United States Department of Agriculture

Draft Environmental Impact Statement

Upper Monument Creek Landscape Restoration

Forest Service

Rocky Mountain Region

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Draft Environmental Impact Statement
Upper Monument Creek Landscape Restoration

Lead Agency:	USDA Forest Service
Cooperating Agencies:	Upper Monument Creek Landscape Restoration Collaborative
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Website: http://www.fs.usda.gov/project/?project=44012

This draft environmental impact statement describes the impacts of treatments in the Upper Monument Creek project area. The purpose of this project is to move the Upper Monument Creek landscape toward a more desirable, resilient condition better able to support more natural forest structures, disturbance regimes, vegetative diversity, wildlife habitats, and properly functioning watersheds. It also aims to maintain healthy and resilient forest conditions for future generations.To help accomplish this purpose, the Pikes Peak Ranger District has identified a need to (1) actively manage the landscape to increase the resiliency of the forest (2) address reduced health of the forest, watersheds, wildlife habitat and (3) address the high risk of catastrophic wildfires. The agency developed a no action and used iterative NEPA and adaptive management to develop and refine the proposed action, which are outlined and analyzed in this draft environmental impact statement.

Draft Environmental Impact Statement:
Reviewers should provide the Forest Service with their comments during the review period of the draft environmental impact statement. Providing comments at the review stage enables the Forest Service to analyze and respond to the comments at one time and to use information acquired in the preparation of the final environmental impact statement, thus avoiding undue delay in the decision making process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewers' position and contentions (Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 553 (1978)). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the final environmental impact statement (City of Angoon v. Hodel (9th Circuit, l986) and Wisconsin Heritages, Inc. v. Harris, 490 F. Supp. 1334, 1338 (E.D. Wis. 1980)). Comments on the draft environmental impact statement should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3).

The Forest Service will use the “predecisional administrative review process,” also referred to as the “objection process” described in 36 CFR 218 Subpart A. This process gives an individual or entity an opportunity for an independent Forest Service review and resolution of issues before the approval of a Record of Decision, this subpart identifies shows may file objections to a plan revision; the responsibilities of the participants in an objection; and the procedures that apply to the review of the

objection. §218.5 describes who may file an objection. Individuals and entities who have submitted specific written comments along with supporting reasons during the opportunities for public comment for this decision may file an objection.

Send Comments to:

Pikes Peak Ranger District
Attn: Upper Monument Creek Project
601 South Weber
Colorado Springs, CO 80903
Facsimile: 719-477-4233
Email: **psicc_umc@fs.fed.us**

Comment Directly online at: https://cara.ecosystem-management.org/Public//CommentInput?Project=44012

For those submitting hand-delivered comments, the Pikes Peak District's office hours are 8:00 A.M. through 4:30 P.M. Monday through Friday, excluding holidays.

Comments may also be sent by fax, or in an e-mail message, pdf, plain text (.txt), rich text format (.rtf), and Word (.doc or .docx). Comments must have an identifiable name attached or verification of identity will be required.

Only those who submit timely and specific written comments regarding the proposed project during a public comment period established by the responsible official are eligible to file an objection.

Date Comments Must Be Received:

Within 45 days following publication of the notice of availability of the DEIS in the Federal Register. The notice of DEIS availability publish date in the Federal Register is the sole date for determining comment period end.

Summary

The purpose of this project is to is to move the Upper Monument Creek landscape toward a more desirable, resilient condition better able to support more natural forest structures, disturbance regimes, vegetative diversity, wildlife habitats, and proper functioning watersheds. The projet also aims to maintain healthy and resilient forest conditions for future generations.To help accomplish this purpose, the Pikes Peak Ranger District has identified a need to (1) actively manage the landscape to increase the resiliency of the forest (2) address reduced health of the forest, watersheds, wildlife habitat and (3) address the high risk of catastrophic wildfires.

The Upper Monument Creek Landscape Restoration Initiative (the UMC Initiative) was launched in 2012 in an effort to accelerate the pace of urgently needed forest restoration by forging collaborative agreement on science-based management recommendations for a high priority area on the United States Forest Service's (USFS) Pike National Forest. The UMC Initiative builds on the work of the Front Range Roundtable (Roundtable), which has been working together since 2004 to dramatically increase forest management that reduces wildfire risks to communities and restores resilient ecological conditions in Front Range forests. The approximately 70,600-acre UMC landscape is located within an area designated as a high priority for management by the Roundtable. Treatment within the landscape will be implemented under the auspices of the Front Range Collaborative Forest Landscape Restoration Project (CFLRP) and Long Term Stewardship Contract, both of which are Roundtable priorities.

The project was posted on the Forest's schedule of proposed actions website on April 1, 2014, the notice-of-intent to prepare an environmental impact statement was published in the Federal Register on May 22, 2014, and an open house and three public meetings were held to discuss the project proposal. Meeting were held in Colorado Springs, Monument and Woodland Park Colorado.

The UMC Initiative used a series of workshops and field visits open to the public to identify effective strategies for restoring desired conditions to the UMC landscape. Using both spatial and non-spatial analyses, the UMC Initiative found that: three major forest types comprise 85% of the landscape; forests in older age classes are significantly underrepresented; and forest conditions are considerably more dense than they would have been historically, particularly in the drier ponderosa pine and mixed conifer systems. Analyses also revealed that these closed forest conditions place people, water and wildlife at significant risk from unnaturally large and damaging wildfires. Based on these analyses, the UMC Initiative recommends that, over the next 7-10 years, the USFS use a combination of mechanical, manual and prescribed fire treatments to manage conditions on approximately 31,700 acres within the UMC landscape.

Through collaborative research, the UMC Initiative found treatments must be designed and implemented at a **meaningful scale**, ensuring that they are able to effect a landscape-scale change in conditions and processes. Treatments should be strategically scheduled and located so that they **maximize benefits** to both people and nature. Finally, the UCM Initiative found treatments must be **carefully designed**, using the best available science for individual forest systems and ensuring that the purpose of treatments is clear (Upper Monument Creek Report, 2014). Thus the project utilized iterative NEPA throughout the analysis as well as adaptive management. The proposed action was changed and updated over the last few years as a result of the collaborative meetings, workshops, and field trips sponsored by the UMC Initiative. The project is adaptive through design, implementation, and monitoring. Based upon the effects of the alternatives, the responsible official can decide: (1) the location and treatment methods for all restoration

activities; (2) timing of treatments across the landscape; and (3) design criteria, mitigation, and monitoring requirements.

Acronyms

ATV – All Terrain Vehicle
BA – Biological Assessment
BE – Biological Evaluation
BMP – Best Management Practice
BO – Biological Opinion
CEQ – Council on Environmental Quality
CFR – Code of Federal Regulations
CRA – Colorado Roadless Area
DBH – diameter breast height
DEIS – Draft Environmental Impact Statement
EIS – Environmental Impact Statement
EPA – Environmental Protection Agency
ESA – Endangered Species Act
FEIS – Final Environmental Impact Statement
FSH – Forest Service Handbook
GIS – Geographic Information System
HRV – Historic Range Of Variability
LRMP – Land and Resources Management Plan
MA – Management Area
MIS – Management Indicator Species
MVUM – Motor Vehicle Use Map
NEPA – National Environmental Policy Act
NHPA - National Historic Preservation Act
NFMA – National Forest Management Act
NOI – Notice of Intent
NFS – National Forest System
OHV – Off-Highway Vehicle
ROD – Record of Decision
ROS – Recreational Opportunity Spectrum
TES – Threatened and endangered species
UMC – Upper Monument Creek
USDA – United States Department of Agriculture
USFWS – US Fish and Wildlife Service
WUI -Wildland Urban Interface

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Chapter 1. Purpose of and Need for Action

Introduction

The U.S. Department of Agriculture (USDA), Forest Service, has prepared this draft environmental impact statement (DEIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This DEIS discloses the environmental consequences that could result from the proposed action and no action alternative. The format of this DEIS follows the Council on Environmental Quality (CEQ) recommended format (40 CFR 1502.10). The document is organized as follows:

Chapter 1 Purpose and Need for Action: This chapter includes information about the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. Forest Service public engagement activities are also outlined in this section.

Chapter 2 Alternatives, including the Proposed Action: This chapter provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. Owing to the iterative NEPA process followed for this project, any significat issues raised by the public, Tribes, the Forest Service and other agencies were incorporated into the proposed action, rather than presented as stand alone alternatives. All proposed action changes are found on pg 21.. Finally, this section provides summary comparison tables of the activities associated with the proposed action.

Chapter 3 Affected Environment and Environmental Consequences: This chapter describes the affected environment and the environmental effects or consequences of implementing the proposed action and other alternatives. The analysis in this section is organized by resource area.

Chapter 4 Consultation and Coordination: This chapter provides a list of preparers and agencies consulted during the development of this draft environmental impact statement (DEIS) and information regarding the distribution of this DEIS.

References and Appendices: The appendix consists of multiple parts and provides detailed information to support the analysis.

Additional documentation, including detailed specialist reports underlying the background and analyses supporting this DEIS, is available in the administrative record (project record) at: Pikes Peak Ranger District, Attn: Upper Monument Creek Project, 601 South Weber, Colorado Springs, CO 80903

Background

The 70,600 acre Upper Monument Creek (UMC) project is located within the Pikes Peak Ranger District on the Pike National Forest in Colorado. From 1910 to current times suppression of both lightning and human caused fires has been the central focus on National SystemForest lands, which has effectively modified the fire regime in many areas. The UMC project area is a reflection of this suppression effort as only two fires have influenced the structure and development of the landscape over this time period. Fire suppression has not only modified the natural fire regime of Front Range forests, but it has also significantly impacted the distribution

and structure of forest vegetation. As resent wildfire evidence proves, current forest vegetation conditions are capable of carrying uncharacteristically large and severe wildfires that negatively affect the integrity of ecological and social systems. The UMC project seeks to address these concerns by restoring forest vegetation to conditions that are more representative of historic patterns that were resistant and resilient to the influences of fire.

The steep eastern face of the Rampart Range (max. elev. 9748'), rises sharply from the adjacent plains, while the top of the range resembles a broad dissected plateau. The UMC landscape is nearly completely underlain by the Pikes Peak Batholith, a massive granite block of 1.4 billion year old rock. The soils developed from this granite are generally shallow, well-drained and poor in organic matter, except where they are alluvial in nature. Due to their coarse condition, these soils are not easily compacted except during road or trail construction and use. They are, however, highly erodible due to their lack of cohesion, a trait that makes them highly prone to post-fire erosion and debris flows. The UMC landscape also contains a few pockets of sandstone and limestone, and the associated soils derived from them. The average annual precipitation for the Upper Monument Creek area is 22 to 25 inches, with the majority falling during April through August. Average annual snowfall ranges from 111 to 115 inches, with the majority falling between October and April.

Project Area History

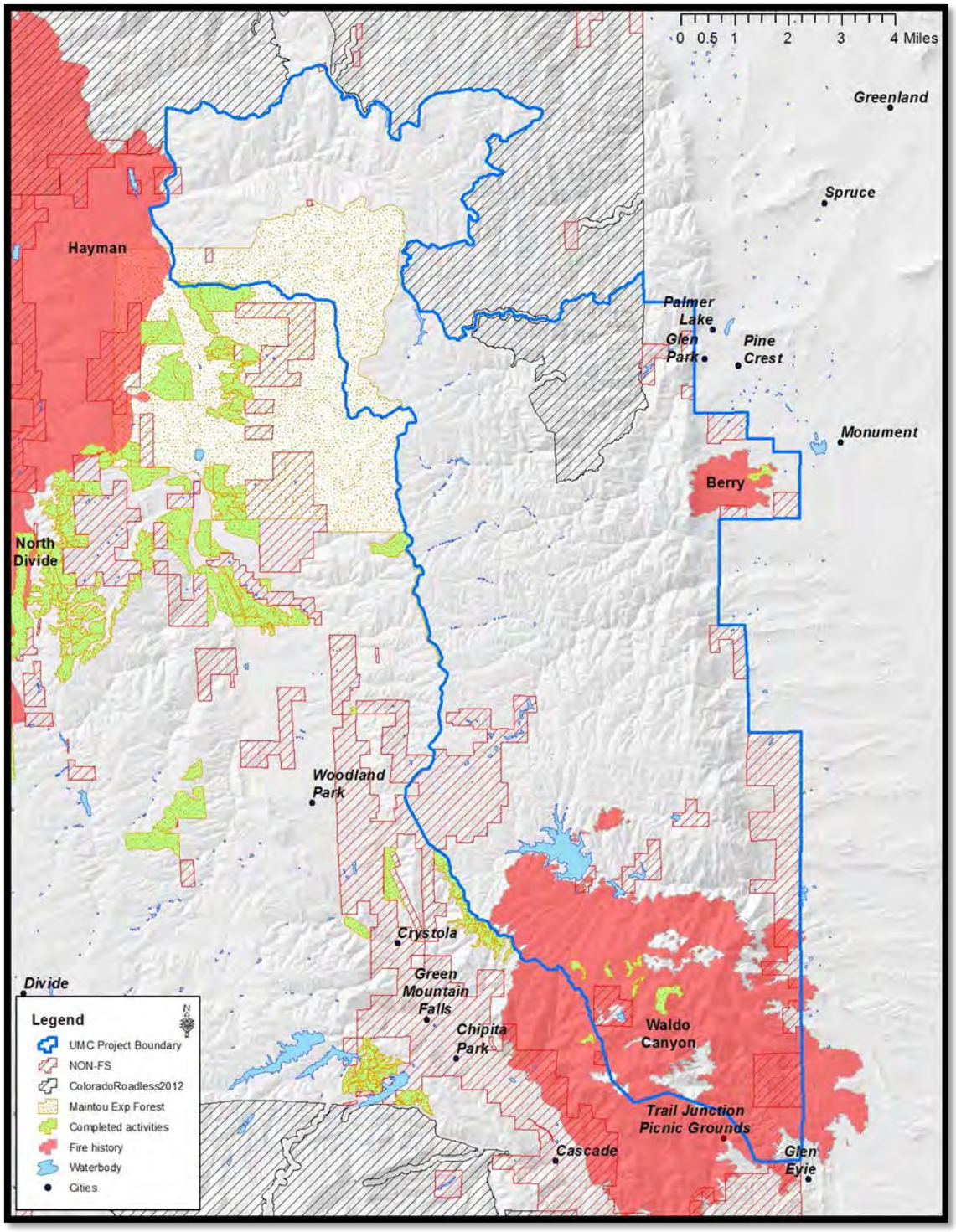
Historical use and development of the UMC landscape is similar to other areas within the Colorado Front Range. Prior to 1860 indigenous groups utilized these lands seasonally for decades although use patterns are a bit unclear (Vale 2002). After 1860 permanent settlement began to shape the area and this increase in population created a growing demand and interest in resources such as timber and metals. Seven years later several large-scale mills were operating in the area to support the growing demands of a developing population. A report compiled in 1900 by U.S. Geological Survey employee John G. Jack stated that approximately 75 percent of the forests around Pikes Peak had been logged, burned, or both and were described as being some of the most damaged forests in the nation (Jack 1900).

