to other areas on the Boulder Ranger District that have similar recreation use dynamics. However, it is widely known that user safety is compromised and compliance issues escalate when large scale projects such as described in the action alternatives are implemented. The BRD has been successful at minimizing these issues by effectively planning implementation contingencies and communicating project work with the local community. This has provided users and local landowners alike an opportunity to establish expectations well in advance. This typically results in users opting to engage in a different recreation activity during their leisure time. Temporary recreation activity displacement has become a common norm in the project area. Nonetheless, a small percentage of users and/or private landowners remain that ignore or act defiantly in response to project work on public lands making recreation displacement appear to be a larger issue than perceived.

The direct and indirect effects of fuels treatment on the recreation resource would vary depending on the type of activity proposed, and would vary depending on time and location. While fuels treatment units identified in the action alternatives may take years to initiate, project work is expected to take only months to complete considering unit layout, treatment type and annual funding. Therefore, only short-term direct effects to recreation users are expected when temporary closures of roads, trails, dispersed areas and developed parking areas are determined necessary, particularly in the vicinity of Nederland and the Gross Reservoir Recreation Area where recreation use is highly concentrated. Displacement is not measurable, and short-term impacts to the recreation resource are considered insignificant. In the event that a NFS trail (or proposed trail) is to be used as a skid road for treatment activities, then the effects would be minimized through use of the design criteria.

Any effects would be noticed primarily from NFS trails and roads. While many enjoy recreational opportunities on non-NFS trails, known as social trails, these unauthorized trails are not actively managed, nor are the effects measureable. Therefore, effects from non-NFS trails are not analyzed. Refer to Tables 31 – 34 for a listing by alternative for the trails that could be affected by the varying vegetation treatments.

Due to the fragmented ownership and landscape within the project boundary, the forest setting changes across the project boundary. The sensitivities that recreationists would experience to vegetation management activities is difficult to measure, particularly when these treated areas evolve over time.

Sensitivities would vary by treatment activity, as well as by past visitor experience. For example, a patchcut in lodgepole pine may be offensive to a visitor whom had frequented the area before, whereas a new visitor may appreciate the opened viewshed of mountains and natural features that would otherwise be blocked from the forested view. These sensitivities are temporal as well; for the first few years after the treatment, visitors may see cut stumps and slash piles, evidence of a vegetation management activity. However, over time successional habitat would evolve and visitors may be attracted to wildflowers in the area, covering up the cut stumps.

Sensitivities would vary by user type as well. A hiker along a trail would move more slowly through or by a lodgepole pine treatment and therefore be more sensitive to the changed setting, whereas equestrian users would move more quickly, yet would notice the changed setting. Mountain bikers, generally speaking, would be moving more quickly and be focused on the trail and not taking in the surroundings.

Other treatment activities would allow for a range of trail enhancement opportunities. Denser stands would create a “tight and twisty” trail experience, whereas treatments in old growth stands would create a “park-like” setting for “open and flowy” trails. This range would change as visitors traveled across the landscape within the project boundary.

Effects by Alternative

The following tables represent NFS trails, and associated mileages, within vegetation treatment units that could be impacted by treatment activities. Impacts include using these trails as skid roads and changing the recreational experience. Implementing the design criteria would alleviate effects to these trails. All action alternatives would be consistent with the goals, objectives, standards, and guidelines established for recreation in the Forest Plan.

Table 31. NFS trails within Alternative 1 treatment units.

Trail Number	Trail Name	Mileage	Treatment Unit	Vegetation Treatment	Treatment Method	Slash Treatment
357.2A	Yellow Dot	0.16	15	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.09	16	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.23	17	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.23	59	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.12	104	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
357.2B	Red Dot	0.03	15	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.07	16	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.11	17	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		< 0.01	59	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.12	60	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.03	104	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
357.2C	Blue Dot	0.02	15	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.21	67	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
606.1D		0.06	15	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.07	67	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
RBRD 359.1M	Winiger Spur	0.16	38	Broadcast Burn		

Trail Number	Trail Name	Mileage	Treatment Unit	Vegetation Treatment	Treatment Method	Slash Treatment
RBRD 606.1D	Blue Dot	< 0.01	11	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.06	14	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		< 0.01	20	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.08	67	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
RBRD 606.1E	Tungsten Spur	0.07	7	Aspen Restoration	Manual	Chip and/or pile & burn
		0.28	9	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
853	Reynolds Ranch	0.02	3	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.25	4	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
853.1A	Reynolds Ranch Spur	0.04	4	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
853.1B	Doe Tr.	0.07	2	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
853.1C	Reynolds Ranch Spur	0.15	2	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
853.1D	Star Wars (name from Magnolia Trails project)	0.21	3	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.22	4	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
	TOTAL	**3.2 miles**				

Table 32. NFS trails within Alternative 2 treatment units.

Trail Number	Trail Name	Mileage	Treatment Unit	Vegetation Treatment	Treatment Method	Slash Treatment
357.2A	Yellow Dot	0.16	15	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.09	16	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.17	17	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.23	59	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.12	104	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site

Trail Number	Trail Name	Mileage	Treatment Unit	Vegetation Treatment	Treatment Method	Slash Treatment
357.2B	Red Dot	0.04	15	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.07	16	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.11	17	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		< 0.01	59	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.03	104	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
357.2C	Blue Dot	0.02	15	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.21	67	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
606.1D		0.07	15	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.07	67	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
RBRD 359.1M	Winiger Spur	0.16	38	Broadcast Burn		
RBRD 606.1D	Blue Dot	< 0.01	11	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.06	14	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		< 0.01	20	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.08	67	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
RBRD 606.1E	Tungsten Spur	0.07	7	Aspen Restoration	Manual	Chip and/or pile & burn
		0.09	9	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
853	Reynolds Ranch	0.15	4	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
853.1C	Reynolds Ranch Spur	0.03	2	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
853.1D	Star Wars (name from Magnolia Trails project)	0.15	3	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.22	4	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
	TOTAL	**2.4 miles**				

Table 33. NFS trails within Alternative 3 treatment units.

Trail Number	Trail Name	Mileage	Treatment Unit	Vegetation Treatment	Treatment Method	Slash Treatment
357.2A	Yellow Dot	0.16	15	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.09	16	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.12	104	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
357.2B	Red Dot	0.03	15	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.07	16	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.03	104	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
357.2C	Blue Dot	0.02	15	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.21	67	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
606.1D		0.06	15	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.07	67	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
RBRD 359.1M	Winiger Spur	0.16	38	Broadcast Burn		
RBRD 606.1D	Blue Dot	0.06	14	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		< 0.01	20	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.08	67	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
RBRD 606.1E	Tungsten Spur	0.07	7	Aspen Restoration	Manual	Chip and/or pile & burn
		0.28	9	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
853	Reynolds Ranch	0.02	3	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.18	4	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
853.1B	Doe Tr.	0.07	2	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
853.1C	Reynolds Ranch Spur	0.15	2	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site

Trail Number	Trail Name	Mileage	Treatment Unit	Vegetation Treatment	Treatment Method	Slash Treatment
853.1D	Star Wars (name from Magnolia Trails project)	0.21	3	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.20	4	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
	TOTAL	**2.3 miles**				

Table 34. NFS trails within Alternative 4 treatment units.

Trail Number	Trail Name	Mileage	Treatment Unit	Vegetation Treatment	Treatment Method	Slash Treatment
357.2A	Yellow Dot	0.16	15	Aspen Restoration	Manual	Chip and/or pile & burn
		0.09	16	Lodgepole Pine Treatment	Manual	Chip and/or pile & burn
		0.23	17	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.23	59	Douglas-fir Mixed Conifer Treatment	Manual	Chip and/or pile & burn
		0.12	104	Ponderosa Pine Mixed Conifer Treatment	Manual	Chip and/or pile & burn
357.2B	Red Dot	0.03	15	Aspen Restoration	Manual	Chip and/or pile & burn
		0.07	16	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.11	17	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		< 0.01	59	Douglas-fir Mixed Conifer Treatment	Manual	Chip and/or pile & burn
		0.12	60	Douglas-fir Mixed Conifer Treatment	Manual	Chip and/or pile & burn
		0.03	104	Ponderosa Pine Mixed Conifer Treatment	Manual	Chip and/or pile & burn
357.2C	Blue Dot	0.02	15	Aspen Restoration	Manual	Chip and/or pile & burn
		0.21	67	Aspen Restoration	Manual	Chip and/or pile & burn
606.1D		0.06	15	Aspen Restoration	Manual	Chip and/or pile & burn
		0.07	67	Aspen Restoration	Manual	Chip and/or pile & burn
RBRD 359.1M	Winiger Spur	0.16	38	Broadcast Burn		
RBRD 606.1D	Blue Dot	< 0.01	11	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.06	14	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		< 0.01	20	Aspen Restoration	Manual	Chip and/or pile & burn
		0.08	67	Aspen Restoration	Manual	Chip and/or pile & burn

Trail Number	Trail Name	Mileage	Treatment Unit	Vegetation Treatment	Treatment Method	Slash Treatment
RBRD 606.1E	Tungsten Spur	0.07	7	Aspen Restoration	Manual	Chip and/or pile & burn
		0.28	9	Douglas-fir Mixed Conifer Treatment	Manual	Chip and/or pile & burn
853	Reynolds Ranch	0.02	3	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.25	4	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
853.1A	Reynolds Ranch Spur	0.04	4	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
853.1B	Doe Tr.	0.07	2	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
853.1C	Reynolds Ranch Spur	0.15	2	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
853.1D	Star Wars (name from Magnolia Trails project)	0.21	3	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
		0.22	4	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site
	TOTAL	**3.2 miles**				

3.7.3 Cumulative Effects of Action Alternatives

Implementation of actions as stated in the Magnolia Non-Motorized Trails Environmental Analysis in the East Magnolia area is planned to happen after Forsythe II vegetation treatments have occurred. Therefore, the Forsythe II project will not add cumulatively to the effects from the Magnolia Trails Non-Motorized Trails. The adaptive management potions of the Magnolia Non-Motorized Trails proposed actions allows trails to be adjusted after the vegetation treatments to least impact recreation experience. Depending on the timing of the Gross Reservoir expansion and Boulder County's Reynolds Ranch fuels and trails projects, recreation users' experience and access in the Forsythe II project area could be negatively cumulatively compounded.

3.8 Visuals

3.8.1 Affected Environment (No Action)

The Forsythe II project area is in the M331 – Southern Rocky Mountain Steppe sub-ecoregion (Bailey, Avers, King, & McNab, 1994). The project area is one of an aspect-dependent dry forest that receives about 20 inches of precipitation per year, nearly half of that coming in the form of snow. The vegetation varies from open areas with grasses and shrubs to conifer trees and deciduous species. Ponderosa pine, grasses, and shrubs dominate the meadows and the south slopes. The north slopes are well-timbered with ponderosa pine, Douglas-fir, and lodgepole pine at the higher elevations. The east and west slopes are moderate to well-timbered with all these tree species. Aspen occurs in the meadows and drainages along with Colorado blue spruce. There are many rock outcrops in the area. The growing season is about 70 days and elevation of the land varies from 6,082 to 8,945 feet.

Streams in the area include South Boulder Creek, Middle Boulder Creek, and South Beaver Creek. South Boulder Creek is augmented by water from west of the Continental Divide that flows through the Moffat Tunnel and into Gross Reservoir. Middle Boulder Creek flows through Barker Reservoir in Nederland and South Beaver Creek forms part of the southern boundary of the area. There are a few small (less than 5 acres surface area) natural and dam-enhanced ponds in the project area on private land. There are also two impoundments for water storage: Barker Reservoir, a lake of approximately 200 surface area acres on Middle Boulder Creek and Gross Reservoir, an approximately 440 surface area acres lake on South Boulder Creek.

There is evidence of past timber harvest activity in the area and currently there is some forest thinning and patchcutting/clearcutting in the project area, including activity to reduce fuels on the private land. There is also evidence of and other fire scars from. There are areas of recent wildfires that have had large negative scenery impacts on the landscape that are adjacent to and visible from the project area. A large recent fire to the north and east of Gross Reservoir, the Black Tiger fire, and the Four Mile fire are visible from parts of the project area. Suppression of fire through human intervention in the project area has made the existing forest vegetation more dense than would be the case if ecological processes were allowed to operate without human intervention. As a result, many portions of the project area could be thought of as having a higher degree of instability of the scenic attributes than would 'naturally' occur.

The main highways that provide access to the area are Colorado State Highway (CO SH) 119 (Boulder Canyon Dr.) forming the northwest boundary of the project area, CO SH 72 (Coal Creek Canyon) forming the southwest boundary of the project area, Peak-to-Peak Scenic Byway (various segments of CO SH 119 and CO SH 72) on the west of the project area, Flagstaff Mountain Road on the east, and Boulder County Road 132 (Magnolia Road) which bisects the project area. Additionally, the main east-west Amtrak transcontinental passenger railroad route is in the southern portion of the project area.

The users of the area, the hikers, hunters, residents and travelers including the passengers on the railroad are interested in the environment and there are strong feelings for the landscape. Users of the Peak to Peak

Scenic Byway are of particular concern. Viewpoints of interest include those from the roads mentioned above, the roads that feed these main roads, the formal NFS trails (#853, #606.1E & # 606.1D), the Amtrak railroad tracks, and the surface of and recreation areas around Gross Reservoir.

The existing SIO is low in some west sections due to clearcutting in lodgepole pine, but generally moderate to high throughout the area. The variety and diversity of tree species and presence of natural openings and rock outcrops makes the landscape able to absorb changes. This landscape has a relatively high visual absorption capability in the central and eastern parts. However, in many of the western parts the vegetation is even aged lodgepole pine. This vegetation comprises a uniform-looking landscape cover and therefore the visual absorption capability of this landscape is low.