In an attempt to ameliorate some of the previous deleterious land uses, an aggressive reforestation program was started on the Pike National Forest in the early 1900s (Bates 1923). Seedlings used for this effort were typically from offsite genetics poorly adapted to growing conditions on the Front Range and many of these plantations are still visible on the landscape due to their short statured "tree farm" appearance. Concurrently the Pike National Forest was also experiencing heightened levels of fire suppression as highly motivated and effective efforts were being made across all National Forest to prevent fire from entering forested landscapes.

The recent history of the UMC project area is more defined by fire rather than resource extraction and use (see Figure 1 below). Few fires of significance took place in the UMC landscape between the mid-to-late 1900s. This cycle of relatively little fire activity was interrupted in 1989 when the Berry Fire burned 850 acres near the outskirts of the USFS Monument Fire Center. More recently the Waldo Canyon Fire burned just northwest of Colorado Springs and south of the UMC project area. Before fully suppressed, the Waldo Canyon Fire destroyed 346 homes and forced 32,000 residents to evacuate. Approximately 10,500 of the total 18,200 acres burned in the Waldo Fire fall within the UMC analysis area. Portions of the Waldo Canyon burn scar have experienced significant erosion and mass wasting due to the loss of slope stability caused by fire related vegetation removal within these watersheds. Millions of dollars

are being spent annually by communities to protect and restore their watershed infrastructure damaged by the Waldo Canyon fire (CSU 2014, Elpasaco 2014).

Figure 1. Fire history on the pike national forest within or adjacent to UMC project boundary.



There has been essentially no significant active management within the UMC analysis area. Select areas within the Waldo Burn Area have been treated with erosion prevention barriers to stabilize hillsides and hazard trees have been treated along the main arterial route (National

Forest System Road 300). Currently efforts are underway to treat approximately 130 acres of hazard trees from the Waldo Canyon Fire within the Rampart Reservoir area. A small portion (approximately 180 acres) of the Waldo burn were planted in 2014 with a mix of ponderosa pine and Douglas-fir seedlings to facilitate stand development in areas of high burn severity. Approximately 970 acres of vegetation management has occurred along the western boundary of the project area. Treatments in these areas range from variable density thinnings, to opening creation, to understory removal and occur mainly in the ponderosa pine-Douglas-fir forest type.

Purpose and Need

Due primarily to increased populations, and changes in the types of land management following European settlement (e.g., timber harvest, large scale plantings, fire suppression), current conditions of the UMC area differ from desired conditions invarying degrees. Therefore the UMC project area continues to exhibit reduced health and ecological resiliency and is in need of active management to reduce fuel loads and increase the ecological resiliency of the forest landscape. Local communities remain dependent on water from these watersheds and on other natural and recreational resources to varing degrees. The purpose of this project is to move the Upper Monument Creek landscape toward a more desirable, ecologically resilient condition better able to support more natural forest structures, disturbance regimes, vegetative diversity, wildlife habitats, and proper functioning watersheds. It also aims to maintain healthy and resilient forest conditions for future generations.

Existing and Desired Conditions

Existing Condition

Forest vegetation within the UMC project area is a diverse mosaic of forest structures and cover types driven by topographic, moisture, and elevational gradients. Vegetative patterns within the UMC project area can be classified into recognizable ecological systems that aid in describing landscape vegetation patterns. Ecological systems represent recurring groups of biological communities that are found in similar physical environments and are influenced by similar ecological process (Comer et al. 2003). Ranging between 6,800 and 9,740 feet in elevation, the project area contains a mix of montane forest vegetation, but three predominant ecological systems comprise 85% of the area, which include: ponderosa pine - Douglas-fir woodland, dry-mesic montane mixed conifer forest and woodland, and mesic montane mixed conifer forest and woodland (Table 1). As seen in Table 1these forest systems are well distributed across the UMC area, and are often associated, with location and patch size based upon aspect, elevation, soils, and other environmental factors.

The main ridge of the Rampart Range also contains a small portion of a larger ecological system of lodgepole pine that extends north of the project area. The eastern portion of the project area contains low lying dry foothills with a mix of Gambel oak-mixed montane shrublands and piñon -juniper woodlands. In addition, montane riparian systems and montane-subalpine grasslands are interspersed throughout the project area within a range of physical environments. Stream courses in the project area are dominated by stands of quaking aspen and mixed conifer, with an understory composed of a variety of obligate and facultative riparian plants, including some willow cover. Existing willow and other deciduous vegetation has a discontinuous distribution as many stream courses have a high gradient or are located within relatively confined drainages that are absent of floodplains, or in which floodplain width is constricted. With the exception of coarse woody debris and plant litter, upland vegetative ground cover is relatively limited in the

project area as soils are rocky, shallow, and coarse textured with thin organic layers. Each distinct ecological system analyzed in this DEIS is described below.

Table 1. Primary forested vegetation systems of the Upper Monument Creek project area.

Forested Vegetation System	Acres	% of Total Area
Ponderosa Pine/Douglas-fir Woodland	17,337	32
Dry-Mesic Montane Mixed Conifer Forest and Woodland	15,426	29
Mesic Montane Mixed Conifer Forest and Woodland	13,003	24
Montane Riparian Systems	5,841	11
Lodgepole Pine Forest	3,512	4
Gambel Oak-Mixed Montane Shrubland	1,710	3
Montane-Subalpine Grassland	1,605	3%
Piñon-Juniper Woodland	67	< 1%

Ponderosa pine/Douglas-fir Woodland (Montane Zone)

The lower montane zone is dominated by ponderosa pine (historically < 30% canopy cover below 6,600 feet), more dense stands of Douglas-fir on north-facing slopes, with occasional large Douglas-fir on other aspects. In the upper montane zone the ponderosa pine cover type occurs both as relatively pure stands and with significant components of Douglas-fir. There is typically a striking contrast in stand density and species composition on south- as opposed to north-facing slopes. Douglas-fir is prominent on north-facing slopes, whereas Ponderosa pine tends to dominate south-facing slopes. Structural changes will vary greatly depending on disturbance history. Limber pine occurs in higher elevations in groups and as scattered individuals. Understory species can include Gambel oak, mountain mahogany, Arizona fescue, mountain muhly, kinnikinnick, and yucca. Surface, mixed, and stand replacing fire types are part of the historic fire regime.

Dry-Mesic Mixed Conifer Forest and Woodland

Ponderosa pine, Douglas-fir, limber pine, and aspen make up the warm/dry mixed conifer forested vegetation system. The composition and structure of the overstory varies based on the temperatures and moisture relationships of the site. Gambel oak is often the dominant shrub in lower elevations. Ponderosa pine regeneration typically occurs after fire. Limber pine regeneration occurs continuously between fires, while Douglas-fir regeneration can occur between and after fires. Douglas-fir can be a canopy dominant with ponderosa pine. Douglas-fir is generally found between 6,900-9,500 feet, but this species can also be found at higher elevations on all slopes. This forest type has a variable distribution on east and west aspects. Surface, mixed, and stand replacing fire types are part of the historic fire regime.

Mesic Montane Mixed Conifer Forest and Woodland

The cool/moist mixed conifer forested vegetation system is driven by elevation and aspect. This system has much less ponderosa pine than the warm/dry system. However, ponderosa pine is found in small groups or isolated patches usually in open areas, on meadow edges, and ridges. Douglas-fir and spruce are often canopy dominants with aspen present in most stands. Limber pine, Englemann spruce, and white fir are other major tree species that can be quite common. Lodgepole pine can also be present, but is uncommon. This forest type is found on north-facing slopes s, generally on steep slopes, and from 7,500 to 9,500 feet in elevation. Surface, mixed, and stand replacing fire types are part of the historic fire regime.

Lodgepole Pine Forest

Rocky mountain lodgepole pine forests are typically found in upper montane and subalpine elevations and are typically above 9,000 feet. Lodgepole pine is generally persistent, although aspen may precede this species in areas. Understory vegetation can vary from sparse shrub cover, to grass, to barren. The fire regime for this forest type is typically high severity and can burn in mixed to stand replacement patterns.

Forested Vegetation Systems have a variety of defining characteristics such as vegetation type, age, development stage, structure, and distribution. These ecological system characteristics form a complex web of relationships between groups of living things and their environment. Those interactions define forested landscapes and lead to a shifting mosaic of forested conditions over time and space. In order to better understand the potential historic distribution and development of forest vegetation on the UMC landscape, model simulations were run using the Vegetation Dynamics Development Tool (VDDT). The project VDDT runs were compiled to generate and establish a natural range of variability (i.e., NRV) for each vegetation class within the UMC project area (Low 2013). Vegetation classes describe stand structure and successional stages, defined separately for each system (Low 2013). The natural range of variability is the expected distribution (based on historic conditions) of vegetation classes within each ecosystem under a natural disturbance regime (Table 2).

Studies from Kaufmann et al. (1999, 2000, 2001), Brown et al. (1999), and Dickinson (2014) indicate that historic forests were older, more open, and more structurally diverse than present conditions. Openings of a variety of sizes were commonly found across the landscape and were highly dependent on fire to create and maintain these breaks in the canopy. Large openings with few or no conifers were persistent across a greater percentage of the Front Range landscape. More recent research also shows smaller and less persistent canopy gaps, distance between tree crowns, at the stand level are also significantly lower than historic conditions.

Current vegetation conditions demonstrate that changes in land use patterns and effective fire suppression over the last 100 or more years have modified ecological systems within the UMC landscape (Table 2). The vegetative conditions within the UMC landscape differ, in both structure and distribution, from historic forest conditions. Forests are underrepresented in a number of the ecological attributes, such as spatial heterogeneity and representation in older succession classes, which were once common and contributed to the resilience of pre-settlement forest landscapes (UMC 2013). The mid-closed vegetation class dominates the UMC landscape and is significantly higher than NRV distributions in all three of the dominant ecological systems. Summary data also indicate that late vegetation classes (open and closed canopy) are found in far smaller quantities within the UMC project area when compared to NRV estimations.

Table 2. Existing distribution of vegetation classes compared to the natural range of variability.

Forested Vegetation System	Acres	Vegetation Class[1] and Acres NRV % (Current %)				
		Early	Mid Closed	Mid Open	Late Open	Late Closed
Ponderosa Pine/Douglas-Fir Woodland	17,337	387 10 (2)	8,124 10 (47)	3,810 15 (22)	1,897 45 (11)	3,119 20 (18)
Dry-Mesic Montane Mixed Conifer Forest and Woodland	15,426	648 10 (4)	7,923 5 (51)	4,073 20 (27)	1,326 40 (9)	1,456 25 (9)
Mesic Montane Mixed Conifer Forest and Woodland	13,003	155 10 (1)	9,232 25 (71)	631 20 (4)	299 15 (3)	2,686 30 (21)
Lodgepole Pine Forest	3,512	76 20 (2)	871 20 (25)	662 20 (19)	543 15 (15)	1,360 30 (39)
Montane Riparian Systems	5,841	1,227 10 (21)	2,862 25 (49)	1,752 65 (30)	-	-
Gambel Oak-Mixed Montane Shrubland	1,710	120 10 (7)	1,077 35 (63)	513 55 (30)	-	-
Montane-Subalpine Grassland	1,605	-	-	-	-	-
Piñon-Juniper Woodland	67	-	-	-	-	-

In order to determine the differences between existing and historical forest conditions, Low (2013) assessed the forest condition of the project area by conducting an analysis of ecological departure and open forest canopy departure (Table 3). Ecological departure incorporates species composition, vegetation structure, and disturbance regimes to estimate an ecological systems' departure from its natural range of variability (Low 2013). The open forest departure metric isolates the degree of canopy closure as compared to the more open historical conditions (Low 2013). Ecological departure from NRV and open forest canopy departure and are measured on a scale of 0 to 100 percent, where a higher percentage indicates a greater departure (Low 2013). Key findings from these evaluations indicate that the three dominant Forested Vegetation Systems within the UMC landscape are all moderately departed from their natural historic

[1] 'Early' is an early seral stand, typically open or dominated by early-successional species; 'Mid Closed' is a mid-seral stand with a closed canopy; 'Mid Open' is a mid-seral stand with a relatively open canopy; 'Late Open' is an open late-seral stand, typically containing a diversity of age and size classes; 'Late Closed' is late-seral closed canopy forest.

conditions and there is currently approximately twice as much forest in a closed canopy condition than occurred historically (Table 3).

Table 3. Departure from natural historic conditions of the major Forested Vegetation Systems within the Upper Monument Creek Project Area.

Forested Vegetation System	Ecological Departure	Open Forest Departure
Ponderosa Pine/Douglas-Fir Woodland	40%	43%
Dry-Mesic Montane Mixed Conifer Forest and Woodland	52%	43%
Mesic Montane Mixed Conifer Forest and Woodland	42%	57%

Summary of Ecological Conditions within the Upper Monument Creek Project Area:

- **High forest density** characterizes much of the current UMC landscape as a result of fire exclusion combined with wet climatic conditions and favorable regeneration conditions that occurred in the late 19th and early 20th centuries. An overabundance of dense, closed canopy forest and corresponding lack of open forest conditions creates continuous, fairly uniform canopy conditions that allow for the unimpeded spread of high-severity disturbances such as crown fire.

- **Loss of spatial heterogeneity** has also occurred as the forest has filled in with younger trees. A spatially hererogenes forest has a structure where trees occur in groups separated by openings. Forests with groups of trees separated by openings is a characteristic found in forests that burn frequently and at low intensity, but is often not apparent in the current Upper Monument Creek landscape. This structure is important for some wildlife, fine-scale ecological processes such as tree mortality and regeneration, and for facilitating low-severity fire regimes.

- **Loss of openings or spatial heterogeneity** is a result of fire exclusion that enabled the increase of forest density. Openings provide many important ecosystem functions, including understory herbaceous vegetation and shrub community development, habitat and foraging opportunities for wildlife, and increased surface water runoff. Openings also contribute to overall landscape heterogeneity and provide natural barriers to the wide-scale spread of high-severity disturbances.

- **Early-seral forest classes are less common and less dispersed** currently than they likely were historically. The Waldo Canyon fire has created one large area of primarily early-seral forest within the UMC landscape, whereas historically early-successional forests were likely smaller in scale and spatially distributed throughout the landscape.

- **The mid-seral forest classes** in the current forest and are somewhat even-aged due to century-old logging.

- **Old trees and old-growth stand classes, are much less common** currently than they were historically due to logging and forest clearing that occurred with Euro-American settlement. There is a deficiency in old-growth, late-seral stand conditions within the

UMC landscape. Old trees and old-growth stands provide landscape structural complexity and important ecosystem functions, especially for wildlife.

- Concurrent with the increase in overall forest density, more **shade-tolerant species have increased**. The growth form of more shade-tolerant species (e.g., Douglas-fir have long crowns with branches spreading to the ground) increases the potential for fire to spread into the tree canopy.

- **Frequent, low-severity surface fire is absent** in the UMC landscape. The low-severity fire regime that historically characterized low-elevation ponderosa pine and dry mixed-conifer forests has largely been replaced by high-severity active crown fire. Loss of low-severity surface fire represents loss of a key ecosystem function.

When comparing the existing forest structure and density to conditions prior to large scale settlement there has been a loss of openings (both large and small) within the forest canopy and a corresponding increase of tree stocking, more trees per forested acre, within most project area stands. The dense forest conditions that characterize the landscape today have increased levels of competition which reduce tree vigor, are more prone to insect outbreaks, and are capable of carrying large active crown fires in all forest ecological systems. Large crown fires within the UMC project area could have profound negative effects on forest vegetation, wildlife habitat, soils, infrastructure, personal property, and municipal and other watershed health.

Desired Conditions

Desired conditions are based on scientifically-derived, ecology-based reference conditions. Desired conditions do not describe a static reference condition. Rather, they highlight how scientists believe a given ecosystem functions and disturbance regimes interact to sustain desired conditions over time. Desired conditions should also be forward-looking in the context of global climate change and should use information from the past as a guide to anticipate likely system responses to future climate and disturbance scenarios. The establishment of desired future conditions for a landscape enables both land managers and diverse stakeholders to agree on a common vision of success. Once identified, these desired landscape conditions can be compared with current conditions to determine the purpose and need for current and future management action. Desired conditions also serve as an important benchmark to measure effective management and determine necessary changes.

Identification of desired future conditions for the UMC landscape was built on previous collaboratively developed visions for Front Range forests. In its 2006 report, the Front Range Roundtable described their goal as a complex mosaic of forest structures, with patches of variable tree densities and ages that favor retention of the older trees. Roundtable members added greater detail to this vision in 2011 when they developed a proposal and subsequent ecological monitoring plan for treatments implemented through the Front Range Collaborative Forest Landscape Restoration Project (CFLRP).

As described below, the UMC Collaborative's desired future conditions for the UMC landscape emphasize the need for a more natural range of forest diversity, heterogeneity and complexity. In contrast, many areas of the UMC landscape currently contain forests that are much denser than would have been seen prior to Euro-American settlement and lack the kind of age and structural diversity needed to promote resilience. As a result, these forests are extremely vulnerable to unnaturally large and damaging wildfires. This situation places both people and key forest values at risk and creates a need for action.

Although initially planned treatment in the UMC landscape will likely have a ten to fifteen-year life span, the UMC Collaborative's desired future conditions for the landscape look much further into the future. Achieving the conditions described below will require sustained action over several decades. The current UMC project is only the beginning of this process. It is also important to note that even though the conditions outlined below focus primarily on the affected areas of the landscape, it is the UMC Collaborative's intention that by promoting greater overall resilience to the forest, land managers will also be reducing risks to human lives, community infrastructure and the many natural benefits that people obtain from the forest.

The "Affected Environment" sections of Chapter 3 provide more information on the ranges in reference conditions and desired conditions used in this DEIS. The UMC Collaborative utilized these ranges of variation in conjunction with the Forest Plan and other policies and guidance as the primary basis for developing the desired conditions for the UMC.

The desired future condition for the UMC landscape is one where the forest structure is such that the outcomes of fire are ecologically appropriate and socially acceptable, thus posing less of a threat to people and the environment and fostering the sustainability of key forest values. The UMC Collaborative anticipates that this forest structure is one that closely approximates the natural range of variability whenever possible, but the UMC Collaborative also recognizes that priorities such as community and watershed protection will sometimes dictate a different treatment regime.

Specific desired conditions include:

- A diverse landscape mosaic with forest composition and structure that reflects variation in topography and underlying moisture gradients.
    - A reduction in mid-closed structural stages for the three predominant forested vegetation systems: Ponderosa pine-Douglas-fir Woodland, Dry-mesic Montane Mixed Conifer Forest and Woodland, and Mesic Montane Mixed Conifer Forest and Woodland to encourage the development of more mid-open, late-open, and late-closed structural stages. Structural stages should include even-aged, uneven-aged, and multi-aged stand and group structures.
- Landscape diversity provides for natural disturbance regimes that are within the natural range of variability and are socially acceptable.
    - Forest conditions where fires are capable of burning with intensities, severities, and at scales within the natural range of variation for specific ecological systems when socially acceptable.
    - Landscape heterogeneity that provides natural barriers to the spread of high-severity disturbance events over large scales.
    - Forest structures that minimize the potential of negative effects from fire and insects on municipal watersheds and infrastructure and that promote watershed health.
    - Forest conditions where epidemic outbreaks of forest pests are minimized.
- Forest stands exhibit fine-scale heterogeneity in structure and tree spatial patterns.

  - A landscape where small and large openings in the forest canopy are more prevalent. Where the prevalent small and large openings have highly variable shapes and arrangements and expand upon existing openings to the extent possible.

- Landscape and stand-scale heterogeneity provide diverse habitats for wildlife.
  - Protect and/or encourage the maintenance and development of large (18+ inches in d.b.h.) old-trees, snags, and downed woody debris to add structural complexity where lacking.
  - Forest conditions that maintain and/or enhance wildlife habitat and corridors.
  - Enhance the aspen component of the landscape by expanding access to available growing space or through regeneration.
- Watersheds and soils are stable and hydrologic processes are intact.
  - Restore or maintain the functionality of ephemeral, intermittent, and perennial streams and springs.
  - Maintain hillslopes cover for soils in a satisfactory natural functioning condition that resists erosion.
  - Maintain a transportation system that does not contribute unbalanced sediment yields into streams. Reduce hill toe, and channel erosion from unauthorized and poorly maintained roads and trails
- In total, the landscape is functional and resilient to large disturbances and climate change, and provides important forest functions and ecosystem services to support wildlife and human populations.
- The desired future condition of the project area for recreation resources is to continue to provide a wide spectrum of opportunities for sustainable developed recreation and motorized and non-motorized dispersed recreation for public use, as well as for outfitters and guides and recreation events. A diverse healthy forest enhances the recreation experience and provides wildlife and scenery viewing.

Proposed Action

In response to the conditions described above, the proposed action is to effectively treat up to 31,700 acres within the 70,600 acre analysis area. Combinations of mechanical thinning with product removal, mastication, hand thinning, lop and scatter, piling, and prescribed fire will be used to shift forest conditions across the analysis area towards desired conditions. Emphasis will be on retention of older trees in all forest types, opening up densely closed stands of mid to late seral classes, creating a more open forest environment and improving shrub and grass diversity. The forested ecosystems that will be the primary targets for treatments will be the ponderosa pine, dry mixed conifer, aspen, and mesic mixed conifer, with some treatments in lodgepole and oak/ponderosa types. Vegetative treatments will balance the need to protect important values at risk within and adjoing the project area. Values at risk include but are not limited to the

following; private property, utility infrastructure, wildlife habitat, soil health, and rivers and streams.

Modifications to the proposed action occurred in the time between scoping and issuing this DEIS as a result of public comments or analyses that relate specifically to the purpose and need and desired conditions. See "Changes to the proposed action since scoping" below. The Modified Proposed Action is analyzed in detail in this DEIS; and unless otherwise noted, is synonymous with the term "proposed action".

The Forest Service proposes to implement vegetation management treatments on the approximately 70,600 acre UMC project analysis area to meet the purpose and need. Treatments would provide a diversity of forest structures that are more in line with desired conditions, and more resilient to anticipated future environmental conditions. Vegetation management treatments would follow a practical, science based approach intended to restore characteristic functionality, and resistance and resilience to disturbance. Known as "ICO" (individuals, clumps and openings), this approach uses historical information at the stand-and landscape-level to design restoration strategies and prescriptions for treatment (e.g., see (Franklin et al. 2013a)).

Vegetation management treatments across approximately 31,700 acres in a variety of forest types would encourage the development of large trees, create heterogenous structural characteristics, develop understory plant diversity, increase forage productivity, create small and larger forest openings, and increase resilience to disturbances such as wildfire (Table 4). Mechanical treatments using ground-based logging would occur on approximately 8,255 acres. A combination of mechanical and hand treatments would occur on approximately 13,351 acres, with about half of each treatment type across those areas. Treatments of approximately 1,127 acres of oakbrush habitat and 1,153 acres of fuelbreak treatment would occur on the eastern side of the project area in the wildland urban interface. Additionally, treatments of approximately 1,021 acres would occur around Palmer Reservoir, and approximately 383 acres of those treatments would occur in the Rampart East Colorado Roadless Area (see Changes to the Proposed Action section). Treatments on approximately 272 acres of transmission line corridor would help maintain the right-of-way and protect the power lines through the forest. Treatments would generally retain and protect large trees of early seral species and trees with old growth physical characteristics consistent with historical reference conditions. As necessary, temporary roads would be constructed, ripped and seeded when the work is complete. Prescribed fire would be utilized after units are treated by other methods to help maintain and enhance desired watershed conditions.

Vegetation management treatments on approximately 3,941 acres in the floodplain improvement areas would be applied where they support attainment of the desired conditions. Floodplain improvement treatment includes thinning of encroaching trees to restore meadow features, hydrologic function, and aquatic habitat conditions. Removal of woody coniferous vegetation encroachment resulting from fire exclusion in some riparian areas would protect and restore watershed function. Riparian and floodplain restoration may also include road improvements or modification, including culvert and storm drainage improvements focused on reducing soil erosion and improving watershed function. Areas within and outside of floodplain treatments showing evidence of gullies, rills, or bare ground created by concentrated use or concentrated flows derived from culvert outlets, or large storm events may be stabilized with native rock and tree structures. Areas exibiting evidence of downcutting and lacking floodplain access for storm flows may include laying vertical banks back to prevent bank erosion, filling the channel/gully

with native material to reduce channel erosion, and reseeding adjacent disturbed areas with native seed.

Vegetation management using prescribed burning, where ecologically appropriate, on up to 2,285 acres would help to reduce fuel loads, increase understory productivity and diversity, reduce uncharacteristic disturbance from wildfire, insects, and disease. Prescribed burning includes both broadcast burning focused on reintroducing fire as a an ecological tool and pile burning necessary to remove woody fuels generated by other stand improvement treatments.

Vegetation management will be employed to achieve wildlife habitat improvement objectives throughout the landscape including creating openings of various sizes and arrangement to provide edge habitat and improve habitat connectivity for a variety of species. Understory conditions would be improved by stimulating grass, forb, and shrub development through tree removal and prescribed fire. Habitat features for cavity nesting birds, and foraging habitat and cover for a variety of mammals, raptors, and ground-dwelling birds would be enhanced by encouraging the development of mature aspen stands through the removal of competing conifers. In areas of decadent aspen clones, regeneration methods would be employed to establish vigorous aspen stands in a variety of age classes. In addition, approximately 320 acres of the escape terrain and movement corridors between the lambing areas of bighorn sheep would be maintained and enhanced on steep, south facing slopes by reducing vegetation cover and creating small openings adjacent to rock outcrops. The foraging and non-breeding habitat of the federally threatened Mexican spotted owl would be moved towards achieving recovery habitat objectives by promoting the development and growth of large trees, retaining and creating large snags and downed woody debris, and by enhancing proper functioning conditions of riparian forests.

The transportation system would be managed through road reconstruction and maintenance, use of temporary roads, and seasonal or permanent closures as needed to support public access, proposed forest management activities, wildlife habitat quality, and aquatic habitat connectivity. The majority of road-related activities would make use of the existing system road network. Hydrologically connected non-system user created roads and trails will be rehabilitated including ripping, recontouring, reseeding, adding drainage features, and adding erosion controls. Recontouring includes moving soil to better align with the natural hillslope and creating an environment that will support native vegetation.

The proposed action would include maintenance and enhancement of culturally significant resources, settings, viewsheds, and sensitive plant and animal species habitat. Vegetation management around known historic resources will help protect and retain the significance of the sites.

A monitoring strategy would be developed in collaboration with the Front Range Rountable to support adaptive management strategies and sharing lessons learned through time. The monitoring strategy would include both stand and landscape level techniques to inform whether the Upper Monument Creek project area is moving towards the desired conditions. Input from interested parties and the most current, applicable science will be used to guide this monitoring.

Connected actions considered in the analysis include road maintenance, fuelwood cutting, and hazard tree cutting or removal. Fuels activities associated with silvicultural treatments (activity fuels) could include mastication, removal, grapple or hand piling, lopping and scattering limbs, and the use of prescribed fire or pile burning.

Given the adaptive nature of the project, site specific design elements and mitigation measures would be developed during the layout of individual activity areas to reduce or eliminate unwanted effects, including those affecting cultural values. Mitigation measures may include avoidance, seasonal operating restrictions, snag creation, and/or soil treatments on compacted or detrimental soils. A full list of design criteria and mitigation measures can be found in Chapter 2.

Table 4. Proposed action type of treatment with the associated cover type and acres.

Treatment Type	Vegetation/Cover type	Acres
Removal	Dry-Mesic Mixed Conifer	2,073.20
	Lodgepole Pine Forest	2,214.53
	Mesic Mixed Conifer	1,787.25
	Ponderosa Pine/Douglas-Fir Woodland	2,180.69
Non-removal	Dry-Mesic Mixed Conifer	3,733.67
	Lodgepole Pine Forest	682.54
	Mesic Mixed Conifer UMC	3,309.42
	Ponderosa Pine/Douglas-Fir Woodland	5,625.99
Broadcast Burn	Ponderosa Pine/Douglas-Fir Woodland	875.25
	Dry-Mesic Mixed Conifer	769.98
	Mesic Mixed Conifer	235.80
	Montane Riparian Systems	353.95
	Non Vegetated/Water	40.10
	Gambel Oak-Mixed Montane Shrubland	9.50
Transmission Line	Ponderosa Pine/Douglas-Fir Woodland	68.72
	Dry-Mesic Mixed Conifer	82.59
	Mesic Mixed Conifer	82.82
	Montane-Subalpine Grassland	2.07
	Montane Riparian Systems	14.86
	Gambel Oak-Mixed Montane Shrubland	15.46
	Non Vegetated/Water	5.05
Fuel Breaks	Dry-Mesic Mixed Conifer	240.15
	Gambel Oak-Mixed Montane Shrubland	101.89
	Ponderosa Pine/Douglas-Fir Woodland	361.98
	Unknown	449.74
Oakbrush Mitigation	Dry-Mesic Mixed Conifer	316.37
	Gambel Oak-Mixed Montane Shrubland	726.20
	Ponderosa Pine/Douglas-Fir Woodland	84.03
Bighorn Sheep Habitat Improvement	Dry-Mesic Mixed Conifer	320.06
Floodplain Improvement	Riparian swale/Mixed Conifer	3,940.83
Palmer Reservoir Watershed	Mixed Vegetation	1,021.9

Changes to the Proposed Action

The DEIS utilized an iterative process to make changes to the proposed action through stakeholder collaboration. See the Procedural Concerns section for more information on the

iterative process. The text and boundary map (Figure 2) below depicts changes made to the proposed action since initial scoping.