Direct and Indirect Effects of No Action

Under the No Action Alternative, the project area would continue to show the effects of fire suppression and recreation impacts. Effects from fire suppression would include a forest more dense with vegetation. Continued recreational activity effects would include soil compaction, erosion, tree scarring and littering. Areas where patchcuts/clearcuts occurred in the past may have ground visible in some areas (green, beige or white depending on the season) and as these areas continue to regenerate, the ground would be less visible and eventually be considered visually 'recovered'. Existing thinned areas would be moderated in their visual nature in that stumps and slash resulting from thinning activities would become less noticeable.

Indirect effects would include a condition of a more dense forest. In addition, if disease and insect mortality were to increase, there would be adverse effects to the scenery resource. Another indirect effect could be a stand replacing fire and the major adverse visual effects that would result from such an event.

Overall, the No Action Alternative would have negligible impact for the scenery resource in the short term. It could have a negligible or major adverse effect on the scenery in the long term. The reason for this large range is due to the unpredictability associated with the possible future events (i.e. fire, insects, and disease).

3.8.2 Direct and Indirect Effects of Action Alternatives

Management activities for all action alternatives includes cutting trees, piling and burning, temporary skid roads, landings, smoke, and noise created as a result of these activities. The management activities would adversely affect the form, line, color, texture and pattern of the landscape. Direct effects of all the action alternatives would include the following negative short term effects as a result of the management activities in the project area: fresh cut stumps, slash (chips and mastication chunks), openings in the tree cover of the forest landscape, smoke (i.e. decreased visibility both on and off site), burn pile scars, and blackened areas in the broadcast burn units. The slash treatments would fade over time and would not have long term negative repercussions for the scenery resource. Benefits associated with the management actions would include greater inter-forest visibility, more variety in forest vegetation, increased aspen in the aspen restoration units, and meadow enhancement. In the long term, the burn areas would not be expected to be noticeable to the casual observer. In all High and Moderate SIO areas, the management activities would have a moderately adverse effect, but still subscribe to the Forest Plan.

The emergency ingress/egress routes, Wildewood Trail and Doe Trail, would require road construction and skid trails would be located according to the design criteria developed for this project, therefore the visual impacts created by these disturbances would meet the Forest Plan SIO for these areas.

Indirect effects would include the increased 'openness' of the forest landscape due to the vegetation manipulations, the potential for increased access, and use afforded by this more open landscape. Long term indirect effects would also include a forest that is less susceptible to insects, disease, fire, and more stable from a visual resources viewpoint because it is less susceptible to drastic change.

Overall, most of the project activities would have moderately adverse impacts for the scenery resource in the short term and would have a beneficial effect in the long term. The alternatives proposed for this project meet the SIOs as described in the Forest Plan for all alternatives with attendant design criteria, however treatment in Unit 1 under Alternatives 1 and 3 would affect the SIO the greatest as opposed to Alternatives 2 and 4 because clearcuts/patchcuts could occur across 50% of the unit. Unit 1 is visible in the foreground and middle ground from the town of Nederland and the Peak to Peak Scenic Byway.

3.8.3 Cumulative Effects of Action Alternatives

Some activities associated with past, present, and foreseeable future projects are/may be noticeable in some views that include the Forsythe II project area. While past activities along Magnolia Road by the USFS and Boulder County have resulted in a low existing scenic integrity level, none of the action alternatives proposed vegetation treatments are likely to further reduce the existing scenic integrity level.

3.9 Noxious Weeds

3.9.1 Affected Environment (No Action)

Vegetation across the project area includes meadows, shrublands, riparian vegetation, aspen stands, open ponderosa pine woodlands, and forested areas dominated by conifers. Mixed conifer stands include ponderosa pine, Douglas-fir, limber pine, and lodgepole pine, and usually interspersed quaking aspen. Some lodgepole pine stands are nearly pure lodgepole, established following large wildfires decades or centuries ago. Depending on elevation and aspect, others are mixtures of lodgepole pine associated with ponderosa pine, Douglas-fir, limber pine, Engelmann spruce, subalpine fir, and aspen. Proposed treatments are based on the dominant overstory species. Topography is variable, with drainages leading into Gross Reservoir and into the larger and more developed drainages of South Boulder Creek and Middle Boulder Creek. Elevation ranges from about 6,082 feet to over 8,945 feet.

Most noxious weeds invading the United States originated in Europe and Asia and were introduced beginning in the 1800s. These plants entered the U.S. by a variety of means, including ship ballast soil, contaminated animal feed and crop seed, and intentional introductions as ornamental or medicinal plants (Sheley & Petroff, 1999). Some nonnative ornamental plants introduced for gardening and landscaping escaped and became invasive (Colorado Weed Management Association, 2009).

Systematic noxious weed inventories were conducted from 1998 through 2001 for the Winiger Ridge Ecosystem Management Pilot Project (Winiger project), which encompasses most of the Forsythe II project area. Vegetation treatments have occurred in Winiger project units, including some that overlap proposed Forsythe II treatment units. Noxious weed inventories included NFS lands and lands managed by Boulder County, the City of Boulder, and Denver Water. Additional inventories specific to noxious weeds were not conducted for the Forsythe II project; however, noxious weed occurrences were noted during botany surveys in 2010 and 2011 for the 2012 Forsythe Fuel Reduction project. Treatment of priority noxious weed infestations in the project area has been ongoing since 1999 on NFS lands and Denver Water lands, including infestations around Gross Reservoir being treated in cooperation with Denver Water.

Because the last systematic noxious weed inventory occurred over ten years ago, an accurate assessment of acres in the project area covered by noxious weeds is not currently available. In general, except for densely forested areas, weeds are abundant throughout much of the project area due to relatively high road and trail density; past disturbance including mining, timber harvest, and construction of residences, roads, utility corridors, etc.; and high levels of human use, both recreational and residential. Weeds are most abundant along roads and in previously disturbed areas. Some high priority weed infestations have been reduced or eliminated with years of treatment.

Areas most likely to facilitate introduction of weeds through disturbance and the presence of vectors are roads, trails, stream corridors, dispersed recreation areas, individual residences, horse feeding or riding areas, areas with previous fire or timber cutting activity, wildfires, and heavily grazed areas (currently or in the past). All of these conditions occur in the Forsythe II project area. Once established, weeds may spread to adjacent, less disturbed or even undisturbed areas. Weeds are most likely to establish and spread in open areas that receive plenty of sunlight and less likely to establish and spread in densely forested, more shaded areas. Riparian and open meadow habitats, including grass, forb and shrub cover types, are particularly susceptible to noxious weed invasion, due to the availability of sunlight, and in riparian areas, the presence of water as a vector. Higher elevations tend to have fewer occurrences of noxious weeds, due to a combination of harsh growing conditions that deter some species and generally fewer human disturbances providing sources of introduction.

Noxious weeds known to occur in the project area include diffuse knapweed, spotted knapweed, dalmatian toadflax, yellow toadflax, Canada thistle, musk thistle, houndstongue, scentless chamomile, and oxeye daisy. Other invasive plant species may occur and be undocumented or have the potential to be introduced and establish in the area. Orange hawkweed, a Colorado A list species (designated for eradication) and a high priority species for the ARP and the BRD, occurs within the project area boundary but is not known to occur within any treatment units.

Canada thistle is by far the most widespread noxious weed in the project area. Musk thistle also occurs in a number of proposed treatment units, but is more sparsely distributed. The highest priority species in the project area are orange hawkweed, diffuse knapweed, spotted knapweed, dalmatian toadflax, yellow toadflax, houndstongue, scentless chamomile, and oxeye daisy. These species are located in relatively few areas, and weed treatments in the project area have focused on them, both because of their potential for spread and because of the feasibility of treating the relatively few and smaller infestations. Canada and musk thistle have been treated in some areas, where they are near higher priority species and in some locations where they have densely infested landings from past fuels treatments.

Other documented invasive plant species include cheatgrass, common mullein, and smooth brome. These species are not a priority for treatment, either because they are a ubiquitous Colorado List C species as with cheatgrass and common mullein – species where the goal is not to stop the spread of these weeds, but rather to provide additional educational, research and biological control resources to jurisdictions that choose to require management; or because they are not a Colorado designated noxious weed species, such as smooth brome.

Treatment of noxious weeds on the ARP is based on the concept of integrated weed management (IWM) and is consistent with the ARP Noxious Weed Management Plan included in the Decision Notice and Finding of No Significant Impact for Noxious Weed Management Plan on the ARP (USDA Forest Service, 2003). The goal of IWM is not total eradication of noxious weeds, but successful long-term management through a combination of biological, chemical, cultural, and physical methods. In general, noxious weeds are prioritized for treatment based on aggressiveness, current extent of infestation, and priority of species by state and county weed programs.

Noxious weeds and other nonnative invasive plants threaten biodiversity and ecosystem stability. They are aggressive and capable of out-competing native plants for moisture, nutrients and sunlight often leading to the establishment of undesirable vegetation monotypes. One reason for this is that nonnative plants seldom have natural controls, including predators such as insects, viruses or bacteria, etc., that feed upon them and help control their spread. Nonnative, invasive plants can alter soil properties and plant community composition, which can negatively affect native plant species diversity and forage for wildlife species, resulting in changes in animal communities that depend on the affected ecosystems. In extreme situations, negative effects on water quality can occur due to increased erosion and runoff (Sheley & Petroff, 1999).

Weeds become established in areas disturbed by motorized and non-motorized recreation, road construction and maintenance, timber harvest, and other activities and by natural disturbances such as fire, and are spread by people, vehicles, wind, water, and wild and domestic animals (Sheley & Petroff, 1999). Roads are frequently sources of noxious weed introduction, increasing both the potential for new infestations and the spread of weeds and weed seeds to new, uninfested areas. Weed seeds can be picked up, transported, and deposited by vehicles, in mud sticking to the vehicle, in wheels, and in other parts of the undercarriage of the vehicle. Road building, off-road vehicles, logging, and construction also damage native vegetation and disturb the soil surface, making it easier for noxious weeds to invade.

Direct and Indirect Effects of No Action

Over time, without vegetation management or wildfire, surface and canopy fuel loads would continue to increase and the potential for extreme wildfires would likely continue to rise. As discussed above, in general weeds are abundant throughout much of the project area, particularly along roads and in previously disturbed areas. Without treatment, existing noxious weed occurrences can be expected to continue to spread into disturbed areas and possibly into native ecosystems. The rate of weed spread without further disturbance from project activities would most likely be less than the rate of spread after project implementation. The exception would be if no fuel reduction occurs, and the forests experience extreme wildfire; in that case openings for weed establishment would be created, soil nutrients would be released, and weed spread may be more rapid than spread resulting from proposed fuel reduction activities.

Given the projected continuation and increase of many of the past and ongoing activities that cause soil disturbance, discussed below under Section 3.9.3, it is expected that the potential for introduction and spread of noxious weed infestations would continue to rise in the future under No Action.

3.9.2 Direct and Indirect Effects of Action Alternatives

As discussed above, in general weeds are abundant in much of the project area, including occurrences in most proposed treatment units. In fuels reduction project areas, the risk of establishment and spread of noxious weeds is highest in more heavily disturbed areas such as landing and staging areas, burned pile areas, areas with temporary road construction or road reconstruction, other areas of heavy activity, and any other areas where mineral soil is exposed.

Project activities are expected to increase risk of introduction and spread of noxious weeds. This risk is greater where: 1) weeds already occur in or near potential treatment units; 2) project activities involve use of mechanical equipment versus hand crews; 3) project activities involve prescribed fire, including broadcast burning and slash pile burning; 4) project activities involve creation of temporary or permanent skid roads, fire lines, landings, and other areas of soil disturbance; and 5) treatments would open up the forest canopy the most, as most weed species grow well in open areas.

Some treatment units are specified for manual vegetation treatment under Alternatives 1, 2, 3, and 4 (Appendix A, Table 35-Table 38), and remaining units could be treated manually or mechanically or a combination of the two. There are two possible ingress/egress routes identified (Doe Trail, 0.04 miles on NFS lands, and Wildewood Trail, 0.32 miles on NFS lands), both currently existing as trails, that could be converted to NFSR for emergency ingress/egress purposes only. Road work would be done including widening, installing gates, and cutting all trees within the 30 foot road corridor. This clearing would be approximately 3.9 acres (2.6 acres along Doe Trail, 1.3 acres along Wildewood Trail). Temporary road construction is proposed on approximately seven miles under Alternatives 1 and 2 and five miles under Alternatives 3 and 4, however specific locations of temporary roads are not determined. Reconstruction of existing roadways may occur on NFS roads throughout the project area, as needed for project activities. Skid trails would be created as needed, may occur in any unit, and would be obliterated once work is completed.

Any ground disturbance increases the possibility of invasion and establishment of nonnative plant species. Use of large mechanical equipment and creation of roads is likely to create greater disturbance than thinning by hand, and weeds can be introduced by equipment. Heavy equipment operation increases soil compaction and ground disturbance, particularly within skid trail, landing, and temporary road areas, which can increase the risk of noxious weed invasion. Road reconstruction with equipment also increases weed invasion risk due to both the additional ground disturbance and the potential of introducing weeds with equipment. Fuels treatments that leave some overstory canopy, minimize exposure of bare ground, and occur on sites that already host species capable of resprouting may be less likely to promote invasives, suggesting that patchcuts and clearcuts are more likely to promote weed establishment than thinning treatments (Erickson & White, 2007). Gibson and colleagues (Erickson & White, 2007) also found that plant communities that retain greater levels of overstory shading and litter or surface cover mitigate the risk of increasing exotic plant cover.

Overall ground disturbance is generally less in manually treated areas than in mechanically treated areas. Ground disturbance in manually treated areas is primarily related to burn pile effects. On average, in manually treated fuels reduction project areas on the BRD, there are about 17 slash piles, covering approximately 100 square feet each, created and burned per acre. In other areas with similar fuels treatments, Canada thistle is especially aggressive to invading burned pile areas, depending on the seed source, availability of light, and other conditions. These infestations usually occur within one to two years subsequent to pile burning.