- When this project began, the 2012 Colorado Roadless Area boundary was not finalized. By incorporating changes to reflect the 2012 roadless boundary, the boundary of the project increased in two key areas. A section in the northeast corner and a very small section in the northwest corner were both included in the new project boundary.
- Other additions to the project boundary include making Forest Road 350 the project boundary, extending a portion to a watershed boundary, and extending a portion to the forest boundary near Palmer Lake.
- Two small sections of the project area were deleted by making the project boundary Forest Road 350 on the west and the 2012 Colorado Roadless Area on the east.
- We received some public comments that recommended either minimizing or removing treatments in roadless areas. We made a few changes to the project analysis area and we removed the proposed treatment in roadless areas on the western side of the Rampart East Colorado Roadless Area.
- We received requests for fuel breaks around Palmer Lake and the reservoir from citizens of Palmer Lake. In collaboration with the City of Palmer Lake and the Coallition of the Upper South Platte we analyzed treatment around the reservoir (approximately 1,022 total acres), including a small area (383 acreas) in the Rampart East Colorado Roadless Area west of the reservoir (Table 5).

Table 5. Combined treatments around Palmer Reservoir.

Cover Type	Total acres around Palmer Reservoir (including roadless)	Acres in Roadless
Ponderosa Pine/Douglas-Fir Woodland	507.5	230.5
Dry-Mesic Mixed Conifer	403.0	126.0
Mesic Mixed Conifer	56.3	26.1
Gambel Oak-Mixed Montane Shrubland	25.8	0.0
WATER	9.0	0.0
Montane-Subalpine Grassland	7.7	0.0
unclassified	7.2	0.8
Montane Riparian Systems	5.4	0.0
Total	1021.9	383.4

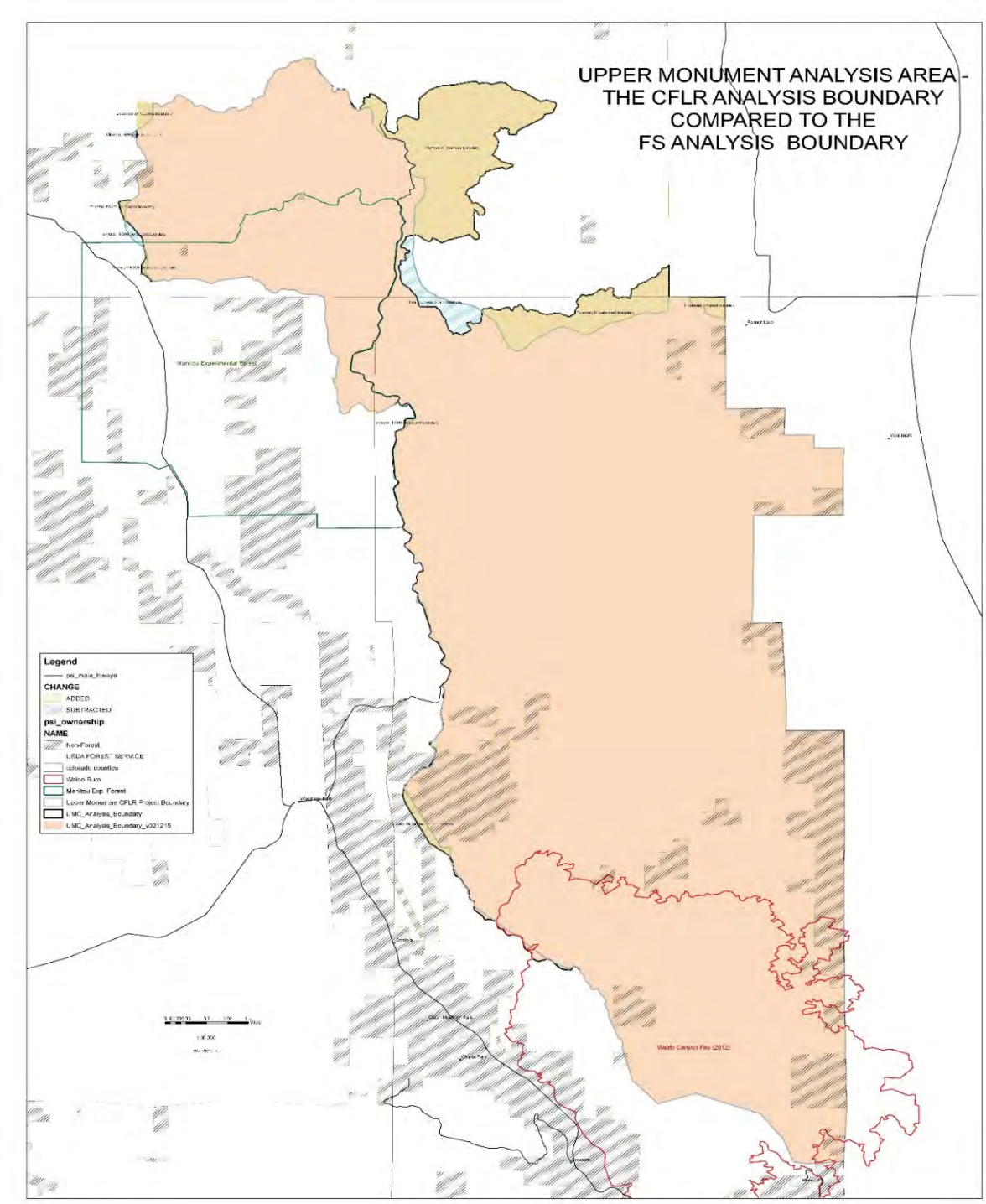


Figure 2. Map of changes made to the proposed action boundary.

- We added floodplain improvement treatments to meet the purpose and need and desired conditions of the landscape.
    - These treatments include actions to protect and restore watershed function by improving watershed condition, floodplain function, and water quality in areas

where upland vegetation is encroaching into riparian areas and altering the habitat and floodplain function,.

- We added more treatments in lodgepole pine to increase the likelihood of being able to support the use of prescribed fire in downslope ponderosa pine-Douglas fir woodlands and dry mixed-conifer forests.
- We decreased the broadcast burn acreages shown in the initial treatments, but retained the ability to burn within any treated areas where burning is feasible or desireable to meet landscape management objectives.
- We removed one polygon of bighorn sheep habitat treatment because it occurred in potential spotted owl habitat.
- We removed all proposed Forest Plan amendments from the analysis.

Adaptive management

The Proposed Action includes the use of adaptive management principals to enable land managers, along with public and partner participation, to identify management treatments that modify forest structure, pattern, and composition across the landscape to help improve forest resiliency and function in response to the threats from large, high intensity wildfires and the subsequent deleterious effects to watersheds within the Upper Monument Project Area. As considered in this analysis, experimentation and monitoring are core principals for effective adaptive management. Adaptive management is an approach to natural resource management in which decisions are made as part of an ongoing learning process.

For the purposes of this analysis, adaptive management has been incorporated in three significant ways. The first is in the use of an adaptive and iterative planning process allowing for the proposed action to be continually revised up to the point of a final decision based on new information received as part of the public process or from improved site-specific information gathered as part of the ongoing analysis. Secondly, this DEIS analyzed the effects of fully implementing the range of actions included in the proposed action thus providing a basis for examining differences between predicted and actual outcomes. This approach is grounded on the recognition and acceptance of certain risks and a degree of uncertainty in being able to fully implement all the actions identified as part of the analysis. As a result, the analysis considers a suite of actions appropriate for meeting desired objectives that may be selected from at the point of project design and layout. Consequently, as new projects are identified, resource specialists and public feedback will be used to modify the project to ensure that appropriate design criteria reflective of site-specific conditions (cover type, slopes, wildlife habitats, etc.) are fully considered prior to implementation of each project.

Thirdly, adaptive management as considered in this analysis also relies on continually monitoring changing conditions and the result of actions to determine if outcomes constitute an adequate basis for changing implementation strategies. Given the large scale and topographical complexity of the project area, this continual monitoring allows for addressing the presence of risk and uncertainty, and so provides capacity to recognize and adjust to ecological landscape changes that may become evident as projects are implemented. Effects are monitored both for the purposes of learning and adjusting future management actions, thereby improving the efficiency and responsiveness of management. It is “a system of management practices based on identified intended outcomes and monitoring to determine if management actions are meeting

those outcomes; and, if not, to facilitate management changes that will best ensure that those outcomes" (40 CFR 220.3). In support of this, partners, stakeholders, and the Forest Service have worked together using the stated goals and objectives in this document to develop specific monitoring questions and plan to implement monitoring strategies throughout the life of the project. The monitoring report is available in Appendix C. Monitoring results will help us determine whether treatments are helping the landscape move towards the desired conditions and whether changes in implementation are necessary.

Prioritizing Treatment Actions

While it is difficult to anticipate the sequence of all potential treatments over the next five-ten years due to the variability in funding levels and availability of contractors to carry out the actions, several general priorities can be described. In order to monitor at the landscape level, project implementation would be designed so they are connected within a watershed, are in areas highly succeptible to catastrophic fire, or provide control features that further the objectives of prescribed or wildland fire management.

Decision Framework

During the final environmental impact statement process the District Ranger for the District is the Forest Service official responsible for deciding whether to select the proposed action or other proposed action interations analyzed in the DEIS. (1) the location and treatment methods for all restoration activities; and (2) design criteria, mitigation, and monitoring requirements.

Other Planning Efforts

Other restoration activities (actions on private, State, and other non-National Forest System lands) that influence, or are complementary to this analysis are addressed in the cumulative effects section.

Management Direction

Over time, a framework of laws, regulation, and guiding legislation that works to guide the management of National Forest System lands has been enacted. Legal mandates governing national forest management date back to the Organic Act of 1897, which provided that national forests would be managed for the dual purpose of protecting water flows and providing a continuous supply of timber for the American public. The Multiple Use Sustained Yield Act (1960) provides for the sustainability of the multiple uses of natural resources in ways that best meet the needs of the public while maintaining the long-term productivity of the land for multiple uses and in such a manner that these lands are available to future generations. The magnitude and intensity of any effects are disclosed to the public, and the public has the opportunity to comment on the actions proposed. The National Forest Management Act 1976 and its accompanying legislation guides the creation, revision, and amendment of National Forest Land Management Plans, and the Forest and Rangeland Renewal Resources Planning Act of 1974 directs that the suitability of lands for resource management be identified and a process for the revision of land and resource management plans established.

The National Environmental Policy Act (NEPA) of 1969 requires that all major Federal actions significantly affecting the human environment be analyzed, and the consequences to the quality of the human environment from proposed management actions are to be considered. The regulations implementing the NEPA further require that agencies prepare environmental impact statements concurrent and integrated with environmental analysis and related surveys and studies required by such laws as the Endangered Species Act of 1973, the National Historic Preservation Act of 1966, the Wilderness Act of 1964, and the Wild and Scenic Rivers Act of 1968. Other environmental review laws and executive orders, such as the Clean Air Act of 1977 and the Clean Water Act of 1948 are also considered.

The Upper Monument Creek Landscape Restoration project will continue to honor American Indian reserved rights through consultation and coordination, and will maintain a government-to-government relationship with federal recognized tribal governments.

Additional direction for managing National Forest System lands comes from a variety of sources, including Executive Orders (EOs), the Code of Federal Regulations (CFRs) and the Forest Service directive system, which includes the Forest Service Manual (FSM) and the Forest Service Handbook (FSH). This management direction is generally not repeated in the environmental assessment.

The scope process for NFS project planning is constrained by laws, government policies, and tribal trust responsibilities. This project is tiered to the Pike and San Isabel National Forests/Cimarron and Comanche National Grasslands Land and Resource Management Plan (forest plan) ROD and FEIS as amended (1984). The forest plan provides primary guidance for where and how each management activity can occur on the forest. It establishes goals, objectives, and desired future conditions, identifies management areas within the Forest, and provides standards and guidelines for implementation (USDA Forest Service 1984). The North half Map for the Pike and San Isabel National Forests illustrates Forest Plan management areas within the UMC boundaries Management direction for the Upper monument project is set forth in the Pike and San Isabel Land and Resource Management Plan (USDA FS 1984). This plan provides the framework to guide project planning as well as resource management operations of the Pike-San Isabel National Forests. The 1976 National Forest Management Act (NFMA) requires that site-specific project decisions must be consistent with the Forest Plan. Forest Plan goals and objectives guide the identification and selection of potential agency projects. The determination of whether or not an individual project is consistent with the Forest Plan is based on whether or not the project adheres to forest-wide and management area standards.

Management direction is expressed in terms of both Forest Direction and Management Area Direction. Forest Direction consists of goals, objectives and management requirements which are generally applicable to the entire Forest (USDA FS 1984). The management requirements contained in the Forest Direction section of the Forest Plan set the minimum conditions that must be maintained while moving toward a desired condition and meeting the specified goals and objectives (USDA FS 1984). Management Area Direction contains management requirements specific to individual areas within the Forest and are applied in addition to the Forest Direction Management Requirements (USDA FS 1984).

There are 8 designated Management Areas within the UMC project area, they are as follows:

Management Area	Description	Acres (Percent of project area)

2A	Focus on outdoor recreation in semiprimitive setting including year-round motorized and non-motorized recreation.	10,944 (16%)
2B	Focus on outdoor recreation in a roaded natural and rural setting including year-round developed facilities and motorized and non-motorized recreation.	21,253 (32%)
4B	Provides wildlife habitat needs and permits dispersed nonmotorized and motorized recreation.	7,116 (11%)
5B	Emphasizes the management of big game winter and summer range.	4, 029 (6%)
7A	Emphasizes productive tree stand management on lands available, capable and suitable for production of a variety of commercial and noncommercial wood products.	3,934 (6%)
7D	Emphasizes productive tree stand management on lands available, capable and suitable for production of a variety of products other than sawtimber.	6, 279 (9%)
10B	Provides for the management of existing or potential research areas.	4,407 (7%)
10E	Provides for municipal watershed and municipal water supply watersheds.	8,880 (13%)

Additionally, a ninth Management Area, Riparian Area Management (MA9A), is an overlay of all component ecosystemns of riparian areas. These components include the aquatic ecosystem, the riparian ecosystem, and adjacent ecosystems within 100 feet of perennial streams, lakes, and other water bodies. Each of these components is managed together as an integrated riparian area. The 9A management areas were not mapped at the time of the Forest Plan release. The goals of

management are to provide healthy self-perpetuating plant communities, meet water quality standards, provide habitats for viable populations of wildlife and fish, and provide stable stream channels. General direction for transportation system management is to locate roads and trails outside riparian areas unless alternative routes have been reviewed and rejected as being more environmentally damaging (III-214). Standards and guidelines for MA 9A are found in the Forest Plan on pages III-204 to III-215.

Project Record

This DEIS incorporates by reference the project record (40 CFR 1502.21). The project record contains specialist reports and other technical documentation used to support the analysis and conclusions in this DEIS. The project record is available for review at the Pikes Peak Ranger District, 601 South Weber, Colorado Springs, CO 80903.