Monitoring of burned slash piles in 2009 in a Canyon Lakes Ranger District fuels treatment project area showed much variation in percentages of observed slash piles invaded by noxious weeds. Weed invasion in burned piles in four units monitored ranged from 2 to 41 percent. In the two units receiving primarily thinning treatments, weed invasion occurred in about two and four percent of burned piles monitored. In the two units receiving clearcuts, weed invasion occurred in about 14 and 41 percent of burned piles monitored. These results are consistent with the increased risk of weed invasion in treatment areas that open up the canopy the most, since clearcuts open up the canopy more than thinning. Other factors that likely influenced weed invasion in burned piles monitored include weeds present before fuels treatment and methods of fuels and slash treatment, for example hand vs. mechanical.

Approximately 968 acres are proposed for prescribed broadcast burning. These areas are west of Gross Reservoir and include units south of Winiger Ridge and units south of Winiger Gulch. Overstory vegetation in the proposed broadcast burn areas is dominated by ponderosa pine, with tree cover percent ranging from about 10 to 40 percent. Understory vegetation is a mix of grasses, forbs, and shrubs. Canada thistle is widespread throughout this area, and cheatgrass is widespread especially in the eastern and southern portions of the proposed prescribed broadcast burn area. Musk thistle occurs in a few locations in small patches. In Winiger Gulch, yellow toadflax and houndstongue occur along with abundant Canada thistle. All of these weed species have the potential to be spread by prescribed broadcast burning activities, including vehicles, people, and hand line. Opening up the canopy generally favors weed species, and prescribed broadcast burning would be expected to create areas of soil disturbance favorable to weed invasion and spread. Based on known weed infestations in the area and potential for spread from prescribed burning, weeds, particularly Canada thistle and cheatgrass, would be expected to increase after prescribed broadcast burning.

Seed and straw for rehabilitation of disturbed areas such as landings can have weed seeds transported in it. Design criteria provide for use of non-agricultural materials such as wood straw or shred, or certified weed-free agricultural materials. Wood straw or other non-agricultural products are naturally weed-free and pose little to no risk of weed introduction. Agricultural products, even certified, can contain weed seeds and pose some risk of introduction. Source sites of crushed rock or gravel can become infested with noxious weeds, and seeds produced by infestations on the stockpile can be transported with the aggregate when it is hauled and placed on roads.

Studies have found that mitigation strategies may be effective. On sites that exhibit species invasions following wildfire, active intervention with herbicides or other treatments designed to control or eliminate the invasive can be highly effective (Erickson & White, 2007). Seeding treatments can increase invasives, especially when not carefully screened for purity (Erickson & White, 2007).

Project design criteria are expected to reduce the risk of weed invasion and spread under Alternatives 1, 2, 3, and 4, using feasible and prudent prevention measures including equipment inspection, avoidance and/or treatment of high priority weed infestations, use of government-furnished seed if available, and use of certified weed-free hay, straw, and mulch. Previous inventory and treatment within Winiger project units have helped to reduce or eliminate some of the highest priority noxious weed infestations in those areas, which include many of the Forsythe II project proposed treatment units. Monitoring measures provide for post-implementation monitoring of areas with the highest risk of noxious weed introduction or spread.

All action alternatives are consistent with Forest Plan direction for undesirable species. Forest Plan direction for undesirable species include the following:

- **GO 128.** *Manage undesirable vegetation, including noxious weeds, using an integrated pest management approach.*
- **ST 129.** *Control undesirable nonnative and noxious plants throughout the Forests, with priority given to new species (new to Colorado or the ARNF-PNG), and to wilderness areas.*
- **ST 130.** *Use only certified "noxious weed-free" hay or straw for feed or revegetation projects anywhere on the ARNF-PNG.*
- **ST 131.** *For all proposed projects or activities, determine the risk of noxious weed introduction or spread, and implement appropriate mitigation measures.*
- **GL 132.** *Develop a noxious-weed and pest-management program that addresses awareness, prevention, inventory, planning, treatment, monitoring, reporting, and management objectives.*
    - Priorities for controlling noxious weeds are:
        a. new invaders
        b. new areas
        c. spreading or expanding infestations
        d. existing infestations

3.9.3 Cumulative Effects of Action Alternatives

Fuels treatments on NFS and County lands have created relatively large forest openings in the West Magnolia area, north and south of Magnolia Drive east of Highway 119, and around Kelly Dahl campground. Other areas, primarily east of Highway 119, have been thinned. Clearcuts on NFS lands have become infested with noxious weeds, in many areas heavily.

All of the activities listed in Section 3.1 above have facilitated introduction and spread of invasive plants, to varying degrees, depending on disturbance size and severity and weeds already present. Cumulatively, past and ongoing activities have resulted in soil disturbance, native vegetation removal, modification of hydrology, establishment of many noxious weed infestations throughout the project area, and high risk for invasion in areas not currently occupied. Given the projected continuation and increase of many of these land uses, it is also reasonably foreseeable that the potential for introduction and spread of noxious weed infestations would continue to rise in the future.

According to the FEIS for the Forest Plan, it is reasonable to expect that, left unchecked, noxious weeds would increase at an annual rate of 10 to 15 percent. Weed management programs have been initiated or improved in recent years on the ARP, including the Boulder Ranger District, and on adjacent lands. In general, invasive plant infestations can be expected to increase over time, unless all landowners and managers dedicate sufficient resources to implement and maintain proactive, integrated weed management programs.

Under Alternatives 1, 2, 3, and 4, both direct and indirect effects would be expected to result in an increase in noxious weed infestations over time, contributing to the long term cumulative impacts of increased infestations from other past, present, and future activities. Project design criteria and a proactive weed management program would help to reduce these risks.

Chapter 4 – Consultation and Coordination

The U.S. 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

Sylvia Clark, District Ranger/Responsible Official
Cambria Armstrong, Project Lead/Fire/Fuels/Air
Bev Baker, Wildlife/Noxious Weeds
Tom Bates/Steve Popovich, Botany
Amy Odom, GIS
Eric Schroder, Soils
Carl Chambers, Hydrology
Mike Johnson, Lands/Special Uses/Minerals
Joseph Graham, Forester
Kevin Zimlinghaus, Silviculturist
Matt Henry/Jared Smith, Recreation
Kevin Colby/Erich Roeber, Landscape Architect
Chris Carroll/Matt Fairchild, Fisheries
Chris Ida, Engineering/Transportation
Reid Armstrong, Public Affairs
Sue Struthers, Archaeology
Colin Hutten, Implementation Forester
Will Briggs/Dave Buchanan, Fire Management

Federal, State, Local Agencies

Boulder County
Gilpin County
Town of Nederland
Denver Water
Colorado Parks and Wildlife
Colorado State Historic Preservation Office
Colorado State Forest Service
Boulder County Parks and Open Space
Nederland Fire Department
Lefthand Fire Department
City of Boulder
U.S. Fish and Wildlife Service

Tribes

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

Others

Colorado Forest Restoration Institute
Local Residential Developments and Associations
Colorado Congressional Delegation
Local Residents
Private Citizens
Magnolia Forest Group

Appendix A

Descriptive Treatment Tables by Unit and Alternative

Table 35. Alternative 1 – Proposed Action treatment table.

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
1	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	35	17.5
2	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	84	42
3	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	31	15.5
4	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	64	32
5	Aspen Restoration	Manual	chip and/or pile & burn	17	17
7	Aspen Restoration	Manual	chip and/or pile & burn	9	9
8	Aspen Restoration	Manual	chip and/or pile & burn	7	7
9	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	156	156
10	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	28	14
11	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	20	10
12	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	7	7
14	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	35	17.5
15	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	21	21
16	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	26	13
17	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	36	18
18	Meadow/Shrubland Restoration	Manual	chip and/or pile & burn	16	16

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
19	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	64	32
20	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	58	58
21	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	27	13.5
22	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	15	7.5
23	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	39	19.5
24	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	48	24
26	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	130	65
27	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	78	39
28	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	164	82
29	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	230	115
30	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	25	12.5
31	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	141	70.5
32	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	3	3
33	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	12	6
37	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	11	11

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
39	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	76	76
40	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	106	106
41	Meadow/Shrubland Restoration	Manual	chip and/or pile & burn	29	29
42	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	19	9.5
43	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	71	71
45	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	132	132
46	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	12	12
47	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	48	48
48	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	75	75
49	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	47	47
50	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	7	7
51	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	90	90
52	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	27	27
53	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	38	38
54	Mixed Conifer Treatment Old Growth	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	37	37

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
55	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	14	14
56	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	10	10
57	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	21	21
58	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	26	13
59	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	16	16
60	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	10	10
61	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	9	9
62	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	5	5
63	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	15	15
67	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	13	13
68	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	10	10
69	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	7	7
72	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	15	15
73	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	76	76
74	2-Staged Mixed Conifer Treatment	Manual	1) pile & burn 2) thin and pile & burn	44	44

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
75	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	18	9
76	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	16	8
77	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	269	269
78	Douglas-fir Mixed Conifer Treatment	Manual	chip and/or pile & burn	9	9
79	Mixed Conifer Treatment Old Growth	Manual	chip and/or pile & burn	5	5
80	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	11	11
81	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	12	12
82	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1
83	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.4	0.4
84	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.3	0.3
85	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1
86	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1
87	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.5	0.5
88	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.4	0.4
89	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1
90	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1
91	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1
92	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1
93	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.5	0.5
94	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1
95	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.4	0.4
96	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	2	2
97	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
98	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.3	0.3
99	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	2	2
100	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1
101	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	45	22.5
102	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	11	11
103	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	20	10
104	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	8	8
105	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	17	17
106	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	18	18
107	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	6	3
			Total Acres	**3,223.8**	**2,482.8**

Table 36. Alternative 2 – Prescription Change treatment table.

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
1	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	14	4.2
2	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	33	9.9
3	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	15	4.5
4	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	41	12.3
5	Aspen Restoration	Manual	chip and/or pile & burn	10	10
7	Aspen Restoration	Manual	chip and/or pile & burn	6	6
8	Aspen Restoration	Manual	chip and/or pile & burn	7	7
9	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	135	135
10	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	21	6.3
11	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	20	6
12	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	7	7
14	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	35	10.5
15	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	21	21
16	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	26	7.8
17	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	27	8.1
18	Meadow/Shrubland Restoration	Manual	chip and/or pile & burn	8	8

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
19	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	64	19.2
20	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	42	42
21	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	18	5.4
22	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	10	3
23	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	17	5.1
24	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	16	4.8
26	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	122	36.6
27	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	55	16.5
28	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	109	32.7
29	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	164	49.2
30	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	14	4.2
31	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	73	21.9
39	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	59	59
40	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	106	106
41	Meadow/Shrubland Restoration	Manual	chip and/or pile & burn	29	29

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
42	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	19	5.7
43	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	42	42
45	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	131	131
46	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	12	12
47	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	20	20
48	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	75	75
49	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	47	47
51	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	50	50
52	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	8	8
53	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	16	16
54	Mixed Conifer Treatment Old Growth	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	8	8
55	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	5	5
58	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	26	7.8
59	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	14	14
61	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	7	7

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
63	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	5	5
67	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	13	13
68	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	10	10
73	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	76	76
74	2-Staged Mixed Conifer Treatment	Manual	1) pile & burn 2) thin and pile & burn	44	44
75	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	14	4.2
76	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	12	3.6
77	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	259	259
80	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	8	8
81	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	12	12
82	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1
83	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.4	0.4
86	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.4	0.4
89	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.3	0.3
90	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.4	0.4
92	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.4	0.4
93	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.5	0.5
94	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.5	0.5
96	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.3	0.3

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
97	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1
98	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.3	0.3
99	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	2	2
100	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.2	0.2
101	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	39	11.7
102	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	11	11
103	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	19	5.7
104	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	8	8
105	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	12	12
106	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	18	18
107	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	5	1.5
			Total Acres	**2,376.7**	**1,657.1**

Table 37. Alternative 3 – Reduced Treatment table.

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
1	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	35	17.5
2	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	27	13.5
3	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	31	15.5
4	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	36	18
5	Aspen Restoration	Manual	chip and/or pile & burn	17	17
7	Aspen Restoration	Manual	chip and/or pile & burn	9	9
8	Aspen Restoration	Manual	chip and/or pile & burn	7	7
9	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	156	156
14	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	35	17.5
15	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	21	21
16	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	26	13
20	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	58	58
22	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	15	7.5
23	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	26	13
24	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	48	24
26	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	69	34.5

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
27	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	78	39
28	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	107	53.5
30	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	25	12.5
31	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	92	46
32	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	3	3
33	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	12	6
37	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	11	11
39	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	54	54
40	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	106	106
41	Meadow/Shrubland Restoration	Manual	chip and/or pile & burn	29	29
43	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	71	71
45	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	132	132
46	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	12	12
47	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	48	48
48	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	57	57

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
49	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	47	47
50	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	7	7
51	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	90	90
52	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	27	27
53	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	38	38
54	Mixed Conifer Treatment Old Growth	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	37	37
55	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	14	14
56	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	10	10
58	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	26	13
61	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	9	9
62	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	5	5
63	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	15	15
67	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	13	13
69	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	7	7
72	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	15	15

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
73	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	76	76
75	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	18	9
77	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	269	269
78	Douglas-fir Mixed Conifer Treatment	Manual	chip and/or pile & burn	9	9
79	Mixed Conifer Treatment Old Growth	Manual	chip and/or pile & burn	5	5
80	Douglas-fir Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	11	11
81	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	12	12
82	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1
83	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.4	0.4
84	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.3	0.3
85	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1
86	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1
87	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.5	0.5
88	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.4	0.4
89	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1
90	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1
91	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1
92	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1
93	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.5	0.5
94	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1
95	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.4	0.4
96	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	2	2
97	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
98	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	0.3	0.3
99	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	2	2
100	Regeneration Thin	Mechanical/Manual	chip and/or pile & burn	1	1
101	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	33	16.5
102	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	11	11
103	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	20	10
104	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	8	8
105	Ponderosa Pine Mixed Conifer Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	13	13
106	Aspen Restoration	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	18	18
107	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	6	3
108	Meadow/Shrubland Restoration	Manual	Chip and/or pile & burn	3	3
109	Thin from Below	Manual	Chip and/or pile & burn	61	61
110	Aspen Restoration	Manual	Chip and/or pile & burn	14	14
111	Aspen Restoration	Manual	Chip and/or pile & burn	2	2
112	Aspen Restoration	Manual	Chip and/or pile & burn	8	8
			Total Acres	**2,426.8**	**2,044.3**

Table 38. Alternative 4 – Treatment Method Change treatment table.

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
1	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	35	10.5
2	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	84	25.2
3	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	31	9.3
4	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	64	19.2
5	Aspen Restoration	Manual	chip and/or pile & burn	17	17
7	Aspen Restoration	Manual	chip and/or pile & burn	9	9
8	Aspen Restoration	Manual	chip and/or pile & burn	7	7
9	Douglas-fir Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	156	156
10	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	28	8.4
11	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	20	6
12	Douglas-fir Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	7	7
14	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	35	10.5
15	Aspen Restoration	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	21	21
16	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	26	7.8
17	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	36	10.8
18	Meadow/Shrubland Restoration	Manual	chip and/or pile & burn	16	16

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
19	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	64	19.2
20	Aspen Restoration	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	58	58
21	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	27	8.1
22	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	15	4.5
23	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	39	11.7
24	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	48	14.4
26	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	130	39
27	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	78	23.4
28	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	164	49.2
29	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	230	69
30	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	25	7.5
31	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	141	42.3
32	Aspen Restoration	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	3	3
33	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	12	3.6
37	Ponderosa Pine Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	11	11

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
39	Douglas-fir Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	76	76
40	Douglas-fir Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	106	106
41	Meadow/Shrubland Restoration	Manual	chip and/or pile & burn	29	29
42	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	19	5.7
43	Douglas-fir Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	71	71
45	Douglas-fir Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	132	132
46	Ponderosa Pine Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	12	12
47	Douglas-fir Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	48	48
48	Ponderosa Pine Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	75	75
49	Ponderosa Pine Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	47	47
50	Ponderosa Pine Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	7	7
51	Ponderosa Pine Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	90	90
52	Ponderosa Pine Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	27	27
53	Aspen Restoration	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	38	38
54	Mixed Conifer Treatment Old Growth	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	37	37

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
55	Douglas-fir Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	14	14
56	Aspen Restoration	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	10	10
57	Douglas-fir Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	21	21
58	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	26	7.8
59	Douglas-fir Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	16	16
60	Douglas-fir Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	10	10
61	Aspen Restoration	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	9	9
62	Aspen Restoration	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	5	5
63	Ponderosa Pine Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	15	15
67	Aspen Restoration	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	13	13
68	Douglas-fir Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	10	10
69	Ponderosa Pine Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	7	7
72	Douglas-fir Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	15	15
73	Ponderosa Pine Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	76	76
74	2-Staged Mixed Conifer Treatment	Manual	1) pile & burn 2) thin and pile & burn	44	44

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
75	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	18	5.4
76	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	16	4.8
77	Douglas-fir Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	269	269
78	Douglas-fir Mixed Conifer Treatment	Manual	chip and/or pile & burn	9	9
79	Mixed Conifer Treatment Old Growth	Manual	chip and/or pile & burn	5	5
80	Douglas-fir Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	11	11
81	Aspen Restoration	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	12	12
82	Regeneration Thin	Manual	chip and/or pile & burn	1	1
83	Regeneration Thin	Manual	chip and/or pile & burn	0.4	0.4
84	Regeneration Thin	Manual	chip and/or pile & burn	0.3	0.3
85	Regeneration Thin	Manual	chip and/or pile & burn	1	1
86	Regeneration Thin	Manual	chip and/or pile & burn	1	1
87	Regeneration Thin	Manual	chip and/or pile & burn	0.5	0.5
88	Regeneration Thin	Manual	chip and/or pile & burn	0.4	0.4
89	Regeneration Thin	Manual	chip and/or pile & burn	1	1
90	Regeneration Thin	Manual	chip and/or pile & burn	1	1
91	Regeneration Thin	Manual	chip and/or pile & burn	1	1
92	Regeneration Thin	Manual	chip and/or pile & burn	1	1
93	Regeneration Thin	Manual	chip and/or pile & burn	0.5	0.5
94	Regeneration Thin	Manual	chip and/or pile & burn	1	1
95	Regeneration Thin	Manual	chip and/or pile & burn	0.4	0.4
96	Regeneration Thin	Manual	chip and/or pile & burn	2	2
97	Regeneration Thin	Manual	chip and/or pile & burn	1	1

Unit Number	Vegetation Treatment	Treatment Method	Slash Treatment	Unit Acres	Treatment Acres
98	Regeneration Thin	Manual	chip and/or pile & burn	0.3	0.3
99	Regeneration Thin	Manual	chip and/or pile & burn	2	2
100	Regeneration Thin	Manual	chip and/or pile & burn	1	1
101	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	45	13.5
102	Aspen Restoration	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	11	11
103	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	20	6
104	Ponderosa Pine Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	8	8
105	Ponderosa Pine Mixed Conifer Treatment	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	17	17
106	Aspen Restoration	Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	18	18
107	Lodgepole Pine Treatment	Mechanical/Manual	Pile & burn and/or chip and/or masticate and/or remove off-site	6	1.8
			Total Acres	**3,223.8**	**2,186.4**

Appendix B
Design Criteria

In response to public comments and collaboration for this project and from analysis by the USFS, project design criteria were developed to minimize the potential impacts the action alternatives may cause. Experience has shown these project design criterion to be effective in other projects. If an action alternative is selected, the following measures would be included in project design and implementation. These design criteria will apply to all action alternatives.

All Treatment Areas

1. Following project implementation, at least 70% effective ground cover shall be maintained within mechanical and hand treatment units to lower the risk of soil erosion. Effective ground cover includes surface rock cover, pine needle cover, and cover provided by low lying vegetation and mulch.
2. In chipped areas, chip depth shall average less than 3”. Chip depth of up to 5” may occur over small areas (not to exceed 5% of the treatment unit). Chips shall be distributed in a mosaic pattern over no more than 30% of the activity area.
3. In masticated areas, chunks shall be distributed to avoid dense accumulations that could potentially impede growth of native grasses, forbs or seedlings.
4. All treatment areas will be reviewed by a USFS Landscape Architect prior to final unit layout. Unit boundaries shall be natural edges whenever possible and prevent the appearance of uniform tree spacing and straight line unit boundaries. Straight line boundaries shall be treated by ‘feathering[9]’ and ‘scalloping[10]’.
5. Minimize damage to aspen 8” DBH and larger.
6. Leave live and dead wildlife trees as individually designated by a USFS Wildlife Biologist and/or according to marking guidelines agreed to in coordination with a USFS Wildlife Biologist, Silviculturist, Fuels Planner, and prep crews. Leave trees may include trees with cavities, trees with large squirrel middens, and/or Abert’s squirrel nest trees.
7. Within treatment units where Rocky Mountain juniper occurs, leave an average of one large individual, or clump of three or more if available, Rocky Mountain Juniper per acre.
8. If a federally listed or USFS sensitive wildlife species is identified within treatment units or areas potentially impacted by proposed project activities prior to or during implementation, a USFS Wildlife Biologist will be contacted as soon as possible to ensure Forest Plan direction and Endangered Species Act requirements are met.
9. 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 USFS Wildlife Biologist will be contacted as soon as possible to ensure Forest Plan direction for nesting raptor protection are met.
10. Retain a minimum of 5 of the largest available dead trees, in clumps where available, minimum 8” DBH for lodgepole and 10” for ponderosa pine and Douglas-fir, per acre, as an average across each

[9] To ‘feather’ would be to go from a clearcut or maximum thinned density to existing stand density in 50 to 200 feet in a gradual progression.

[10] To ‘scallop’ would be to cut curvilinear edges of varying wavelength and amplitude for example, a short one followed by two long ones, and then a medium one, etc.

treatment unit. Give preference to retaining ponderosa pine snags where available. Criteria for snag selection will be specified in the silviculture prescription with emphasis on retaining the largest diameter snags present. If the minimum number of snags is not available, then the largest available live, green replacement trees will be retained for future snags.

11. Retain a minimum of 5 logs and 100 linear feet per acre of existing down logs distributed randomly across each unit, with a minimum diameter of 8” for lodgepole pine and 10” for other conifer species. Do not cut live trees to meet this criterion, except where live trees would be cut according to the prescription in lodgepole pine patchcuts and clearcuts. Jackstrawed bole wood, created by treatment, 6” in diameter or greater and left in the unit must be scattered and be in contact with the ground. Individual boles of 6” or greater can be left unbucked.

12. Within flammulated owl territories:
    a. Thin small and medium sized trees to maintain large-open grown canopies.
    b. Retain live trees, 12” DBH and greater, including on ridgelines.
    c. In riparian areas, leave all trees with existing cavities and remove conifers less than 8” DBH except those with cavities.

13. All treatment units adjacent to existing raptor nests will be resurveyed the nesting season prior to implementation. This is to ensure that the birds have not moved their nests into an active unit.

14. Buffer known roost locations for Fringed myotis bat and Townsend’s big-eared bat from treatment activities during key activity times. Prescribed burning should avoid smoke saturation of roost sites during key activity times.

15. Sensitive plant species and species of local concern locations will be determined by a USFS Botanist and designated buffers would be applied.

16. All areas potentially impacted by proposed project activities that have not been surveyed for rare plants and that contain high-quality suitable habitat for sensitive and local concern plant species will be surveyed in such habitat prior to disturbance activities.

17. To minimize risk of noxious weed introduction and spread, require all equipment to be used for ground-disturbing activities for this project (not including service trucks or other vehicles that remain on roadways) to be cleaned, i.e., free of mud, dirt, plant parts, and seeds, or other debris that could contain or hold seeds, prior to entering the project area. All wheeled or tracked vehicles, including trailers, or other equipment entering constructed temporary roads shall be cleaned prior to entry to the project area. Equipment will be considered free of soil and other debris when a visual inspection does not disclose such material. Equipment shall be re-cleaned prior to transfer from a unit where noxious weeds are known to be present into a unit where noxious weeds are not known present.

18. For known weed occurrences and for any new noxious weed infestations found in or near units prior to or during implementation of vegetation treatment, implementation personnel will coordinate with USFS District Invasive Plants Coordinator to implement appropriate prevention measures, such as avoidance, treatment of weeds prior to fuels implementation, and/or additional equipment cleaning requirements, such as between infested and uninfested units.

19. Coordinate with USFS District Invasive Plants Coordinator to locate landings, staging areas, skid trails, burn piles, and other areas of severe soil disturbance to best reduce risk of spread of invasive plants.

20. Use non-agricultural mulch materials for revegetation and sediment/erosion control. Non-agricultural products include wood straw or shred and wattles made from excelsior, wood or other non-agricultural materials.

21. To avoid damage to the Boulder Gravity Line, driving across the line shall be avoided.
22. Consultation with Denver Water Board shall occur for any project activities occurring within the FERC boundary for the Gross Reservoir Hydroelectric Project.
23. There are several utility (electric, natural gas and communication) lines within the project area. Care shall be taken when working around these lines to avoid damage to them or their infrastructure.
24. All recreation facilities (NFS roads, NFS trails, recreation sites) and infrastructure (such as gates, fences, sign kiosks, picnic tables) shall be protected from damage from all treatment activities. Any damaged facilities or infrastructure shall be repaired, replaced, or reconditioned to the level of the existing condition, or greater, to provide safe public access, as needed. Consult with Recreation Staff and/or Specialist as needed.
25. High use public access portals (such as trailheads and highly traveled trail corridors) will not be used for fuels treatment project work or long term operations unless no other alternative exists. If used, safe public access on weekends would be provided. Fuels treatment work sites would be designed in a manner to allow safe public access even when occupied. Where this is not feasible, short-term forest orders closing fuels treatment areas to public access would be implemented, as needed, to ensure public safety, protect natural resources and improve effectiveness of project area objectives. Involve the Recreation Staff and/or Specialist through planning, implementation, and monitoring as needed.
26. Public outreach and notification shall occur prior to major project activities to raise public awareness. Local agency cooperators would be notified about the duration, intensity, and potential issues for the project work.

Mechanical Treatment Areas

1. No mechanical logging equipment (e.g. feller-bunchers, skidders, etc.) shall be permitted to operate within a 100 foot buffer from the edge of the water around perennial streams[11], intermittent streams[12], lakes, ponds, wetlands, fens, or wet meadows[13]. A no mechanical treatment buffer of 328 feet (100 meters) from the edge of the water shall be established around Winiger Gulch and the unnamed southern tributary to Winiger Gulch as shown in the attached map. Activities that shall be excluded from the buffer include:
    - Mechanical fuels treatment operations using heavy equipment
    - Machine piles
    - Vehicle service and fueling areas
    - Driving tracked or wheeled machinery except along existing roads, in the southwest corner of Unit 40 and the northeast corner of Unit 74 where they overlap mapped Preble's meadow jumping mouse habitat.
2. For ephemeral streams[14], equipment shall be excluded from the stream channel, except to cross at points designated by a USFS Contract or Sale Administrator(s).

[11] Perennial Streams: Streams that carry water year round.

[12] Intermittent Streams: Streams that carry water for at least some period of time annually, sufficient to maintain a defined streambed.

[13] 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.

[14] Ephemeral Streams: Streams that carry water only during precipitation or runoff events. Ephemeral streams do have a defined streambed and do not support riparian vegetation.