Public Involvement

Collaboration

In May 2004, the Front Range Rountable was formed to provide diverse stakeholder input to improve forest health through fuels treatment along the Colorado Front Range and to reduce wildland fire risks. The Roundtable is made up of several different stakeholders (Figure 3), divided up into five different teams. The group meets quarterly and the meetings and membership are open to the public.

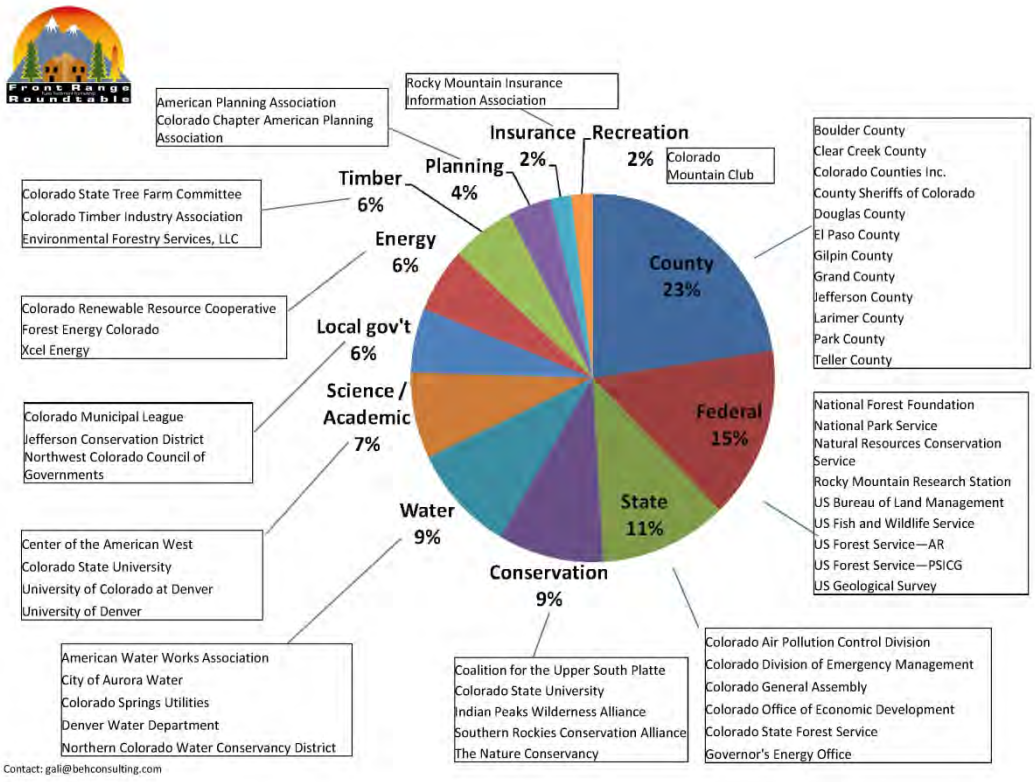


Figure 3. Division of membership of the front range roundtable.

In 2010 the Forest Service created the Collaborative Forest Landscape Restoration Program and the Front Range Roundtable submitted a proposal requesting funds to accelerate treatment on Forest System lands that provide long-lasting ecological, social, and economic benefit. The proposal was one of the initial selected for funds to establish a collaborative forest landscape restoration program. As a team on the Frontrange Roundtable, the Landscape Restoration Team was to:

- Serve as the Front Range Collaborative Forest Landscape Restoration (CFLR) Project multi-party monitoring group. This includes collecting and evaluating data.
- Develop an adaptive management process and recommendations.
- Revise the June 2011 CLFR monitoring plan (through addendums until funding identified for a re-write)

As part of this effort, the Pike National Forest submitted the Upper Monument Creek project proposal that could effectively test the desired conditions and long term monitoring of treatment across the landscape. The proposal was accepted and the Roundtable created the Upper Monument Creek Collaborative to provide recommendations and feedback to the District as the project was developed.

In addition, the District supports the Air Force Academy, County, City and State Lands, and private land owners conducting fuels reduction treatments on private lands. Some landowners have and continue to implement fuels reduction work on their private lands adjoining the project boundary. As an active participant in Community Wildfire Protection Planning efforts, the District would continue to encourage and support fuels reduction treatments on private lands. This work on private lands would be included in the cumulative effects analysis.

Scoping

The project was posted on the Forest's schedule of proposed actions website on April 1, 2014 and the notice of intent (NOI) to prepare an environmental impact statement was published in the Federal Register on May 22, 2014 (FR Doc. 2012-24317). The NOI asked for public comment on the proposal from May 22 until July 7, 2014. The District received comments from 24 entities including individuals, local government, state government, federal and state agencies, and organizations. Scoping comments and response can be found in Appendix A.

Public Meetings

Three public meetings were conducted in May and June of 2014: specifically on May 28 in Colorado Springs, CO; May 29 in Monument, CO; and June 3 in Woodland Park, CO. The meetings were held in an open house style with a brief PowerPoint and the opportunity for the public to view documents and maps of the proposal, ask questions, and submit comments. Additionally, the District has met with the collaborative group consistently throughout the process. These meetings are always open to the public to provide information, ask and answer questions, and discuss the proposal.

Issues

The interdisciplinary team reviewed the scoping comments from public individuals, interest groups, local governments, and other agencies, to develop a list of issues to address. The issues were separated into two groups: key and non-key issues. Key issues were defined as those directly or indirectly caused by implementing the proposed action. Non-key issues were identified as those:
1. Addressed through LRMP or implementation of LRMP standards and guidelines and best management practices;
2. Addressed through implementation of project-specific mitigation measures;
3. Addressed during processes or analyses routinely conducted by an interdisciplinary team;
4. Addressed through spatial location of activities during alternative design;
5. Beyond the scope of the project; or
6. General comment.

The Council on Environmental Quality (CEQ) NEPA regulations explain these delineations in Sec. 1501.7, "…identify, and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…" A list of non-key issues and reasons regarding their categorization as non-significant is in the project record. Following are the key issues identified by the public and used to focus the analysis or drive alternative development. As for significant issues, the Forest Service identified the following issues during scoping:

1. Project activities may result in adverse impacts to forest, recreation, and riparian resources.

   There is concern about which vegetation treatments will best restore forest structure and composition toward HRV. In particular, there is disagreement about the size and species of trees to retain or harvest, and how to best minimize impacts from harvest and prescribed burning on forest, wildlife, recreation, and riparian resources.

   Indicator: forest composition moving towards desired conditions, minimize disturbance to wildlife and increase wildlife habitat, minimize user created recreation routes following treatments, minimize erosion, invasive species following treatment

2. Prescribed fire activities may impact adjacent private property

   Prescribed fire activities may result in impacts to private property. Current fuel loads in areas adjacent to private properties generally do not allow prescribed fire activities to be managed safely with low risk of affecting private property. The reduced occurrence of wildland fire primarily due to an increase in wildland fire suppression has contributed to the increased fuel loads over most of the Upper Monument Creek project area, including areas adjacent to private property.

   Indicator: changing fire behavior (flame length, spotting, and crown fire) adjacent to private lands, via mechanical treatments, to facilitate safer prescribed fire burn conditions

3. Project activities may result in wildlife being displaced

Prescribed fire and mechanical thinning activities that occur within or adjacent to wildlife, such as the Northern goshawk, territories may result in nest abandonment, the displacement of wildlife, and potential mortality. Project activities may remove or degrade potential foraging habitat in the short-term.

Indicator: habitat availability, nesting success, recruitment, and percent survival

Procedural Concerns

Range of Alternatives and Comparison of Alternatives

This procedural concern was raised in scoping comments. There is a concern about the lack of action alternatives identified during intial comments. However, the DEIS utilized iterative NEPA to incrementally make changes to refine the proposed action as new information became available in response to comments or from additional field surveys. In 2008 the U.S. Forest Service (USFS) and the U.S. Department of the Interior updated their existing National Environmental Policy Act (NEPA) procedures (36 CFR 220; 43 CFR 46) to permit a more open, transparent and collaborative approach to carrying out the NEPA mandate. Called Iterative NEPA, the approach reflects the incremental stages in which proposed actions and alternatives are improved throughout the NEPA process with stakeholders to meet as many interests as possible prior to making a final decision. Many different stakeholders have been participating in the NEPA process through a collaborative group formed as a subset of the Front Range Roundtable. The collaborative meets every few months and provides the Forest Service with feedback and recommendations on desired conditions, treatments, and monitoring of treatments across the landscape. The meetings are open to the public. There are two other sections in the DEIS that help address this concern “changes to the proposed action” and “actions considered but dismissed from further analysis.”

Further, as an adaptive management project, this EIS analyzes a range of potential actions within the scope of the proposed action alternative. This DEIS analyzed the effects of fully implementing those actions thus providing a basis for examining differences between predicted and actual outcomes. This management approach is grounded on the recognition and acceptance of certain risks and a degree of uncertainty in being able to fully implement all the actions within a rigid construct that is not flexible to the site-specific variations encountered as projects are actually layout on the ground. As a result, the analysis considers a suite of actions appropriate for meeting desired objectives that may be selected at the point of project design and layout. Consequently, this approach to alternative design ultimately provides for a greater range of possible implementation scenerios not focused on expanding the range of alternatives, but rather on having the ability to apply the right vegetation treatment on the right acres.

Significant Forest Plan Amendments

This procedural concern is based on scoping comments. Commenters stated the plan amendments are significant because they may bring about changes that may have an important effect on the entire land management plan. Three Forest Plan Amendments were evaluated.

1. Wildlife amendment for Elk hiding cover. It was determined this project would meet the intent of the wildlife hiding cover described in the Forest Plan.

2. Allowing fire to burn on the landscape. Letting fire burn on the landscape is a function of time or year, location, and whether treatments have occurred to provide safe anchor points.

3. Timber openings: Currenlty a maximum size of 40 acre openings can be created and maintained in all management areas other than timber management areas 7A and 7D, with the exception of aspen enhancement in those timber management areas. NFMA standards require certification or replanting within five years in suitable timber management areas 7A and 7D. The amendment would require changing the management area and the suitability of timber.

The proposed plan amendments specific to this project could impose direction on ongoing or future analyses. Therefore, it was determined that these amendments have a greater implication beyond the current project and should be reevaluated during the Forest Plan revision process (estimated start 2018). Also, project implementation without any amendment would still meet the purpose and need and bring the landscape closer to the desired conditions.

Chapter 2. Alternatives, Including the Proposed Action

Introduction

This chapter describes the no action alternative and proposed action, and compares the alternatives considered but dismissed for the Upper Monument Creek project. It includes the description and maps for the proposed action.

Alternatives Considered in Detail

The Forest Service developed 2 alternatives, including the No Action and Modified Proposed Action alternatives, in response to issues raised by the public, collaborative discussions, and the guidance found in law, policy, and the Forest Plan.

Alternative 1 (No Action)

Under this alternative, vegetation management actions would not be employed on the UMC landscape. The departure of ecological conditions from a natural range of variability would persist. The vegetative conditions within the UMC landscape would continue to differ, in both structure and distribution, from historic forest conditions. The project area would also remain at risk from large-scale, high-intensity wildfire due to an altered fuel load and structure resulting from increases in tree density, encroachment of shade tolerant tree species, or loss of shade intolerant tree species.

In the absence of natural disturbance events, the following ecological conditions would exist:

- High forest density
- Loss of spatial heterogeneity
- Loss of openings
- Less common and less dispersed early-seral forest structures
- Overabundance of mid-seral forest classes
- Less common old trees and old-growth structures
- Increased shade-tolerant species
- Absence of low-severity surface fire

Alternative 2 (Modified Proposed Action)

The intent of the proposed action is to restore more resilient ecological conditions across the entire landscape and particularly Front Range forests; reduce the impacts of severe wildfires on property, infrastructure, and natural resources; and contribute towards the long-term sustainability of a full range of forest values including creating effective wildlife habitat and protecting aquatic resources. The proposed action entails the treatment of up to 31,700 acres within the 70,600 acre UMC project area (Figure 4). A combination of mechanical thinning with product removal, service work, manual thinning, pile burning, post treatment broadcast burning, and first entry prescribed fire would be utilized to achieve the desired ecological conditions. Implementation of these management actions is expected to begin in 2016 or 2017, and extend over a period of 10 years or more.

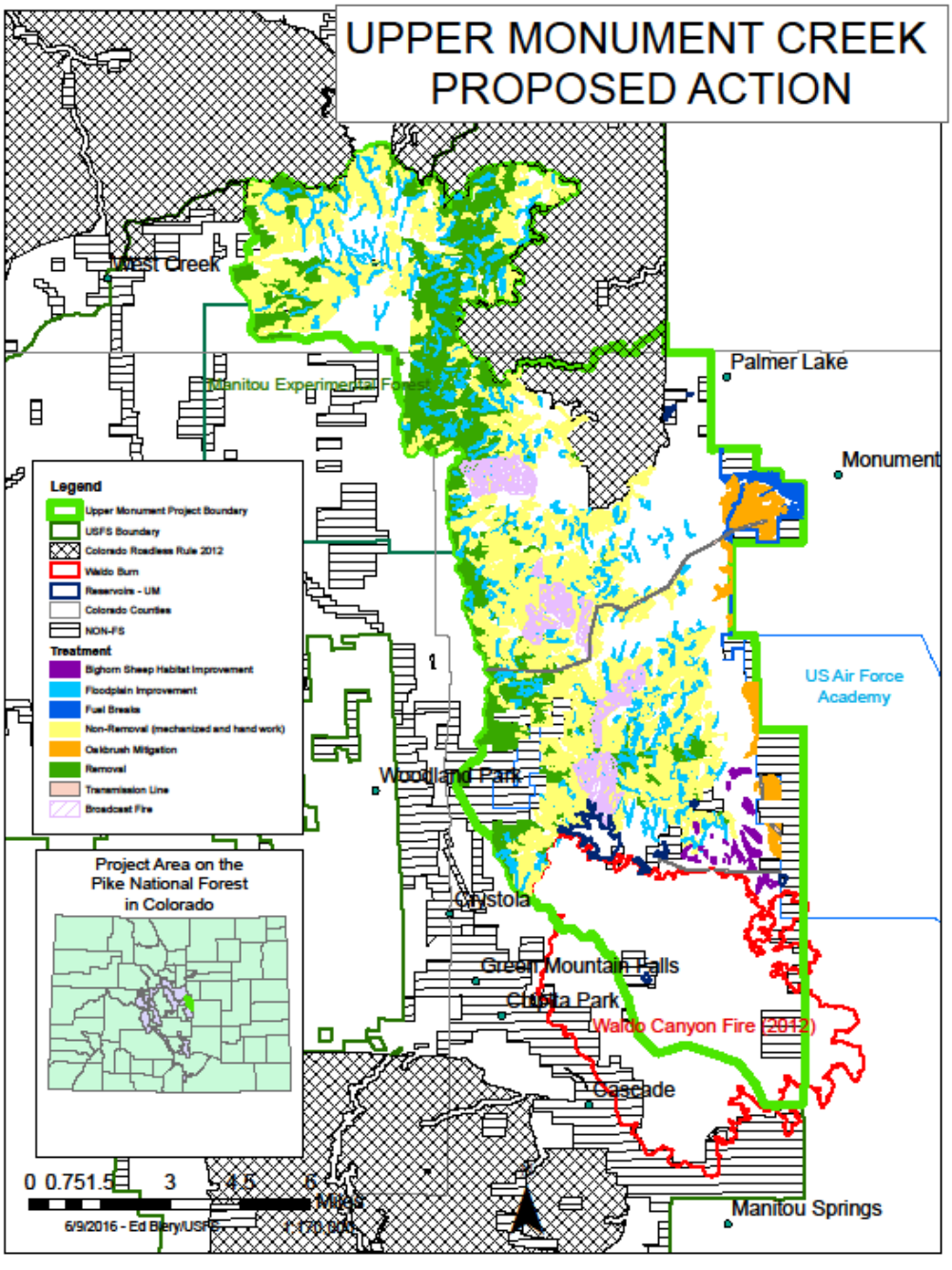


Figure 4. Map of the Proposed Action.