3. Limit operation of heavy equipment to slopes of less than 30%. Slopes up to 40% may be considered on a site specific basis and will require evaluation by a Soils Scientist.
4. Slash take back will only be allowed on skid trails, in patchcut/clearcut units where it is needed to meet the coarse and fine woody debris retention criteria (see Patchcut/Clearcut Areas, 1a and 1b, in this document), or other areas designated as adversely impacted by a USFS Soil Scientist/Hydrologist/Contracting Officer Representative (COR)/Sale Administrator, for soil stabilization, and to a maximum depth of 18 inches.
5. A cultural resource inventory will be completed on all units that have been identified by a USFS Archaeologist in consultation with the SHPO. The survey and reports will be completed and sent to the SHPO prior to project implementation. Implementation will not begin until the SHPO has concurred with a determination of *no historic properties affected* or *no historic properties adversely affected*.
6. Sites located during the field inventory that are evaluated as eligible for the NRHP, will have a 50 foot buffer placed around the exterior site boundary. No mechanical treatment will occur within the site boundary and the 50 foot buffer. When treatment is necessary, eligible sites and the 50 foot buffer will be hand treated for hazard trees and accumulated fuel build up by hand felling trees. Slash will either be hand piled for chipping and/or bucked up by hand, and loaded onto rubber tired vehicles to be hauled to designated burn piles for burning. No thinning, pile burning, or other slash treatments will occur within these buffers unless determined to be appropriate by a USFS Archaeologist.
7. All NRHP eligible or unevaluated sites within the units proposed for mechanical treatments will be flagged on the ground for avoidance during implementation.
8. Previously undiscovered sites encountered during the course of project activities will be avoided until they can be evaluated by a USFS Archaeologist. If affected properties are discovered after project activities are completed, the USFS will document any damage and consult with SHPO and Council pursuant to the procedures in 36CFR (Code of Federal Regulations) Part 800.13(b).

Manual Treatment Areas

1. Tree cutting of conifers can occur to the edge of the stream bank for perennial, intermittent and ephemeral streams. No woody riparian vegetation (e.g. willows, alders, river birch, etc.) shall be cut. Trees shall be directionally felled away from stream channels where practicable.
2. Retain all existing down woody material 5” DBH or greater within and up to 100 feet of riparian areas. This applies to portions of Units 40 and 74 where they overlap Preble’s meadow jumping mouse habitat.
3. Lopped and scattered slash shall be removed from the stream channel of perennial, intermittent and ephemeral streams.
4. No tree cutting shall occur within wetlands, fens, or wet meadows. These features may not be mapped, and may only be discovered during unit layout.

Mixed Conifer Areas

1. Trees shall be marked as either leave trees or cut trees, whichever is most efficient, prior to any cutting.

Patchcut/Clearcut Areas

1. Retain coarse and fine woody debris (CWD and FWD) throughout clearcut/patchcut units to maintain long term soil productivity.
    a. At least 8 tons/acre of CWD[15], with preference for large diameter material (boles)
    b. At least 4 tons/acre of FWD[16]
2. Involve a USFS Wildlife Biologist during layout of patchcuts/clearcuts to determine needs for narrow areas and/or island exclusions for wildlife crossing and cover.
3. In general, locate openings away from system trails, or social trails that will be changed to system trails, once a Decision is made on the Magnolia Trails Project. A USFS Wildlife Biologist shall approve locations of patchcuts and clearcuts in the vicinity of such trails.
4. In order to meet scenery standards within the proposed patchcut/clearcut lodgepole pine dominated units, three to five uncut islands of trees must be retained within patchcut/clearcuts greater or equal to 5 acres in size. These islands shall be at least ½ acre in size and total 25% of the appropriate patchcut/clearcut area within each unit. The acreage within the islands would not decrease the number of overall acres to be cut within a designated patch/clearcut unit. For example under the proposed action in unit 11 (20 acres), 50% or 10 acres of the unit could be cut utilizing a combination of patchcut/clearcuts. To equate to a one 10-acre clearcut that is treated, the boundary of the clearcut will encompass 12.5 acres to account for the 25% acre retention to be included without changing the intent of reducing the overall acreage by 50%.

Old Growth/Effective Habitat/Interior Forest Areas

1. In Management Area 3.5, exclude vegetation treatment from inventoried or discovered lodgepole pine old growth per Forest Plan standard. Exceptions may be made if the lodgepole old growth is considered non-functional at time of implementation. This determination of functionality is to be made for the stand as a whole within the treatment unit. (See Old Growth Criteria, USDA Forest Service, 1997b).
2. Where effective habitat occurs in treatment units, unit boundaries and/or canopy cover reduction may be modified as determined by a USFS Wildlife Biologist, if needed to maintain these habitats.
3. Within mapped interior forest and within a 328 foot buffer around mapped interior forest, retain at least 40% canopy cover.
4. Retain a minimum of 5 of the largest available dead trees, minimum 8” DBH for lodgepole and 10” for ponderosa pine and Douglas-fir, per acre, as an average across old growth retention and inventoried stands within a treatment unit. Give preference to retaining ponderosa pine snags where available. Criteria for snag selection would be specified in the silviculture prescription with emphasis on retaining the largest diameter snags present. If the minimum number of snags is not available, then the largest available live, green replacement trees would be retained for future snags.

Slash Piles

1. To the extent practicable, construct machine slash piles on landings. If machine piling is done off landings, conduct piling to leave topsoil in place and to avoid displacement of topsoil. Machinery that lifts and places material into burn piles is recommended over machinery that pushes or drags material into burn piles.

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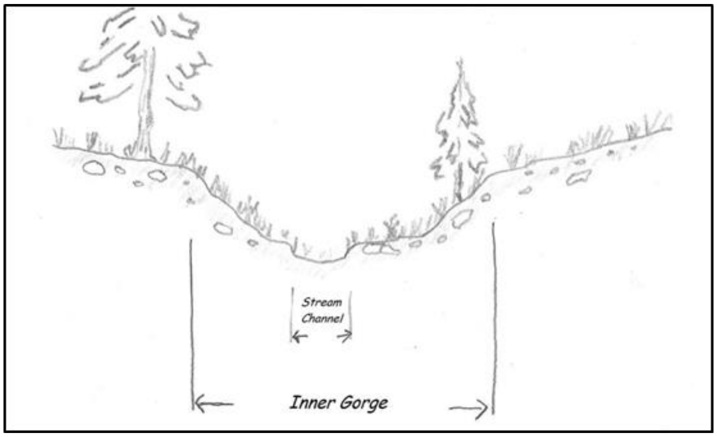
[15] Coarse woody debris is defined as material >3” in diameter

[16] Fine woody debris is defined as material <3” in diameter

2. Hand constructed burn piles shall be located at least 50 feet from perennial streams, wetlands, fens, wet meadows, and aspen stands. For intermittent and ephemeral streams, burn piles shall be located 50 feet from the stream or outside the inner gorge, whichever is less. For Preble's meadow jumping mouse, piles shall be located at least 100 feet from the edge of the water around Winiger Gulch and the unnamed southern tributary to Winiger Gulch. If it not practicable to locate piles sufficiently away from streams, or if doing so would violate other requirements (e.g. minimum spacing between piles, minimum distance from residual trees), do not cut the water adjacent trees, unless approved by a USFS Soil Scientist, Hydrologist, or Fish Biologist.



Inner Gorge: Many streams exhibit a sharp increase in slope as the stream channel is approached. The first sharp break in slope on either side of the stream defines the inner gorge.

3. To minimize long term effects of pile burning, watershed, botany and/or implementation personnel will conduct surveys to identify if and where burn pile restoration actions are needed following pile burning activities. Any combination of the following restoration actions will be recommended if/where needed:
   a. Tilling/scarifying after burning to promote recovery by breaking up water repellent layers, increasing water infiltration, and mixing in organic material from areas adjacent to the pile.
   b. Weed treatments
   c. Seeding
   d. Covering with litter, duff and/or slash

4. Burn piles should be located out of sight of major viewpoints as designated by a USFS Landscape Architect whenever possible within the constraints of the contract.

5. In treatment units where slash is piled by hand, leave an average of 2 piles per acre for wildlife habitat, including any piles remaining from previous vegetation treatment, distributed randomly throughout the unit.

6. Minimum pile size, hand or machine created, shall be no less than 6 feet high by 6 feet wide.

7. Consult USFS Fuels Specialist during contract preparation for current maximum pile size and pile separation requirements as regulated by the Colorado Air Pollution Control Division.

8. Piles shall be constructed in a manner to minimize large air spaces and dirt within the piles. Piles shall not have material extending more than 4 feet in any direction beyond the pile perimeter and a minimum of 4 feet of separation from pile perimeter to surrounding down woody material to reduce unwanted fire spread.

9. Construct a minimum of a 6 foot wide control line, down to bare mineral soil, around each machine pile to create separation between piled material and surrounding slash mat. If piles are grouped, a single control line may be placed around the entire group rather than around individual piles. The scraped material must be moved outward to avoid a berm adjacent to the piles' edge.

10. In machine units, reasonably gather and place activity slash material, 1" to 6" diameter, into piles. If more than 50% of a treatment unit has continuous slash depth greater than 6" after initial treatment, additional piling would be required.

11. In hand units, pile sound, existing and/or created slash material, 1" to 6" diameter and 2 feet or longer. Alternatively, any slash that must be moved more than 50 feet to meet minimum required pile size may be lopped and scattered to a maximum depth of 18".

12. Locate machine piles a minimum of 150 feet and hand piles a minimum of 50 feet from any infrastructure or private property boundary.

Broadcast Burning

1. Limit total unrecovered burned area within the project area to no more than 340 acres.

2. Design and implement prescribed fire for low soil burn severity effects and rapid recovery[17] of ground cover. Soil burn severity classes are defined in the Field Guide for Mapping Soil Burn Severity (http://www.fs.fed.us/rm/pubs/rmrs_gtr243.pdf).

3. Rehabilitate constructed fire lines by installing water bars, raking topsoil back over the line, covering with slash or other mulch materials; and seeding, if recommended by a USFS Botanist.

4. A 300 foot buffer shall be established around Winiger Gulch and the unnamed southern tributary to Winiger Gulch as shown in the attached map. No active ignition shall occur within the buffer. Fire will be allowed to back down into riparian areas and streamside zones. If needed to accomplish burn objectives or to provide for safety, establishment of control features (e.g. fire lines) or active ignition may occur within the buffer following consultation and agreement with a USFS Fish Biologist, Soil Scientist or Hydrologist.

5. Conduct burning operations so that no more than 10% of either stream bank area within riparian zones burns with high intensity (i.e. top kill of willow and/or aspen). Actively suppress fire if this 10% threshold is exceeded.

6. No active ignition shall occur within 25 feet of ephemeral streams.

7. In prescribed burn Units 38 and 44, choose individuals or clumps of three or more, if available, Rocky Mountain juniper to leave that are not ladder fuels for other conifers 12"+ DBH. Leave trees shall be at least 300 feet away from property boundaries and prescribed burn containment lines.

8. Prior to prescribed burning in Units 38 and 44 within inventoried old growth, old growth retention, and identified old growth development areas, remove ladder fuels from around trees 12" DBH and larger to minimize fire moving into crowns of these larger trees. Where feasible, such as near firelines during mopup, moisten coarse woody material within root zones of trees 12" DBH and larger, to minimize root damage from smoldering material.

[17] An unrecovered burn is one that has insufficient ground cover to reduce runoff, erosion, and sedimentation rates to pre-burn conditions. Typical recovery time is 2-4 years, but is highly variable with vegetation type and precipitation.

9. Prior to prescribed burning in Units 38 and 44, scratch fireline around and/or use other techniques to minimize fire impacts to at least 5 logs per acre totaling at least 100 linear feet. These logs should have a minimum diameter of ten inches if available, or largest down logs available.
10. A cultural resource inventory will be completed on all areas within prescribed burn units that have been identified by a USFS Archaeologist in consultation with the SHPO. This inventory may be completed after the NEPA decision has been made but prior to burn implementation.
11. All NRHP eligible or unevaluated sites located within prescribed burn units will be marked on the ground by the Project Archaeologist. A USFS Archaeologist and Fire Staff will design protection measures to remove the sites from the burn's Area of Potential Effects. These protection measures will 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.
12. All potentially ground-disturbing fire lines, staging areas, helispots, and all road improvement, construction or deconstruction, or designated ATV or vehicle routes/ways will be intensively (Class III) surveyed for cultural resources prior to project implementation; any NRHP-eligible cultural resources will be avoided by project design.

Timing Restrictions

1. Avoid treatment operations from May 1 through August 10 in flammulated owl territories. Avoidance areas will be determined by a USFS Wildlife Biologist based on survey results, flammulated owl territory size, topography, and vegetation. Prescribed burning operations may be conducted if determined to be appropriate by a USFS Wildlife Biologist. This applies to most units in the Winiger Ridge and South Winiger areas, and may apply to other areas if appropriate based on survey results.
2. Raptor nest areas, including species-specific buffers, will generally have no treatment activity from March 1 through September 15, depending on species, or until determined unoccupied by the USFS Wildlife Biologist. Access through buffers during this period will be assessed by a USFS Wildlife Biologist.
    a. If known nests become unoccupied, additional surveys will be conducted during the breeding season prior to any project activity. The extent and timing of surveys will be determined by a USFS Wildlife Biologist.
    b. Units with suitable nest habitat will also be resurveyed for new nest locations prior to implementation. If a new active nest is detected during surveys or becomes known by other means, appropriate mitigations will be implemented.
    c. For northern goshawk nests including alternate nest sites, exclude treatment in up to a 30-acre area containing the nest tree. Site-specific exclusion areas will be determined by a USFS Wildlife Biologist based on topography, vegetation and other factors. Outside of the breeding season, generally from September 16 through February 28, limited thinning may be allowed within this area if determined necessary to help reduce the risk of losing the nest site to wildfire. A USFS Wildlife Biologist will help design and approve treatment.
3. Unless a site-specific exception is determined to be appropriate by a USFS Wildlife Biologist, avoid treatment from December 1 through March 30 in elk severe winter range and winter concentration areas. These areas are based on the most current available mapping data from Colorado Parks and Wildlife.
4. Project operations will not be conducted on Memorial Day, 4th of July and Labor Day holiday weekends and on Sundays. Operating times for heavy equipment and chainsaws shall be limited to the hours of 7 a.m. to 7 p.m.

5. Piles outside the 100 foot riparian buffer but within 328 feet of the stream channel may only be burned from November 1 through April 30 during Preble's meadow jumping mouse hibernation. This applies to Units 40 and 74.