Vegetation Management

Vegetation management treatments would occur in a variety of forest types in order to promote the composition, structure, and function that is more characteristic of project area desired ecological conditions. The proposed treatments are intended to result in the development of large trees, small and larger forest openings, heterogeneous structural characteristics, understory plant diversity and forage productivity, and resiliency to disturbance events.

Mechanical treatments employing ground-based logging techniques would occur on about 8,277 acres, while a combination of mechanical and manual treatments (i.e., hand treatment methods) would occur

on about 13,519 acres. An estimated 1,127 acres of oakbrush and 1,153 acres of fuel break treatments would occur on the eastern side of the project area in a wildland urban interface zone adjacent to Monument, CO; Palmer Lake, CO; and the Air Force Academy. About 272 acres of transmission line corridor clearing would also be performed in order to maintain the right-of-way and protect the power lines that traverse the project area.

The majority of the proposed treatments would occur in ponderosa pine/Douglas-fir, dry mixed conifer, and mesic mixed conifer stands, especially those in a closed canopy condition (i.e., vegetation classes in 'mid closed' and 'late closed'). Openings of various sizes would be created in all vegetation classes, but placement in 'mid closed' stands or expansion of existing openings would be favored (Figure 5). The enhancement of existing openings (i.e., expanding from pre-existing openings) would be emphasized over created openings where feasible. Other treatments in ''mid closed' and 'late closed' stands would target ladder fuels, dense understories, and the spatial arrangement in stands with a large ponderosa pine component. Vegetation management in forest types other than the three predominant forested vegetation systems, such as lodgepole pine, would generally serve to reduce fuels, increase landscape heterogeneity, assist in the progress towards uneven-aged characteristics, and open growing space for intermediate and co-dominant trees (See summary Table 6).

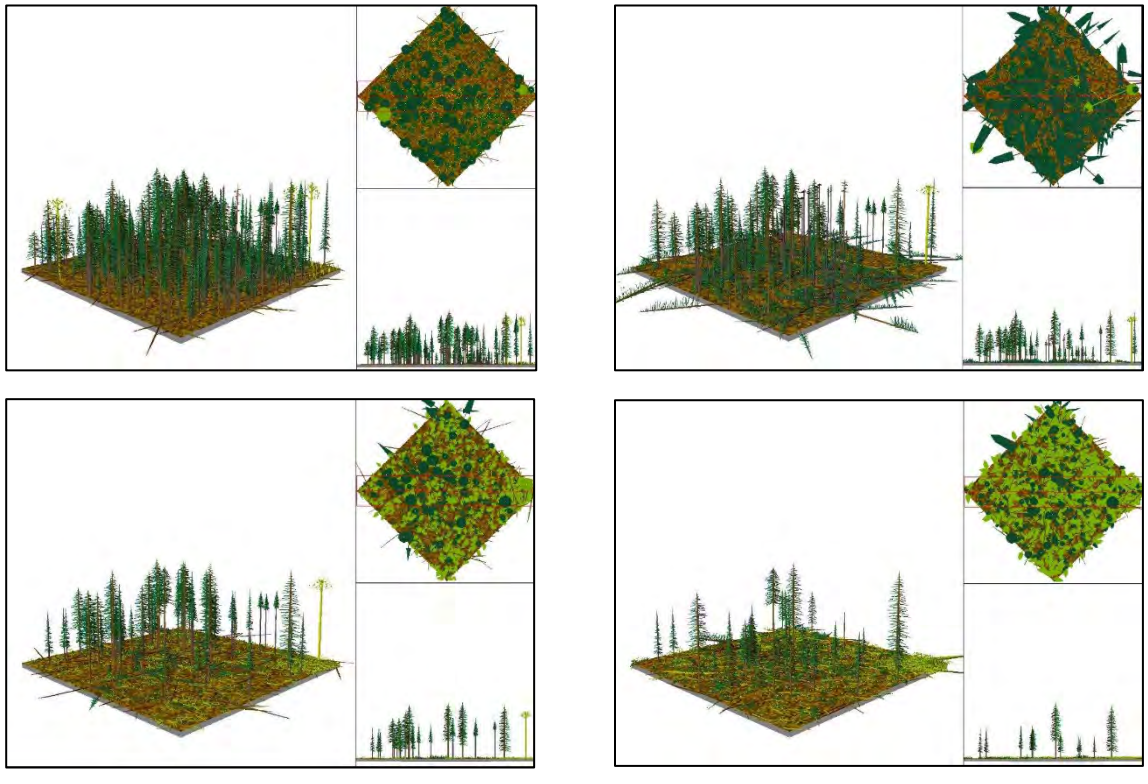


Figure 5. From top left to bottom right, graphic representation of pre-treatment, 2 acre, 15 acre, and 30 acre openings.

Ponderosa Pine – Douglas-fir Forests

The ponderosa pine – Douglas-fir forested vegetation system is located primarily at lower elevations and dry sites at higher elevations. Historically, these systems were shaped by low- to mixed-severity, frequent fire, which maintained an open stand structure with variably spaced individual trees, groups of trees, and openings. Current conditions are much denser than historical conditions for this system, and thus this system is a high priority for restoration.

A predominantly uneven-aged, open stand condition that contains larger openings (i.e., one acre and larger) irregularly distributed throughout the treatment area is the desired condition for this forested vegetation system. Management in ponderosa pine – Douglas-fir woodlands would focus on reducing

stand densities, and restoring spatial structure by enhancing tree groups, scattered individual trees, and openings. Ponderosa pine would be the dominant species, but Douglas-fir would be present in areas with higher moisture availability and productivity. In all cases, aspen would be retained and enhanced. Small, untreated pockets would be retained for landscape heterogeneity and wildlife cover. Old trees, snags, and coarse woody debris would be retained as well to provide wildlife benefit and structural complexity.

Management objectives within the ponderosa pine – Douglas-fir forested vegetation system:

- Residual basal area (BA) would range from 30 to 50 ft^2 per acre, but would be distributed according to site variability in topography and substrate characteristics such that BA in any given stand may range from 0 ft^2 per acre (openings) up to 80+ ft^2 per acre (high-density patches).

- Openings would be variable in size, shape, and distribution. Enhancing existing openings would allow for the restoration of larger openings (e.g., up to 40 acres in size), while creating new openings would enhance landscape heterogeneity and break canopy continuity. Suitable locations for openings include low-productivity areas such as shallow soils, areas currently lacking ponderosa pine, areas where disease or insect infestation are present, and plantations established from off-site seed sources. Created openings may range in size from 1 to 20 acres.

- A low-density matrix (i.e., basal area of 20 to 40 ft^2 per acre) would exist. Suitable locations for low density structures include ridges, south-facing slopes, and other areas of low productivity. Residual trees would be variably spaced. Existing tree groups (i.e., trees having interlocking crowns) would be enhanced by clearing around the group. Approximately 50-70 percent of trees may occur in groups, whereas the remaining 30-50 percent may occur as scattered, individual trees at low densities. Tree groups may contain anywhere from 2 to 10+ trees, but would most likely contain around 2-4 trees. Tree groups would be separated from one another by at least 1 to 1.5 tree lengths from drip-line to drip-line (distance of limbs from tree trunk), based on the heights of trees in the group.

- A medium-density matrix (i.e., basal area of 40 to 60 ft^2 per acre) would occur most often at mid-slope positions and other areas of intermediate productivity, such as gentle slopes. Approximately 70-90% of trees may occur in groups that typically contain 5-10 trees.

- Areas of high density (i.e., basal area of 60 to 80+ ft^2 per acre) would occur on north-facing slopes and other moist, higher-productivity areas. The characteristic structure of lower-density areas (i.e., tree groups, individual scattered trees, and openings) may be less evident in these areas as most trees occur in groups (90+ percent), with few scattered individual trees.

- Untreated "reserves" representing unique ecological or cultural areas would occur within the treatment areas.

- Fuel breaks would be created in strategic locations for firefighter safety, to prevent crown fire spread, and to create holding areas for prescribed fire.

Dry Mixed-Conifer Forests

Dry mixed-conifer forests often represent subtle transitions from ponderosa pine – Douglas-fir forests where moisture availability and the proportion of Douglas-fir both increase. Dry mixed-conifer forests are naturally denser and more productive than ponderosa pine – Douglas-fir forests, but have similar ecological dynamics. Low-severity fire was the dominant disturbance regime in this forest type historically, but with some increase in the preponderance of moderate- and high-severity fire and slightly longer fire return intervals compared to ponderosa pine – Douglas-fir forests. Dry mixed-conifer forests typically have greater variability in tree group composition, from single-species to

mixed-species groups, and from single-aged to multi-aged groups. There is also higher potential for ladder fuel development in this system due to the higher productivity and increased proportion of Douglas-fir.

The treatment approach in dry mixed-conifer forests is similar to that in ponderosa pine - Douglas-fir forest, though higher overall densities and a higher proportion of Douglas-fir and other conifers, such as limber pine, would be present. Greater variability in tree group composition may be present as well. Groups may contain single species or multiple species and may be single-aged or multi-aged. Old trees, snags, and coarse woody debris are important structural components that would be retained to provide wildlife benefit and structural complexity.

Management objectives within the dry mixed-conifer forested vegetation system:

- Residual basal area would range from 40 to 60 ft^2 per acre and would be distributed according to site variability in productivity, ranging from 0 ft^2 per acre (openings) up to 80+ ft^2 per acre (high-density patches).
- Openings would be variable in size, shape, and distribution. Sizes may range from 1 to 20 acres. Suitable locations for openings may include low-productivity areas such as shallow soils and areas where disease or insect infestation is present. Higher productivity areas may be suitable as well to mimic 'blow-outs' that occur with mixed-severity fire and to create opportunities for regeneration and early-seral habitat structures.
- A low-density matrix (i.e., basal area of 20 to 40 ft^2 per acre) would occur primarily in areas where a high ponderosa pine component (as much as 50%) is present. These areas may have been ponderosa pine – Douglas-fir woodlands prior to fire exclusion and conversion back to this woodland structure may be appropriate. Tree groups, individual scattered trees, and openings would all be present. Approximately 50-70 percent of the trees may occur in groups containing anywhere from 2 to 10+ trees, but would most often contain 2-4 trees. The remaining 30-50 percent of trees may occur as scattered individuals.
- A medium-density matrix (i.e., basal area of 40 to 60 ft^2 per acre) would occur with emphasis on restoring spatial structure. More trees would occur in groups (70-90%) that typically contain 5-10 trees. Mixed species groups are appropriate. Ponderosa pine, Douglas-fir, limber pine, and aspen may all occur.
- A high-density matrix (i.e., basal area of 60 to 80+ ft^2 per acre) would occur in higher productivity areas. Most (90 percent or more) trees may occur in groups containing a large proportion of Douglas-fir, but blue spruce may be present as well.
- Untreated "reserves" representing unique ecological or cultural areas would occur within the treatment areas.
- Fuel breaks would be created in strategic locations for firefighter safety, to prevent crown fire spread, and to create holding areas for prescribed fire.

Mesic Mixed-Conifer Forests

Mesic mixed-conifer forests are found primarily in mesic or areas with cooler temperatures and higher moisture retention rates such as north-facing slopes and at higher elevations. The presence of Engelmann spruce often signals the transition from dry mixed-conifer to mesic mixed-conifer forests. Historically, mesic mixed-conifer forests were prone to extremes in fire activity, depending on climatic conditions. Under mild conditions they may not have burned at all, whereas during drought they may have burned with high severity. This disturbance dynamic would tend to create more of an even-aged,

patch structured system as opposed to the uneven-aged matrix characteristic of drier settings. A range of structural stages would have characterized the system across the landscape, representing varying degrees of recovery following stand-replacing fire.

Treatments in mesic mixed-conifer forests would focus on enhancing structural and age-class diversity between stands (e.g., young stands adjacent to older stands), reducing the density of older stands, and reducing fuels. In general, the mesic mixed-conifer systems are not as ecologically departed from the natural range of variability compared to the drier forest systems. However, treatments in mesic mixed-conifer that are designed for fuels reduction are desired in order to break canopy continuity and increase the potential for the use of prescribed fire within this forest type and adjacent dry forest types. Treatments would be based on the local context and the presence of values at risk. For example, a high-density patch of mesic mixed-conifer adjacent to an old-growth stand of ponderosa pine may be a candidate for treatment in order to reduce the potential for crown fire and protect the old-growth conditions.

Management objectives within the mesic mixed-conifer forested vegetation system:

- Large openings (10 to 20 acres in size) would be created in early- and mid-seral stands to mimic natural disturbances such as wind throw or blow-outs that occurred historically with mixed-severity fire. Diseased or insect-infested areas may provide an opportunity for creating openings. Uniform shapes would be avoided, and the spacing and placement of openings would be located in areas that have moderate to low risk of wind throw.
- The density in late-seral, closed stands would be reduced in order to release large, old trees and accelerate development of structural complexity and old-growth features. Removal would be focused on small-diameter trees and ladder fuels.
- A high proportion of the total area in mesic-mixed conifer would remain untreated. Closed forests interspersed with open, drier forests would provide a natural and desirable landscape pattern, including habitat that is important for wildlife.
- Fuel breaks would be created in strategic locations for firefighter safety, to prevent crown fire spread, and to create holding areas for prescribed fire.

Lodgepole Pine Forests

The lodgepole pine forested vegetation system is located primarily along the Rampart Range Road within the north-central part of the project area. Lodgepole pine stands consist of a diverse range of structural types, from late-seral, uneven-aged stands to younger, even-aged stands. The late-seral, uneven-aged stands within the project area appear to be a somewhat rare compositional and structural type for lodgepole pine. These stands are relatively open with patches of well-developed understory and old trees, and are dominated by lodgepole pine but also include a diverse suite of additional species such as Douglas-fir, limber pine, aspen, and occasionally ponderosa pine. Some evidence of surface fire is present throughout these stands as well. Small-scale tree mortality and regeneration processes appear to be operating in these stands, consistent with uneven-aged stand dynamics. These late-seral stands occur along flat ridges of the Rampart Range and grade downslope into younger, even-aged stands, particularly on north-facing slopes. These younger stands likely represent recovery from stand-replacing fire and are more typical of lodgepole pine, exhibiting fairly uniform stand structure and sparse understory vegetation. Stands that are regenerating from clearcutting treatments in the 1960s and 1970s are also present. These stands exhibit the classic “dog-hair” structure of young lodgepole stands.

Lodgepole pine forests within the project area do not appear to be considerably departed from historical conditions for this system type (Table 16). A suitable range of seral stages are represented at appropriate scales, and the stands currently appear healthy and have not been significantly impacted by the mountain pine beetle. However, treatments designed for fuels reduction are desired due to the location of the lodgepole pine forests relative to other high priority ecological systems. Fuels reduction would increase the feasibility of prescribed fire in downslope ponderosa pine – Douglas-fir and dry mixed-conifer forests and thus would advance larger landscape restoration objectives. Such treatment

would also serve to protect late-seral lodgepole pine stands that have been identified as unique within the landscape.

Management in lodgepole pine forests would focus on reducing fuel loads and canopy continuity, increasing structural diversity and resilience to fire and mountain pine beetle, encouraging aspen cover, and moving younger, more uniform stands in the direction of late-seral stand structures. Openings would be created to slow the rate of spread and break the direction of an active crown fire.

Management objectives within the lodgepole pine forested vegetation system:

- Precommercial thinning would be utilized in sapling-size lodgepole pine areas, but some denser thickets would remain for wildlife cover.
- Treatments would target mid-seral and closed stand structures, while treatments in late-seral, uneven-aged stands would be minimized. Windthrow would also be minimized during treatment design (e.g., thinning between openings would be avoided in mature stands).
- Patch clearcuts (3 to 20 acres in size) would be created that target mid-closed structure classes.
- Both small (<1 acre) and large (1-5 acres) openings would be created by an uneven-aged, group selection approach.
- Openings greater than 1 acre would be placed in areas considered to have moderate-to-low risk of windthrow.
- Where feasible, larger openings would be located adjacent to drainages to enhance aspen sprouting.
- Homogenous patterns, such as evenly spaced openings of the same size and even-spacing of trees, would be avoided.
- Fuel breaks would be created in strategic locations for firefighter safety, to prevent crown fire spread, and to create holding areas for prescribed fire (e.g., roadways and areas located along the roadless boundary).

Gambel Oak – Mixed Montane Shrublands

Gambel oak – mixed montane shrublands occupy lower elevation, dry settings primarily along the eastern portion of the project area. This vegetation system occurs both as an oak-dominated shrubland and as more of an understory component within the ponderosa pine – Douglas-fir woodland. As one of the few deciduous tree species present within the project area, Gambel oak adds species diversity and has an important role for wildlife in terms of both cover and forage.

Gambel oak is likely over-represented on the landscape due to fire exclusion. Given a low-elevation range of occurrence, Gambel oak likely experienced frequent fire historically, which would have maintained a more open and diverse structural condition than presently exists on the landscape. A range of growth forms from large individual trees to shrubby thickets, and a rich understory community of grasses, forbs, and shrubs, were likely present historically. The area in the vicinity of the Town of Monument is currently composed of dense, uniform Gambel oak following recovery from the Berry fire of 1989. Very little structural diversity occurs and the area represents high potential for stand-replacing fire.

Management in Gambel oak – mixed montane shrublands would focus on reducing fuels, increasing structural diversity, and breaking canopy continuity where uniform canopy cover exists. Where possible, prescribed fire would be used to reduce fuel loads, increase structural heterogeneity, and enhance understory herbaceous vegetation. Priority would be given to treatments along roadsides and private land interfaces, especially where opportunity exists for complementing defensible space activities implemented by surrounding homeowners. Treatment prescriptions would also incorporate wildlife objectives where possible.

Management objectives within the Gambel oak shrubland vegetation system:

- Ponderosa pine islands and individual trees would be protected by removing Gambel oak and other woody brush that may serve as ladder fuels.
- Pine regeneration and establishment would be encouraged by removing Gambel oak in the vicinity of ponderosa pine seed trees.
- A variation in oak growth forms, sizes, age-classes, densities, and spatial distribution would exist.
- Large, old oak trees would be maintained.
- Fuel breaks would be created in strategic locations for firefighter safety, to prevent fire spread, and to create holding areas for prescribed fire (e.g., adjacent to other land ownerships, roadways, and in the ecological transition zones between forest types).

Table 6. Summary of potential treatment acres by forested vegetation system and vegetation class.

Forested Vegetation System	Acres	Vegetation Class				
		Early	Mid Closed	Mid Open	Late Open	Late Closed
Ponderosa Pine/Douglas-Fir Woodland						
Mechanized feasible	2,624	82	996	671	213	662
Mechanized marginal	2,180	82	877	474	168	579
Dry-Mesic Montane Mixed Conifer Forest and Woodland						
Mechanized feasible	2,627	237	1,273	775	80	262
Mechanized marginal	2,393	237	1,521	398	72	165
Mesic Montane Mixed Conifer Forest and Woodland						
Mechanized feasible	1,787	0	1,108	75	68	536
Mechanized marginal	3,273	2	2,548	89	59	575
Lodgepole Pine Forest						
Mechanized feasible	2,213	17	802	255	362	777
Mechanized marginal	681	0	36	363	58	224
Floodplain Improvement						
Mechanized feasible	0	0	0	0	0	0
Mechanized marginal	3,940	16	2,617	935	8	364
Gambel Oak-Mixed Montane Shrubland						
Mechanized feasible	826	0	458	368	0	0
Mechanized marginal	0	0	0	0	0	0

Floodplain Improvement

Floodplain improvement treatments would occur on approximately 3,940 acres of the analysis area. They would be applied to improve the Watershed Condition Classification and attain overall project desired conditions. Floodplain improvements include riparian and wetland vegetation enhancement, hillslope and stream restoration, and soil stability. Thinning of encroaching upland vegetation will restore meadow features, hydrologic function, and aquatic habitat conditions.

Riparian and Wetland Vegetation Enhancement

Floodplain improvements found in between draws and in valley bottoms bounded by upland forests has highly variable vegetation and can range from nearly pure even-aged aspen stands to conditions and structures that closely mimic uneven-aged mesic mixed conifer forests. Trees in these areas are typically larger than the surrounding upland site due to the alluvial soils and mesic conditions that classify these areas. These areas have better growing conditions that can support greater tree densities than more upland sites and typically have two to three distinct canopy classes.

The mesic conditions that typify these areas do not tend to favor frequent low intensity fire. More typically these areas are prone to high intensity and severity fires that occur infrequently. These fires tend to originate in upland sites and can carry into wetlands and riparian areas during optimum burning conditions and/or during extended drought periods when riparian areas are much drier than normal. The good growing conditions, capacity of maintaining high levels of tree density and typically infrequent fire return intervals means that conifer encroachment and fuel loadings in these areas can be relatively high under normal conditions.

Wetland and riparian areas, and corresponding vegetation, are important components of the larger watershed health as they serve as filters for upland sedimentation, buffer overland flow of water, sustain ecological diversity, and provide hydrological input into larger stream classes.

Management objectives within the floodplain improvements:

- Thinning of encroaching upland vegetation to restore meadow features, hydrologic function, and aquatic habitat conditions.
- Enhancing aspen component of the landscape by expanding access to available growing space or through regeneration.
- Broadcast burning and the removal of woody coniferous and decadent (i.e. decaying, non-vigorous) vegetation encroachment resulting from past fire exclusion to protect and restore watershed function.
- Willow staking and transplanting will improve channel function and enhance riparian buffers.
- Riparian/wetland vegetation planting will restore features to a properly function condition.
- Reducing hydrologic connectivity with abundant sediment sources and minimizing soil erosion and sedimentation will result in effective sediment transport and maximize riparian vegetation.
- Restoring disturbed areas include hillslope/rill/gully erosional surfaces contributing sediment to streams will maintain water quality and re-establish vegetation cover.

Management objectives within the riparian and wetland vegetation areas:

- Reduce fuels, increase structural diversity, break canopy continuity where uniform canopy cover exists, perpetuate vigorous aspen clones, and protect and enhance the large conifer component of these systems. Where possible, prescribed fire should be used to reduce fuel loads, increase structural heterogeneity, and enhance understory herbaceous vegetation.

Wildlife Habitat Improvement

Vegetation management will be employed to achieve various wildlife habitat improvement objectives throughout the Upper Monument Creek landscape. Openings of various size, shape, and arrangement would be created to provide edge habitat and improve habitat connectivity for a variety of species. Understory conditions would be improved by stimulating grass, forb, and shrub development through tree removal and prescribed fire. Habitat features for cavity nesting birds and roosting or hibernating mammals, and foraging habitat and cover for a variety of mammals, raptors, and ground-dwelling birds would be maintained and enhanced by encouraging the development of mature aspen stands through the removal of competing conifers. In areas of decadent aspen clones, regeneration methods would be employed to establish vigorous aspen stands in a variety of age classes. Large trees and trees with old

growth characteristics would be retained throughout the landscape. Habitat components (e.g., snags, cavities, etc.) would also be created or enhanced in areas in which these features are deficient or desired.

Bighorn Sheep Habitat Improvement

The intent of the proposed bighorn sheep habitat improvements is to maintain and enhance occupied habitat, escape terrain, and movement corridors for the Rampart herd by reducing vegetative cover to improve sight distances important for this species. The proposed treatments areas were identified and designed through cooperation with Colorado Parks and Wildlife (CPW). CPW biologists provided site-specific expertise of bighorn sheep habitat use and movements within the project area (Stiver 2015, pers. Communication). Under Alternative 2, vegetation management techniques would be employed to maintain or improve habitat conditions in west Monument Creek and Blodgett Peak, as well as enhance escape terrain and movement corridors between Queens Canyon, Stanley Canyon, and slopes in the vicinity of Eagle Rock.

Management objectives within the Bighorn sheep habitat:

- Habitat improvement would occur on about 320 acres, primarily within stands of the ponderosa pine/Douglas-fir and the dry-mesic mixed conifer vegetation systems
- Treatments would occur on steep slopes (i.e., generally greater than 45 percent) with predominantly eastern to southwestern aspects.
- Based on accessibility and site conditions, a combination of thinning, pruning, and regeneration cutting would be performed with mechanical (i.e., mastication) and/or manual methods (e.g., hand treatment methods) to reduce vegetative cover.
- Broadcast burning would be employed to reduce tree or shrub encroachment, maintain open conditions, and improve forage quality and production, when and where feasible.
- The target residual basal area would range from 0 to 60 ft^2 per acre, but may exceed the upper range in stands with a high tree density.
- In stands where residual tree cover is retained, select for removal tree species that are contributing to horizontal cover (e.g., Douglas-fir).
- Pruning, girdling, inoculation, or other methods would be used to create snags, where desired as an alternative to tree felling.
- Residual slash (i.e., coarse and fine woody debris) would be treated with a combination of lop and scatter, pile burn, or broadcast burn techniques.
- Treatment units would be seeded with native grasses and forbs to inhibit conifer regeneration, if necessary.
- Treatments methods would be employed in phases over time to achieve and maintain desired conditions, such as persistent openings.

Mexican Spotted Owl

The objective of these management actions is to support the recovery of the federally threatened Mexican spotted owl (MSO) by maintaining or improving habitat conditions for this species in the long-term. Vegetation management would occur primarily within modeled MSO Forested Recovery Habitat, consisting predominantly of mixed conifer and riparian forest that has the potential of becoming nest/roost habitat, or provides habitat for foraging, dispersal, or wintering.

- All vegetation management treatments in MSO habitat that are identified and permitted by the Mexican Spotted Owl Recovery Plan, First Revision, may occur throughout the UMC landscape (e.g., prescribed fire, thinning, or other silviculture treatments).

- Habitat improvement treatments would occur on about 7,242 acres of MSO Recovery Habitat, primarily within stands of the dry-mesic mixed conifer, mesic mixed conifer, and montane riparian ecological systems.

- Vegetation management would reduce the density in late-seral, closed stands, releasing large, old trees and accelerating the development of structural complexity and old-growth features.
- Small-diameter trees and ladder fuels would be reduced in stands targeted for protection against stand-replacing fire.
- Prescribed fire, thinning, and other silvicultural treatments would be employed to limit the spread of insects and disease when considered to be a threat to the habitat of MSO or prey.

Management objectives within forested recovery habitat:

- In stands designated for the development of desired nest/roost conditions, vegetation management treatments would be designed to achieve species diversity and spatial heterogeneity, and promote the development and growth of large trees, while retaining or creating large snags and downed woody debris.

Management objectives within riparian recovery habitat:

- Vegetation management treatments would restore or enhance Proper Functioning Condition (PFC), to attain the highest ecological status and potential natural community structure (i.e., mid- to late-seral conditions) possible within the capability and potential of the site.
- Treatments would provide for a diversity of species, age, and size classes of native riparian trees and shrubs, as well as a diversity of understory herbaceous species.

Management objectives within other forest and woodland types:

- Vegetation management treatments would maintain or improve 6,695 acres of habitat for foraging, dispersing, and wintering spotted owls by emphasizing sustainable and resilient forest conditions.

Management objectives within other riparian forests types:

- Vegetation management treatments would maintain or improve 809 of habitat for dispersing and wintering spotted owls by emphasizing proper functioning ecological condition and the retention of structural and floristic characteristics that typify riparian systems in PFC.

Snags, Partially Dead Trees, and Coarse Woody Debris

The objective of these management actions is to ensure that features that have the potential to be utilized by wildlife for foraging, roosting, nesting, denning, cover, and hibernacula are available throughout the UMC landscape.

Management objectives for snags, partially dead trees, and coarse woody debris:

- Individual and groups of snags of a variety of species, sizes, and decay class, would be retained and created on all aspects and slope positions, or where determined to be deficient or desired throughout the UMC landscape.
- Snag recruitment would be encouraged through deliberate tree manipulation. A variety of methods would be utilized for the creation of snags or partially dead trees, including, but not limited to: girdling, inoculation, pheromones, drilling, prescribed fire, manual and mechanical manipulation (e.g., topping, limbing, etc.), and use of explosives.
- Snags created by natural processes (e.g., insects and disease) would be preferred for retention as potential nest cavity trees.
- Coarse woody debris of various size and decomposition classes would be retained or created where determined to be deficient or desired throughout the UMC landscape.
- Snags and coarse woody debris would be reduced or removed from locations in which the reduction of fire hazards is the management emphasis (e.g., fuel breaks, infrastructure, etc.).

- Snags and coarse woody debris would be reduced or removed from stands in which opening enhancement or creation is desired, including sites impacted by insect and disease outbreaks.