Roads/Skid Trails/Temp Roads/Landings/Equipment Use

1. Temporary roads, skid trails, landing areas, and equipment use in mechanical treatment units shall be subject to operating equipment restrictions to protect soil and water. Operate heavy equipment only when soil moisture in the upper 6 inches is below the plastic limit (a ball can be formed in the fist that holds together on gentle tossing or shaking) OR protected by at least one foot of packed snow or 2 inches of frozen soil. This may mean temporary restriction on equipment operation and travel within the treatment area in periods of heavy rains and snow or when soils are wet.

2. The USFS shall approve locations of skid trails and landings prior to treatment. Re-use existing skid trails as much as practicable to minimize new disturbance. Within mapped effective habitat, a USFS Wildlife Biologist will approve locations of skid trails and landings.

3. All temporary road construction, including skid trails, shall be obliterated within one year of completion of use, including pile burning. Project implementation, watershed, soil, and engineering personnel shall cooperate to determine appropriate obliteration methods.

    a. Temporary road surfaces, including skid trails and landings, shall be decompacted along the entire road/skid trail length or landing area unless waived by Soil Scientist. Roads that were constructed with cut and fill shall be partially or fully recontoured or pitted. Roads that were constructed on the natural ground contour shall be pitted, subsoiled, or ripped.

        - Partial recontouring of the road prisms shall be utilized in areas where it is not feasible or beneficial to disturb soils previously unaffected by construction operations to stabilize a decommissioned temporary road. Factors such as steep slopes, large amounts of rock, or vegetation may impact a decision to utilize partial recontouring. Partial recontouring shall use available fill material from original construction. Fills shall be returned to, and compacted into, the cut removal area. No further ground disturbance involving cutting material shall occur. Handle soil to ensure that minimal segregation of materials occurs. Compaction may be by machine track or bucket. The recontoured surface shall be outsloped a minimum of 5% for the entire road prism width and no berms shall remain. Finished grades shall minimize drainage following the contour of the road, where necessary grade dips shall be installed along the grade to direct drainage off the disturbed area. Where high cut slopes are present, continue pulling up fill material and backfilling cut removal areas until no cut slope remains greater than 1:1 H:V in slope and two feet in height.
        - Full recontouring of the road prisms shall be utilized in decommissioning temporary road segments where it is both feasible and advantageous to disturb soil previously unaffected by construction operations to completely recontour the road. Full recontouring shall include pull up of all fill material and place/compact into the cut removal area. Very little disturbance of the natural ground under the fill shall occur. The final slope area, over the entire width of the road prism, shall reproduce the pre-road natural slope. It shall blend in with the surrounding slope and no berms or windrows of any material shall remain.

    b. Where applicable, remove all temporary stream crossings and restore stream bed and banks.

    c. Restore natural drainage patterns across the road template.

   d. Provide effective closure at junctions with open roads and NFS trails to prevent unauthorized use. Effective closure techniques may include recontouring or pitting for site distance, fencing, gates, berms, barrier rocks of various sizes (median size of 2.5 ft. x 2.5 ft. x 2.5 ft. [1 ton], grouped in natural arrangements and 1/3-1/2 buried), plantings, and/or felled trees.
   e. Scatter slash on restored disturbance.
   f. Restore ground cover using native seed or plants, methods and timing, and soil amendments as practicable to meet revegetation objectives and in consultation with a USFS Botany Representative. Use government furnished seed when available.

4. Vegetation treatment implementation and related contracting will incorporate use of existing and/or previously used areas as much as possible for fuels treatment operations, in order to reduce the amount of new disturbance which usually leads to new “social” routes being created. Any non-system roads which are used for access to fuels treatment units shall be considered to be temporary roads and shall be obliterated following the design criteria for temporary roads.
5. Where topsoil depth exceeds 2”, topsoil shall be salvaged and stockpiled from all areas to be disturbed by construction of temporary roads and road improvements and shall be incorporated into the reclamation.
6. Temporary road construction shall be kept to the minimum construction possible to accommodate intended use and shall meet the following guideline.
   a. Roads shall not follow fall line of the land but shall traverse contours to minimize slopes. Generally, slopes of 10 percent or less shall be maintained, however reaches of 200 feet or less may be up to 14 percent in slope.
   b. Road alignment shall be selected to minimize cuts and fills to 2-foot maximum.
   c. Road widths shall be the minimum required for the equipment and shall not exceed 15 feet.
   d. Roads shall be outsloped where possible and rolling dips shall be constructed instead of ditches and culverts, wherever practicable, as necessary to control sediment and erosion. Drainage features shall not drain directly into streams. Best Management Practices shall be employed at the termination of drainage features to protect vegetation from sedimentation.
7. Construction of permanent and temporary roads and road improvements shall to the extent possible minimize ground disturbance, avoid crossings of drainages, provide buffers to drainages and sensitive areas, avoid steep slopes, avoid wet areas and swale bottoms, avoid unstable slopes, and shall minimize erosion potential and sedimentation of water ways.
8. If material will be imported for road base or other uses, developed borrow sources or pit-run material sources will be inspected for weeds, weed parts or weed seeds by either a USFS employee or other party approved by the USFS. Aggregate base or riprap sourced from commercial pits does not need to be inspected.
9. Planning, construction and maintenance of permanent and temporary roads shall include sediment and erosion controls as necessary to prevent resource damage. Such controls are to be maintained and supplemented as necessary through the life of the project.
10. Prior to the construction on NFS land of any egress route from Big Springs subdivision, the Forest shall approve locations, plans, best management practices, storm water management plans, and any other plans necessary to protect NFS lands and resources. Resource protection measures shall be installed and maintained during construction and for a sufficient time after construction until the site has stabilized.

11. System roads shall not be used during winter and wet periods when there is a reduction in the ability of the road or road structure to support traffic, provide drainage, or provide safe transportation. Examples of reduction in the support value or safety of the roadway include, but are not limited to, soil, mud, debris, or oversized rocks incorporated into the roadway that affect drainage, normal maintenance activities, or the strength of the surface structure; intermixing of slash or subgrade soil with aggregate base; severe alteration of drainage that leads to surface aggregate loss, changes in character of ditches or drainage structures, or concentration of water that harms streams or water sources; accelerated breakdown of asphalt surfaces.

    If removal of snow from system roads for winter operations is allowed, provide adequate maintenance to maintain the road surface structure, drainage of the roadway, and safe passage for vehicles.

    Snow storage areas shall be approved by the USFS. Avoid riparian areas, wetlands or streams for snow storage to the extent possible.

    Space, construct, and maintain drainage holes in the dike of snow or berm caused by snow removal operations. Place drain holes to obtain surface drainage without discharging on erodible fills.

    Perform maintenance work in a manner to preserve and protect roads and appurtenances, and prevent erosion damage to streams and other Forest values.

    Any type of equipment to remove snow may be utilized provided:

    a. The equipment is of the size and type commonly used to remove snow and would not cause damage to the road surface or structure.
    b. The use of plows or dozers to remove snow requires written approval by the USFS. Equip plows or dozers with shoes or runners to keep the dozer blade a minimum of 2 inches above the road surface.

12. Existing road conditions shall be assessed prior to implementation for all roads to be used for the project including County and private roads used to access National Forest lands. Roads shall be maintained in their existing condition through-out the project, if any widening or other improvements are required for the project these improvements shall be assessed at the completion of the project to determine if they are acceptable or need to be removed.

13. When the work is complete the existing roads shall be inventoried to ensure drainage is operational and road surface is intact.

14. Unless the condition of an existing road is suitable for truck and trailer traffic, mechanized equipment shall be ‘walked’ (travel under its own power as opposed to transported on a trailer) into any units where mechanical treatments is planned.

15. Coordinate all work and traffic that impacts County roads, including hauling, with the County ahead of the work commencing. Obtain County permits as necessary.

16. Coordinate with road users, who will be impacted by the work, obtain access as necessary and contact information for any temporary closures or other coordination.

17. All roads impacted by project activities shall have warning signs and traffic control as follows:
    a. In accordance with the "Manual of Uniform Traffic Control Devices."
    b. Maintained for through traffic during felling, slash treatment, and/or removal operations.
    c. Left in an operational condition that would adequately accommodate traffic at the end of each work day.
    d. Have barricades erected and/or proper signs placed at any traffic hazards in or adjacent to the road at the end of each workday.
    e. All felled trees shall be decked or removed and slash piled or removed from the bladed, mowed, or brushed road corridor each day.
18. Linear woody material designated to remain from roadway clearing activities shall be placed outside the clearing limits in close contact with, and perpendicular to, the slope. All other available organic and inorganic debris shall be scattered evenly outside of the clearing limits.
19. Roads which have been authorized for private uses should remain available to those uses to the greatest extent possible. Any deterioration of the road should be repaired to a similar or better condition than before project activities occurred.
20. 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 terrain to use the vehicle (four-wheel drive or all-terrain vehicles included). These areas will be protected from further encroachment of motorized vehicles by creating a buffer zone of no treatment or modification of treatment between the road, open for motorized travel, and the treatment area by installing fencing or other barriers made from natural materials (rock or wood). Buffer zones should be wide enough (minimum of 100 feet from edge of road) to discourage attempts at creating new routes. These areas will be identified with input from Recreation Staff and unit layout personnel prior to final unit boundary designation.
21. NRHP eligible sites located during the field inventory will have a 50 foot buffer established around the exterior boundary of the site. No construction activities will take place within the site and the 50 foot buffer area.
22. All potentially ground-disturbing activities proposed for staging areas, road improvement, construction, or obliteration outside of planned treatment units will be intensively surveyed for cultural resources prior to project implementation. Any NRHP-eligible cultural resources will be avoided by project design.
23. Consultation with Native American tribes must be completed prior to the closure of roads to ensure that access to areas of cultural importance is not inadvertently removed.

Appendix C
Proposed Forest Plan Amendment

Forest Service Direction for Amending Forest Plans

The U.S. Forest Service requirements for amending forest plans are included in agency regulations and policies. These require that proposed activities be consistent with forest plans and that proposed activities which may be in conflict with the Forest Plan either be denied, modified (so as to be consistent), or that the Forest Plan be amended. The USFS is authorized to implement amendments to forest plans in response to changing needs and opportunities, information identified during project analysis, or the results of monitoring and evaluation. The process to consider Forest Plan Amendments, review them for significance, document results, and reach a decision is contained in 36 CFR 219.17(b)(2) and FSM 1926.5.

If the responsible official determines that a Forest Plan Amendment is appropriate and necessary, regulations direct the USFS to consider whether a proposed amendment to a forest plan would be considered a significant change.

The USFS is authorized to implement amendments to forest plans in response to changing needs and opportunities, information identified during project analysis, or the results of monitoring and evaluation. The process to consider Forest Plan Amendments, review them for significance, document results, and reach a decision is contained in FSM 1926. An assessment of a proposed amendment's significance in the context of the larger Forest Plan is a crucial part to the process. It is important to note that the definition of significance for amending a forest plan is not the same significance as defined by NEPA. Under NEPA, significance is determined by whether a proposal is considered to be a "major federal action significantly affecting the quality of the human environment," or whether the relative severity of the environmental impacts would be significant based on their context and intensity[18].

In contrast, the National Forest Management Act requires that proposed Forest Plan Amendments be evaluated for whether they would constitute a significant change in the long-term goods, outputs, and services projected for an entire National Forest. Amendments that are not significant may be adopted following disclosure and notification in an environmental document, such as an EA, EIS, or a supplement to one of these documents.

The criteria to analyze the significance of a Forest Plan Amendment are summarized below. Each of the four criteria for determining significance of the proposed amendment is responded to directly in the next section.

1. Timing. When the change in the Forest Plan would take place relative to the planning period and scheduled revisions of the plan.
2. Location and size. Location and size of the area affected compared to the size for the overall planning area.
3. Goals, Objectives, and Outputs. How, or to what degree, the amendment would affect the long-term relationship between levels of goods and services projected by the Forest Plan.
4. Management Prescription. Whether the change would apply only to a specific situation, or to future situations across the planning area.

[18] 40 CFR 1502.3; 40 CFR 1508.27

Proposed Amendment to the ARP Land and Resource Management Plan

Forest Plan Goad 95 states, *Retain the integrity of effective habitat areas* (p. 30) and Forest Plan Standard 2 under Management Area 3.5 states, *Maintain or increase habitat effectiveness, except where new access is required by law* (p. 359). A non-significant Forest Plan Amendment is proposed to remove the applicability of this goal and standard for effective habitat within the Forsythe II project boundary for Alternatives 1-4. Alternatives 1-4 would reduce effective habitat and therefore, would not meet this goal and standard.

Based on data used for the Forest Plan, mapped effective habitat occurred in the project area as of the 1997 Forest Plan. The Forest Plan developed in the mid-1990s, listed the percentages of effective habitat by Geographic Area (Forest Plan FEIS Appendix B (pg. 15-16). The Geographic Areas, which partially occur in the Forsythe II project area, were between 41% - 59% (Table 27 of this EA). However, current effective habitat in all four geographic areas is estimated to be lower than Forest Plan percentages due to changes in the project area since 1997. These changes on NFS lands are due to increased private home development (construction of roads accessing private lands); increasing recreation use (development of unauthorized social trails); changed vegetation conditions (including hazardous fuels vegetation treatments, natural and human caused fires, etc.). Fuels treatments, particularly patchcuts and clearcuts, can reduce effective habitat when they are located near roads or trails.

The alternatives were reviewed for consistency with Forest Plan standards and guidelines, as well as the four criteria to analyze the significance of a Forest Plan Amendment.

Alternatives 1-4

Alternatives 1-4 would decrease the effective habitat from the existing condition and therefore would not meet the intent of the Forest Plan Goal 95 nor meet Standard 2 because the proposed activities would likely further reduce effective habitat based on reduction in canopy closure from thinning, patchcuts, and clearcuts where they are in close proximity to roads or trails. Some effective habitat reductions from fuels treatments would be expected to return to functioning as effective habitat in the long-term as trees grow back, depending on human activity.

Four criteria were used for determining significance of the proposed amendment for these four alternatives is responded to directly.

1. Timing. When the change in the Forest Plan would take place relative to the planning period and scheduled revisions of the plan.

   The ARP is not currently undertaking a formal Forest Plan revision process. Because the completion of the Forest Plan revision process is not imminent and the last Forest Plan revision was approximately 19 years ago, this non-significant Forest Plan Amendment is being proposed at an appropriate time. In addition, guidance states that in most cases, the later the change, the less likely it is to be significant to the current forest plan. The current Forest Plan was authorized in 1997; this amendment would help keep management within the plan consistent with current planning in this area. This change would take place during this planning period.

2. Location and Size. Location and size of the area affected compared to the size for the overall planning area.

   The ARP includes approximately 2 million acres of forests and grassland in north central Colorado. This proposed site-specific amendment would pertain to the NFS lands within the 18,954 acre Forsythe II project area.

3. Goals, Objectives, and Outputs. How, or to what degree, the amendment would affect the long-term relationship between levels of goods and services projected by the Forest Plan.

   The proposed site specific amendment would not affect the long-term relationship between levels of goods and services projected by the Forest Plan.

4. Management Prescription. Whether the change would apply only to a specific situation, or to future situations across the planning area.

   The proposed amendment would apply only to the NFS lands within the 18,954 acre Forsythe II project area.

For these reasons, the proposed Forest Plan Amendment to the goal and standard is a non-significant amendment to the Forest Plan.

Appendix D
Road Actions

The following table lists the proposed road actions as shown in Figure 6. Map of Proposed Road Actions for All Action Alternatives.

Road Number	Road Action	Miles
68.2E	Decommission	0.11
68.2F	Decommission	0.13
97.1	Administrative Use Only	2.33
201.1B	Decommission	0.02
201.1C	Decommission	0.26
302.1F	Decommission	0.07
302.1G	Decommission	0.17
302.1H	Decommission	0.21
348.1A	Decommission	0.09
348.1C	Decommission	0.22
349.1A	Decommission	0.28
350.1	Decommission	0.07
351.1	Decommission	0.65
352.1A	Decommission	0.04
356.1B	Decommission	0.05
356.1C	Decommission	0.11
356.1D	Decommission	0.14
356.1E	Decommission	0.10
359.1C	Decommission	0.25
359.1D	Decommission	0.26
359.1E	Decommission	0.11
359.1F	Decommission	0.19
359.1F	Decommission	0.17
359.1I	Decommission	0.49
359.1J	Decommission	0.23
359.1K	Decommission	0.24
359.1L	Decommission	0.51
359.1Q	Decommission	0.21
359.1R	Decommission	0.11
359.1S	Decommission	0.05
359.1T	Decommission	0.21
3W72.0	Decommission	0.10
4W72.0	Decommission	0.15
68.2E	Decommission	0.11
Total Miles to Decommission		**6.03**
Total Miles to Convert to Administrative Use Only		**2.33**
Total Road Action Miles		**8.36**

Appendix E

Glossary of Terms

The following terms appear throughout the Forsythe II Environmental Assessment document and are provided for clarification.

Active Crown Fire (AC): Also called a running or continuous crown fire, are when the entire surface/canopy fuel complex becomes involved, but the crowning phase remains dependent on heat from the surface fuels for continued spread. Characterized by a solid wall of flame extending from the fuel bed surface through the top of the canopy.

Age Class: Groups of trees or shrubs approximately the same age.

Aspen Clone: Analogous to aspen 'stand' and aspen 'community'. Unique habitat occupied by aspen.

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 such as a result of a wildland fire disturbance event.

Basal Area (BA): Common term used to describe the average amount of an area (usually an acre) occupied by tree stems. The total cross-sectional area of a stand of trees measured at breast height (4.5 feet) and expressed in square feet per acre.

Biological Diversity (biodiversity): The full variety of life in an area including the ecosystems, plant, and animal communities; species and genes; and the processes through which individual organisms interact with one another and with their environments.

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.

Canopy: The extent of the outer layer of leaves of an individual tree or group of trees.

Canopy Closure: The percentage of the ground and/or sky covered by vegetation and/or branches.

Canopy Fuels: The live and dead foliage, live and dead branches, and lichen of trees and tall shrubs that lie above the surface fuels.

Canopy Layer: Cover by vegetation and branches in different height intervals. These intervals are often defined in terms of vegetation, such as herbaceous or grass/forbs less than two feet tall, shrubs less than six feet tall, and overstory greater than six feet tall.

Chipping: The process of reducing larger woody material into smaller pieces using a wood chipper machine.

Clearcut: A forestry or logging practice in which most or all trees in an area are uniformly cut down.

Closed Canopy Forest: A condition in which the crowns or canopies of individual trees overlap to form a virtually continuous canopy layer.

Common Stand Exams (CSE): Inventory plots installed to collect stand data and information.

Community Wildfire Protection Plan (CWPP): 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 with 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 one or more at-risk communities and essential infrastructure; and

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

Condition Class: 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.

Conditional Crown Fire (CC): A potential type of fire in which conditions for sustained active crown fire spread are met but conditions for crown fire initiation are not.

Conifer: Cone-bearing trees, mostly evergreen, such as pine, spruce, fir, and juniper.

Control Feature: A term for used to describe all constructed or natural barriers and treated fire edges used to control a fire.

Course Woody Debris (CWD): Material >3 inches in diameter.

Cover Type: The vegetative species that dominates a site. Cover types are named for one plant species or non-vegetated condition presently (not potentially) dominant, using canopy or foliage cover as the measure of dominance. In several cases, sites with different species dominant have been lumped together into one cover type; co-dominance is not necessarily implied.

Crown: The upper part of a tree or other woody plant carrying the main branch system and foliage and surmounting at the crown base a more or less clean stem.

Crown/Canopy Bulk Density: A relative measurement of the total crown area compared to the overall land area in a given area.

Crown Density: The thickness both spatially in depth and in closeness of growth of an individual crown, such as its opacity as measured by its shade density.

Crown Height: For a standing tree, crown height is the vertical distance from ground level to the base of the crown, measured either to the lowest live branch-whorl or to the lowest live branch, excluding shoots arising spontaneously from buds on the stem of a woody plant or to a point halfway between.

Crowning Index: The open wind speed at which active crown fire is possible for the specified fire environment (surface and canopy fuel characteristics – i.e. fuel model, wind speed and direction, relative humidity, and slope steepness). When wind speeds are greater than the crowning index an active crown fire can be expected.

Crown Ratio: The ratio of live crown length to total tree height.

Decommission (Roads): The reclamation and/or restoration of the land occupied by a road prism that is no longer needed or desired.

Defensible Space: 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.

Design Criteria: Features included in project design to avoid or minimize impacts to resources.

Desired Future Condition: A portrayal of the land or resource conditions that are expected to result if goals and objectives are fully achieved.

Diameter at Breast Height (DBH): The diameter of a standing tree at a point 4.5 feet from ground level.

Diversity: Refers to the distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan (LMRP). This term is derived from the National Forest Management Act.

Effective Habitat: Mostly undisturbed habitat, which is buffered from regularly used roads and trails, including both motorized and non-motorized travel. Buffer distances vary based on vegetation cover and topography.

Endangered Species: Any species in danger of extinction throughout all or a significant portion of its range and that the appropriate Secretary (of the Interior or Commerce) has designated as an endangered species (USDA Forest Service, 2016).

Ephemeral Streams: Streams that carry water only during precipitation or runoff events. Ephemeral streams do not have a defined streambed and do not support riparian vegetation.

Fine Woody Debris (FWD): Material <3 inches in diameter.

Fire Frequency: A term referring to the recurrence of fire in a given area over time.

Fire Hazard: A fuel complex, defined by volume, type condition, arrangement, and location that determines the degree of ease of ignition and of resistance to control.

Fire Regime: Description of the patterns of fire occurrences, frequency, size, severity, and sometimes vegetation and fire effects as well, in a given area or ecosystem. A fire regime is a generalization based on fire histories at individual sites. Fire regimes can often be described as cycles because some parts of the histories usually get repeated, and the repetitions can be counted and measured, such as fire return interval.

Fire Return Interval: The number of years between two successive fire events for a given area; also referred to as fire-free interval or fire-return interval.

Fire Risk: The chance of fire starting, as determined by the presence and activity of causative agents, a causative agent, and a number related to the potential number of firebrands to which a given area will be exposed during the rating day (National Fire Danger Rating System).

Fire Severity: Degree to which a site has been altered or disrupted by fire; loosely, a product of fire intensity and residence time.

Forest Plan Components:

- **Goals (GO):** Describes desired end-results and are normally expressed in broad general terms. Forest Plan goals link broad agency goals as set forth by law, executive order, regulation, agency directives and the Resource Planning Act (RPA) program (USDA Forest Service, 1997a).
- **Objectives:** Are concise statements of measurable, desired results intended to promote achievement of *Forest Plan* goals (USDA Forest Service, 1997a).
- **Standards (ST):** Defined as courses of action or levels of attainment required to achieve goals and objectives. Standards are mandatory and deviation from them is not permissible without an amendment to the *Forest Plan* (USDA Forest Service, 1997a).
- **Guidelines (GL):** Defined as preferred or advisable courses of action or levels of attainment designed to achieve the goals and objectives. When deviation from a guideline is necessary, it will be documented during the project-level analysis (USDA Forest Service, 1997a).

Fuel Breaks: Generally wide strips of land 60 to 1,000 feet in width on which native vegetation has been modified so that fires burning into them can be more readily controlled. Some fuel breaks contain fire lines such as road or hand lines that can be widened.

Fuel Continuity: Degree or extent of continuous or uninterrupted distribution of fuel particles (surface or aerial) in a fuel bed that affects a fire's ability to sustain combustion and spread.

Fuel Hazard: The percent canopy cover, tree/shrub/forb/grass species, and the presence of ladder fuels.

Fuel Loading: The volume of the available or burnable fuels in a specified area, usually expressed in tons per acre.

Fuel Treatment: Any manipulation or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control, including lopping, chipping, crushing, piling, and burning.

Fuels: The organic materials that will support the start and spread of a fire: duff, litter, grass, weeds, forbs, brush, trees, and dead woody materials.

Fuelwood: Material collected that is utilized for burning.

Group Selection: An uneven-aged silviculture method where trees are removed and new age classes are established in small groups.

Healthy Forests Restoration Act (HFRA) 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.

Heterogeneous: A complex mixture of multiple stands that are dissimilar from one another with both horizontal and vertical structure diversity across a landscape.

High Soil Burn Severity: All or nearly all of the pre-fire ground cover and surface organic matter (litter, duff, and fine roots) is generally consumed, and charring may be visible on larger roots. The prevailing color of the site is often "black" due to extensive charring. Bare soil or ash is exposed and susceptible to erosion, and aggregate structure may be less stable. White or gray ash (up to several centimeters in depth) indicates that considerable ground cover or fuels were consumed. Sometimes very large tree roots (> 3 inches or 8 cm diameter) are entirely burned extending from a charred stump hole. Soil is often gray, orange, or reddish at the ground surface where large fuels were concentrated and consumed.

Historical Range of Variability: The change over time and space in the ecological condition of potential natural vegetation types and the ecological processes that shape those types.

Homogeneous: A stand of trees in a contiguous area or across a landscape that have a common set of characteristics and similar forest structure.

Individual Tree Selection (free thinning): The removal of individual trees based on project objectives.

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 sizable forest openings, and also from human disturbances along regularly used roads and trails. Interior forests occur exclusively within effective habitat but are smaller in area because they are free from the influence of adjacent openings.

Intermittent Streams: Streams that carry water for at least some period of time annually, sufficient to maintain a defined streambed.

Invasive Plants: An alien plant species whose introduction does or is likely to cause economic or environmental harm or harm to human health (Clinton, 1999).

Ladder Fuel: Fuels which provide vertical continuity between strata, thereby allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease. They help initiate and assure the continuation of crowning.

Landscape Character: The combination of physical, biological and cultural attributes that gives an area its visual and cultural identity. Each attribute contributes to the uniqueness of the landscape and gives a particular place meaning and value and helps to define a "sense of place". Landscape character provides a frame of reference from which to determine scenic attractiveness and to measure scenic integrity and scenic sustainability.

Landscape Visibility: Addresses the relative importance and sensitivity of what is seen and perceived in the landscape. It is a function of many important and interconnected considerations such as number and *context of viewers*, *duration of views*, *degree of discernable detail* (which depends in part on the position of the viewer, i.e. the landscape may be *superior*, *level with* or *inferior*) and *seasonal variation*. Landscape visibility inventory and analysis consists of three elements, including travel ways and use areas, concern levels and distance zones.

- **Travel Ways and Use Areas:** These are identified and classified to determine which observer positions would be most relevant and useful in the landscape visibility analysis. Travel ways represent linear concentrations of public viewings, including highways, roads, trails, rivers and other waterways. Use areas are spots that receive concentrated public viewing such as vista points, trailheads, campgrounds, resorts, ski areas, as well as towns, subdivisions, private land or other public lands within or adjacent to national forests.
- **Concern Levels:** This assists in scenic inventory and analysis by ranking this importance according to public opinion. There are three concern levels. The type of area and the level of use is an adequate indicator in discerning the level of interest people are likely to have about the forest scenery.

- **Distance Zones:** The concept of distance and visual impact. Increasing the distance from an observer to an activity reduces the apparent impact and ability to identify details on the activity area. A visible activity is considered to be in one of three distance zones for scenery analysis. The Foreground (FG) extends from an identified viewing location or *viewpoint* out to 1/2 mile, Middleground (MG) is from 1/2 to 4 miles, and Background (BG) is the area visible 4 miles and beyond from the viewpoint (USDA Forest Service, 1995).

Lop and Scatter: Lopping logging debris and spreading it more or less evenly on the ground.

Low Soil Burn Severity: Surface organic layers are not completely consumed and are still recognizable. Structural aggregate stability is not changed from its unburned condition, and roots are generally unchanged because the heat pulse below the soil surface was not great enough to consume or char any underlying organics. The ground surface, including any exposed mineral soil, may appear brown or black (lightly charred), and the canopy and understory vegetation will likely appear "green."

Lower Montane: The lower montane zone contains a variety of forests and woodlands with complex mixtures of tree species, understory species, local environmental conditions, and histories of natural and human disturbances (Kaufmann, Veblen, & Romme, 2006). This zone is dominated with ponderosa pine trees with Douglas-fir found mainly in drainages or on northerly slopes. The lower montane zone is between 5,900-8,000 feet in elevation.

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

Moderate Soil Burn Severity: Up to 80 percent of the pre-fire ground cover (litter and ground fuels) may be consumed but generally not all of it. Fine roots (~0.1 inch or 0.25 cm diameter) may be scorched but are rarely completely consumed over much of the area. The color of the ash on the surface is generally blackened with possible gray patches. There may be potential for recruitment of effective ground cover from scorched needles or leaves remaining in the canopy that will soon fall to the ground. The prevailing color of the site is often "brown" due to canopy needle and other vegetation scorch. Soil structure is generally unchanged.

Natural Fuels: Fuels resulting from natural processes and not directly generated or altered by land-management practices.

Natural Regeneration: The renewal of a tree crop by natural means without seeding or planting done by people. The new crop is grown from self-sown seed or by vegetative means, such as root suckers (i.e. aspen).

Noxious Weed: Any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment. Listed noxious weeds meet specific legal definitions and are included on a list at the federal or state level. For purposes of this analysis, noxious weed and invasive plant are used interchangeably.

Objective: Concise statement of desired measurable results intended to promote achievement of specific goals. Attainment of objectives is limited by the application of standards and guidelines.

Old Growth: Typically distinguished from younger growth by several of the following attributes: large trees for species and site; variation of tree sizes and spacing; standing and down dead trees; decadence in the form of broken or deformed tops, or bole and root decay; multiple canopy layers; and gaps in the tree canopy and understory patchiness. Minimum prerequisites for a site to be classified as old growth are large live trees some of which are old and declining, either snags or fallen trees, and greater than 20 percent canopy closure.

- **Retention Old Growth:** Identified within the timber suitability analysis in the Forest Plan and are generally excluded from management activity, with exceptions such as for wildlife habitat improvement.
- **Inventoried Old Growth:** Areas that have been inventoried and meet the overall definition of old growth as described above. Management is generally allowed, depending on the designated Management Area, but often retains the character of these inventoried stands.
- **Development Old Growth:** Areas estimated to become old growth stands within the next century in the absence of catastrophic change; management activity is allowed in these areas as long as the treatment objective supports old growth development.

Open canopy forest: A condition in which individual tree crowns or canopies do not overlap to form a continuous canopy layer but are more widely spaced, leaving open sunlit areas within the forested area.

Passive Crown Fire (P): Also called torching fires, are when individual or small groups of trees torch out, but solid flame is not consistently maintained in the canopy.

Patchcut: Clearcutting of small areas (less than 5 acres).

Perennial Streams: Streams that carry water year round.

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.

Products Other than Logs (POL): Forest products such as posts, poles, and fiber from trees or parts of trees less than sawlog size. POL usually include trees greater than 5 inches DBH and less than 7.9 inches DBH, with tops of trees greater than 4 inches to less than 6 inches in diameter.

Proposed Species: Any species of fish, wildlife, or plant that is proposed by the Department of the Interior, U.S. Fish and Wildlife Service or the Department of Commerce, National Oceanic and Atmospheric Administration Fisheries Service to be listed as threatened or endangered (USDA Forest Service, 2016).

Quadratic Mean Diameter (QMD): The square root of the arithmetic average of the squared values across a particular inventory (Avery & Burkhart, 2002).

Reforestation: Reestablishment of a tree crop on forested land.

Resiliency: The capacity of an ecosystem to respond to a disturbance by resisting damage and recovering quickly.

Restoration: The overall goal of reducing forest densities, restoring spatial heterogeneity at multiple scales, and restoring a fire regime more characteristic of historical conditions.

Retention: To keep the existing extent of a vegetative component (i.e. old growth). Usually refers to a species (i.e. aspen).

Road: A motor vehicle travel way over 50 inches wide, unless designated and managed as a trail. A road may be classified, unclassified, or temporary.

- **Classified Roads:** Roads wholly or partially within or adjacent to NFS lands that are determined to be needed for long term motor vehicle access, including state, county, and privately owned roads, NFS roads, and other roads authorized by the USFS.
- **Unclassified Roads or User-Created Roads:** Roads on National Forest System lands that are not managed as part of the forest transportation system, such as unplanned roads, abandoned travel ways, unauthorized roads, and off-road vehicle tracks that have not been designated and managed as a road; and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization.
- **Temporary Roads:** Roads authorized by contract, permit, lease, other written authorization or emergency operation not intended to be part of the forest transportation system and not necessary for long term management.

Road Decommissioning: Activities that result in the stabilization and restoration of unneeded roads to a more natural state.

Scenic Attractiveness: A measure of the landscape's scenic importance based on common human perceptions *of the intrinsic* scenic beauty of landforms, rock forms, water forms, vegetation patterns, and cultural features. There are three levels of inherent scenic attractiveness that classify the scenic quality of natural landscapes.

- **Class A – Distinctive:** Areas where features of landform, vegetative patterns, water forms and rock formation are of unusual or outstanding scenic quality.
- **Class B – Common:** Areas where features contain variety in form, line, color and texture or combinations thereof but which tend to be common throughout the landscape province and are not outstanding scenic quality.
- **Class C – Undistinguished:** Areas whose features have little change in form, line, color, or texture. Includes all areas not found under Classes A and B.

Scenic Integrity: The state of naturalness or conversely, the state of disturbance created by human activities or alteration. Integrity is stated in degrees of deviation from the existing landscape character in a national forest (USDA Forest Service, 1995).

Scenic Integrity Objective (SIO): The management objective for scenery in a particular area. There are five categories of SIO.

- **Very High SIO:** Refers to landscapes where the valued landscape character "is" intact with only minute, if any, deviations. The existing landscape character and sense of place is expressed at the highest possible level.
- **High SIO:** Refers to landscapes where the valued landscape character "appears" intact. Deviations may be present but must repeat the form, line, color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident.
- **Moderate SIO:** Refers to landscapes where the valued landscape character "appears slightly altered". Noticeable deviations must remain visually subordinate to the landscape character being viewed.

- **Low SIO:** Refers to landscapes where the valued landscape character "appears moderately altered". Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes or architectural styles outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed but compatible or complimentary to the character within.
- **Very Low SIO:** Refers to landscapes where the valued landscape character "appears heavily altered". Deviations may strongly dominate the valued landscape character. They may not borrow from valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes or architectural styles within or outside the landscape being viewed. However deviations must be shaped and blended with the natural terrain (landforms) so that elements such as unnatural edges, roads, landings, and structures do not dominate the composition.

Sensitive Species: Forest Service Sensitive Species are those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by: a. Significant current or predicted downward trends in population numbers or density; or b. Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (USDA Forest Service, 2016).

Shade Tolerance: Species that have a tolerance to shading by other species. Shade tolerant species will grow and regenerate under a stand's overstory.

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

Silvicultural System: A management process that tends, harvests, and replaces forests, resulting in a forest of distinctive form with a desired condition.

Silviculture: Generally, the science and art of tree management, based on the study of the life history and general characteristics of forest trees and stands, with particular reference to local factors; more particularly, the theory and practice of controlling the establishment, composition, constitution, and growth of forests for desired conditions.

Site Index: A measure of the relative productive capacity of an area for growing trees. Measurement is based on height of the dominant trees in a stand at a given age.

Stand Replacing Fire: A fire that kills all or most living overstory trees in a forest and initiates secondary succession or regrowth.

Stocking: An indication of growing space occupancy relative to a pre-established standard, such as basal area or trees per acre.

Structural Stages: Any of several developmental stages of tree stands described in terms of tree size and the extent of canopy closure they create.

- **Structural Stage 1 (grass/forb):** An early forest successional stage during which grasses and forbs are the dominant vegetation and tree cover is less than one percent.
- **Structural Stage 2 (shrubs/seedlings):** Developmental stage dominated by tree seedlings (less than one inch DBH) and shrub species.
- **Structural Stage 3 (sapling/pole):** Developmental stage dominated by young trees 1 to 7 inches DBH, 10 to 50 feet tall, and usually less than 50 years old. This stage is subdivided into three canopy closure classes: A (less than 40 percent); B (40 to 70 percent); and C (greater than 70 percent).

- **Structural Stage 4 (mature):** Consists of trees larger and older than structural stage 3. Also classified by the same canopy closure categories as structural stage 3.

Successional Stages: The relatively transitory communities that replace one another during development toward a potential natural community.

Surface Fire (S): Fires that do not get into the canopy, but rather remain on the ground only.

Surface Fuels: Fuel on the surface of the ground, consisting of: needles, leaves, grass, forbs, dead and down branches and boles, stumps, shrubs, and short trees.

Task Order: A supplemental document to a parent service/stewardship contract that directs the work to be completed by a contractor.

Thinning: A treatment where individual trees are cut to reduce stand density of trees primarily to improve growth, enhance forest health, or recover potential mortality.

Threatened Species: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range and that the appropriate Secretary (of the Interior or Commerce) has designated as a threatened species (USDA Forest Service, 2016).

Timber: A general term applied to tree stands that provide a wood-fiber product.

Torching Index: The open wind speed at which crown fire activity can initiate for the specified fire environment (surface and canopy fuel characteristics – i.e. fuel model, wind speed and direction, relative humidity, and slope steepness). When wind speeds are less than the torching index a surface fire is expected.

Trees per Acre (TPA): The number of trees, on average, on an acre of land where stand examination inventories have been conducted; this is a modeled average for this document.

Uneven-Aged: Forest stand composed of intermingling of trees that differ markedly in age (Avery & Burkhart, 2002).

Upper Diameter Limit (UDL): The diameter at which removal of trees is restricted or meets the objectives of the silvicultural prescription. This may be a hard value or a flexible estimate depending on the type of thinning and the objectives of the silvicultural prescription.

Upper Montane: In the upper montane zone there is typically a striking contrast in stand density and species composition on south as opposed to north facing slopes. On xeric, south facing slopes ponderosa pine forms relatively open stands, sometimes with scattered Rocky Mountain juniper. Stands on mesic, north facing slopes are typically much denser and the relative proportion of Douglas-fir is greater (Veblen and Donnegan 2005). The elevation range for the upper montane zone is 8,000 to 9,000 feet.

Visual Absorption Capability: The ability of the landscape to absorb visual change.

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:

    a. an area extending ½ mile from the boundary of an at-risk community;

    b. 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

    c. 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.

Appendix F
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This appendix contains references cited throughout the Forsythe II Environmental Assessment to support the analysis and conclusions.

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Appendix G
List of Acronyms

$\mu g/m^3$ – Micrograms per Cubic Meter

APCD – Air Pollution Control Division

ARP – Arapaho and Roosevelt National Forests and Pawnee National Grassland

ATV – All-terrain Vehicle

AWHC – Available Water Holding Capacity

BA – Basal Area

BAER – Burned Area Emergency Response

BLM – Bureau of Land Management

BRD – Boulder Ranger District

BTU – British Thermal Unit

CE – Categorical Exclusion

CFLRP – Collaborative Forest Landscape Restoration Program

CFR – Code of Federal Regulations

Ch. – Chains

CNHP – Colorado Natural Heritage Program

CO SH – Colorado State Highway

COR – Contracting Officer Representative

CPW – Colorado Parks and Wildlife

CSFS – Colorado State Forest Service

CWD – Coarse Woody Debris

CWPP – Community Wildfire Protection Plan

DBH – Diameter at Breast Height

EA – Environmental Assessment

EIS – Environmental Impact Statement

EMU – Ecological Management Unit

ESA – Endangered Species Act

FACTS – Forest Service Activity Tracking System

FEIS – Final Environmental Impact Statement

FERC – Federal Energy Regulatory Commission

FIRESTAT – Fire Statistics System

FONSI – Finding of No Significant Impact

FSH – Forest Service Handbook

FSM – Forest Service Manual

Ft – Feet

FWD – Fine Woody Debris

GIS – Geographic Information System

GL – Guideline

GMU – Game Management Unit

GO – Goal

GPS – Global Positioning System

GR – Grass

GS – Grass-shrub

HFRA – Healthy Forests Restoration Act

Hr. – Hour

HSS – Habitat Structural Stage

ID or IDT – Interdisciplinary Team

IWM – Integrated Weed Management

MA – Management Area

MAII – May impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing

MFG – Magnolia Forest Group

Mi. – Miles

MIC – Management Indicator Communities

MIS – Management Indicator Species

MOU – Memorandum of Understanding

MPB – Mountain Pine Beetle

MPH – Miles per Hour

NAAQS – National Ambient Air Quality Standards

NB – Non-burnable

NC – No Change to populations locally or on the planning area

NE – No Effect

NEPA – National Environmental Policy Act

NFMA – National Forest Management Act

NFS – National Forest System

NFSR – National Forest System Road

NI – No Impact

NLAA – May affect, not likely to adversely affect

NPS – National Park Service

NRHP – National Register of Historic Places

NRIS – Natural Resources Information System

OHV – Off-Highway Vehicle

PALS – Planning, Appeals, and Litigation System

PM – Particulate Matter

PTES – Proposed, Threatened, or Endangered, Forest Service Sensitive Species

RAWS – Remote Automated Weather Station

SB – Slash or blowdown

Sec – Seconds

SH – Shrubs

SHPO – Colorado State Historic Preservation Officer

SIO – Scenic Integrity Objective

SIR – Supplemental Information Report

SPOTS – Strategic Placement of Treatments

SRM – Southern Rocky Mountains

ST – Standard

TES – Threatened or Endangered Species

TL – Timber Litter

TPA – Trees per Acre

TU – Timber with a grass or shrub understory

USDA – U.S. Department of Agriculture

USEPA – U.S. Environmental Protection Agency

USFS – U.S. Forest Service

USFWS – U.S. Fish and Wildlife Service

UTV – Utility Vehicle

WS – Wind Speed

WUI – Wildland Urban Interface