Aspen Restoration and Enhancement

The objective of these management actions is to maintain, enhance, and expand Quaking aspen stands for primary and secondary cavity nesting birds and canopy nesting birds, as well as for foraging and cover for a variety of mammals, raptors, and ground-dwelling birds. Vegetation management would occur in aspen stands that are decadent, or in which recruitment is deficient or competition is occurring due to conifer encroachment.

Management objectives for aspen restoration and enhancement:

- Individual aspen trees and aspen stands would be retained and enhanced during vegetation management treatments.
    - In coniferous stands in which there is an aspen component, prescriptions would be designed to promote aspen cover.
- Aspen stand vigor would be protected and enhanced by removing conifer encroachment.
    - Aspen stands would be restored by removing competing vegetation, allowing more sunlight to reach the understory.
    - Competing conifers would be removed by selective cutting or girdling.
    - Habitat features would be maintained and enhanced by encouraging the development of mature aspen stands.
- Aspen restoration would be encouraged in aspen stands that are decadent or in which recruitment is deficient.
    - Regeneration methods (e.g., clearcut) would be employed to promote the propagation of new suckers and establish vigorous aspen stands in a variety of age classes.
    - Prescribed fire would be employed to remove encroaching conifers and to promote aspen suckering.
    - Aspen stands would be manipulated to stimulate new growth. Potential methods include selective cutting, girdling, pushing over mature aspen stems with a dozer, severing aspen roots of parent stems, and ripping the perimeter of a decadent aspen clone, etc.
- Seeding, and the planting of seedlings and/or stem or root cuttings may occur where aspen is desired but not present.

- Where feasible, larger openings would be located adjacent to drainages to enhance aspen sprouting (e.g., within the lodgepole pine forested vegetation system).

- Residual trees or slash would be retained or removed from treated aspen stands depending on objectives or site conditions.

- Barriers would be employed to protect aspen regeneration from herbivory, when necessary.
    - Fencing would be constructed to prevent the browsing of aspen suckers by ungulates.
    - Barriers of felled trees or hinge trees would be arranged as to impede ungulate access (e.g., jackstraw method).

Opening Creation and Enhancement

The objective of these management actions is to create and enhance forest openings that provide edge habitat and improve habitat connectivity for a variety of species. Vegetation management would be employed to create conditions in which openings in the forest canopy are more prevalent.

Management objectives for opening creation and enhancement:

- Openings of variable size, shape, and arrangement would be created or enhanced where determined to be deficient or desired throughout the UMC landscape.
    - Openings would be created in all vegetation classes, but placement in 'mid closed' stands would be favored.
    - The enhancement of existing openings (i.e., expansion of pre-existing openings) would be emphasized over created openings where feasible.
- Persistent openings would be created when compatible with resource objectives, and where permitted by the Forest Plan (e.g., Management Areas 4B and 5B).
    - Vegetation management would be employed in phases over time to achieve and maintain persistent openings.
    - Large persistent openings, up to 40 acres in size, would be created and maintained in all management areas, with the exception of 7A and 7D,
    - In management areas in which large persistent openings are not permitted by the Forest Plan, aspen may be enhanced if present.
- Smaller and less persistent canopy openings would be created at a stand level.
- Habitat features would be retained within openings where determined to be deficient or desired throughout the UMC landscape.
    - Groups of live trees or snags may be retained in large created openings for nesting and foraging birds. High tree stumps or short snags would be retained where desired for woodpecker foraging.
    - Slash piles, piles of logs, stumps, or other debris may be created within openings to maintain habitat connectivity, and provide shelter, foraging, and denning habitat for small mammals.
    - Aspen trees would be retained and regeneration would be encouraged when present.
-

Prescribed Burning

Prescribed fire as considered in this analysis focuses on the use of pile burning and under burning to help remove or modify fuels within stands or broader vegetations types. Prescribed burning of existing natural fuels is targeted on up to 2,285 acres with a focus on reduceing fuel loads, increasing understory productivity and diversity, allowing for fire to perform its natural ecological role. In these cases, use of prescribed fire may be used as the primary treatment tool for achieving those objectives on those stands that are currenty in fuel models 2, 9, and 10 which can be safely burned with low intensity fire without much need for significant mechancal manipulation of the existing overstory or fuel components.

A larger percentage of acres is also targeted for the use of pile burning and prescribed fire as secondary or final treatments in association with stands or cover types where other silivicultural treatments will first be required to meet the objecties of reducing the density and distribution of the overlaying forest cover. In these instances, fire will be used to both remove concentration of slash and other fuels, as well as to further thin the remaining forest to help create forest conditions more typical of historical wildfire, insects, and disease patterns.

Management objectives for prescribed burning:

Pile Burning Objectives

- Burn slash piles to remove woody fuels in a safe and economical manner.
- Limit scorch damage to residual trees.
- Minimize and manage smoke generation and maximize pile burning to help address wildfire control hazards.
- Minimize soil damage by controlling amounts of heavy fuels included in piles and by igniting under proper weather conditions.
- Consume a minimum of 75% of fuels less than 5 inches in diameter and 50% of fuels larger than 5 inches in diameter within piles.
- Consume at least 95% of dozer or hand piles, and 100% of the landing piles.

Broadcast Burning Objectives

- Reduce 1, 10, 100 hr dead fuel loading by 50-75% within burn units.
- Introduce fire on at least 50% of burn unit acres.
- Design burn plans to reduce conifer regeneration and raise crown heights of conifers greater than 8" DBH.
- Limit mortality of residual conifers over 12" DBH to a maximum of 15%.

First Entry Broadcast Burn Objectives

- Reduce 1, 10, 100 hr dead fuel loading by 50-75% in burn units.
- Introduce fire on a minimum of 70% of identified acres.
- Reduce conifer regeneration and raise crown heights for conifers greater than 8" DBH.
- Limit conifer mortality to a maximum of 35%.

Table of Treatments Under the Proposed Action

The table below describes the proposed treatments by forest cover, description, management goals, desired outcomes, associated polygons on the proposed action map, acres, and treatment actions. The forest and collaborative group intend to use an adaptive management approach during implementation of this project, but in a very specific manner. It would be difficult (in fact, impossible) to describe the exact location, timing, combination of treatment actions, and specific amounts of each treatment type over a period of years that would best move us toward the desired conditions. Rather than guess at specific amounts, timings and mixes of treatments (which as stated above would almost certainly be wrong) the forest proposes to display the areas where these intensive silvicultural treatments would be applied, describe the multiple treatment actions which are appropriate to use, describe the circumstances under which each of the treatments would be or would not be appropriate, acknowledge that the treatments would be applied within approximately the next ten-fifteen years, but defer selection of the specific treatment actions until resources are available for implementation. The specialists analyzed effects to resources by analyzing the areas where the actions might occur (see polygons on the proposed action map), as though they will occur. By doing so, the agencies are prepared for whatever action is needed in the areas identified for treatment.

Forest Cover	Description/Historical Conditions	Management Goals	Desired Outcomes	Proposed Action Polygons	Acres	Treatment Actions
Ponderosa Pine/Douglas Fir Woodland	The ponderosa pine–Douglas-fir forested vegetation system is primarily at lower elevations and dry sites at higher elevations. Historically, these systems were shaped by low- to mixed-severity, frequent fire, which maintained an open stand structure with variably spaced individual trees, groups of trees, and openings.	Focus on reducing stand densities and restoring spatial structure via enhancement of tree groups, scattered individual trees, and openings. Promote predominantly uneven-aged, open stand conditions that contains lesser amounts of even-aged trees and having larger openings (one acre and larger) irregularly distributed throughout the treatment area.	Basal areas ranging from 30 to 50 ft2 per acre, Variable BA wthin stands ranging from 0 ft2 per acre (openings) up to 80+ ft2 per acre (high-density patches). Low-density matrix (20 to 40 ft2 per acre BA) Medium-density matrix (40 to 60 ft2 per acre BA) High density (60 to 80+ ft2 per acre BA) Untreated “reserves” Openings (1-20 ac) should be variable in size, shape, and distribution. Install fuelbreaks in tactical locations for firefighter safety, prevent crown fire spread, and to create holding areas for prescribed fire.	Removal Mechanical feasible-slopes from 0-30%	2180.69	Tree cutting Tree Removal Mechanical logging Whole tree skidding Mastication Lop and scatter Prescribed Burning Pile burning
				Non-Removal Mechanical marginal –slopes 30-40% use of mechanical equipment unlikely but possible given isolated breaks in slope	5625.99	Tree cutting Chainsaw use Tracked masticators Tracked chippers Lop and scatter Pile burning Prescribed Burn
				Fuel Breaks	361.98	Tree cutting Chainsaw use Tracked masticator Tracked mowing Lop and scatter Pile burning Prescribe burning

Forest Cover	Description/Historical Conditions	Management Goals	Desired Outcomes	Proposed Action Polygons	Acres	Treatment Actions
				Oak Brush Mitigation	84.03	Tree cutting Chainsaw use Tracked masticator Tracked mowing Lop and scatter Pile burning Prescribe burning
Dry Mixed Conifer	Dry mixed-conifer forests represent transitions from ponderosa pine – Douglas-fir forests. Dry mixed-conifer forests are naturally denser and more productive than ponderosa pine – Douglas-fir forests. Low-severity fire was the dominant disturbance, but some increase in the preponderance of moderate- and high-severity fire having slightly longer fire return intervals Greater variability in tree group composition, from single-species to mixed-species groups, and from single-aged to multi-aged groups.	Management goals for the dry mixed-conifer forested vegetation system are similar to those for ponderosa pine – Douglas-fir woodlands. Higher overall tree densities and a higher proportion of Douglas-fir and other conifers such as limber pine should be allowed	Residual basal area ranging from 40 to 60 ft2 per acre distributed according to site variability. Ranging from 0 ft2 per acre (openings) up to 80+ ft2 per acre (high-density patches). Openings variable in size, shape, and distribution. Sizes may range from 1 to 20 acres. Low-density matrix (20 to 40 ft2 per acre BA); Pine Present Medium-density matrix (40 to 60 ft2 per acre BA) High-density matrix (60 to 80+ ft2 per acre BA); Blue spruce present. Untreated “reserves” Install fuelbreaks in tactical locations for	Removal Mechanical feasible-slopes from 0-30%	2073.2	Tree cutting Tree Removal Mechanical logging Whole tree skidding Lop and scatter Mastication Prescribed Burning Pile burning
				Non-Removal Mechanical marginal –slopes 30-40% use of mechanical equipment unlikely but possible given isolated breaks in slope	3733.67	Tree cutting Chainsaw use Tracked masticators Tracked chippers Lop and scatter Pile burning Prescribed Burn
				Fuel Breaks	240.15	Tree cutting Chainsaw use Tracked masticators Tracked chippers Lop and scatter Pile burning

Forest Cover	Description/Historical Conditions	Management Goals	Desired Outcomes	Proposed Action Polygons	Acres	Treatment Actions
			firefighter safety, to prevent crown fire spread, and to create holding areas for prescribed fire.			Prescribed Burning
				Oak Brush Mitigation	316.37	Tree cutting Chainsaw use Tracked masticators Tracked chippers Lop and scatter Pile burning Prescribed Burn
				Bighon Sheep Habitat Improvement	320.06	Tree cutting Chainsaw use Lop and scatter Pile burning Prescribed Burn
Mesic Mixed Conifer	Mesic mixed-conifer forests found in north-facing slopes and at higher elevations. Transition from dry mixed-conifer to mesic mixed-conifer forests. Prone to extremes in fire activity, under mild conditions may not have burned, but during drought may burn with high severity. More of an even-aged, patch structured system	Enhancing structural and age-class diversity between stands (e.g. young stands adjacent to older stands) Reduce density of older stands, and fuel loading. Decisions to treat based on the local context and presence of values at risk.	Create openings (10 to 20 acres in size) in early- and mid-seral stands to mimic natural disturbances Reduce density in late-seral, closed stands to release large, old trees and accelerate development of structural complexity and old-growth features. Removal of small-diameter trees and ladder fuels. High proportion of total area in mesic-mixed conifer untreated. Install fuelbreaks in tactical locations for firefighter safety, to prevent crown fire spread, and to create holding areas for prescribed fire.	Removal Mechanical feasible-slopes from 0-30%	1787.25	Tree cutting Tree Removal Mechanical logging Whole tree skidding Mastication Lop and scatter Prescribed Burning Pile burning
				Non-Removal Mechanical marginal –slopes 30-40% use of mechanical equipment unlikely but possible given isolated breaks in slope	3309.42	Tree cutting Chainsaw use Tracked masticators Tracked chippers Lop and scatter Pile burning Prescribed Burning

Forest Cover	Description/Historical Conditions	Management Goals	Desired Outcomes	Proposed Action Polygons	Acres	Treatment Actions
Lodgepole Pine Forests	Stands consist of a diverse range of structural types from late-seral, uneven-aged stands to younger, even-aged stands within the north-central part of the project area. The late-seral, uneven-aged stands appear to be a rare compositional and structural type. Lodgepole pine forests do not appear to be departed from historical conditions and have not been significantly impacted by the mountain pine beetle.	Ecological restoration not a high priority for lodgepole pine. Focus on fuels reduction in support of prescribed fire in downslope cover types. Protect the late-seral lodgepole pine stands identified as unique on the landscape. Overall, the goal of these treatments would be to reduce fuel loads and canopy continuity, increase structural diversity and resilience to fire and mountain pine beetle, encourage aspen cover, and move younger, more uniform stands in the direction of late-seral stand structures	Minimize treatments in late-seral, uneven-aged stands. Target mid-seral and closed stand structures. Install patch clearcuts ranging from 3-20 acres targeting mid-closed structure classes. Create both small (<1 acre) and large (1-5 acres) openings via an uneven-aged, group selection approach in other stands. Locate larger openings adjacent to drainages to enhance aspen sprouting. Install fuelbreaks in tactical locations for firefighter safety, to prevent crown fire spread, and to create holding areas for prescribed fire. Targeting areas along roadways and areas along the Roadless boundary.	Removal Mechanical feasible-slopes from 0-30%	2214.53	Tree cutting Tree Removal Mechanical logging Whole tree skidding Lop and scatter Mastication Prescribed Burning Pile burning
				Non-Removal Mechanical marginal –slopes 30-40% use of mechanical equipment unlikely but possible given isolated breaks in slope	682.54	Tree cutting Chainsaw use Tracked masticators Tracked chippers Lop and scatter Pile burning Prescribed Burning

Forest Cover	Description/Historical Conditions	Management Goals	Desired Outcomes	Proposed Action Polygons	Acres	Treatment Actions
Gambel Oak-Mixed montane shrublands	Mixed montane shrublands occupy lower elevations primarily along the eastern portion of the project area. Occurs both as an oak-dominated shrubland and as an understory component within the ponderosa pine – Douglas-fir woodlands. Provides species diversity and has an important role for wildlife as both cover and forage.	Reduce fuel loading, increase structural diversity, and break canopy continuity where uniform canopies exist. Where practical prescribed fire can be used to reduce fuel loads, increase structural heterogeneity, and promote understory herbaceous vegetation.	Protect ponderosa pine islands and individual trees by removing Gambel oak and other woody brush that may serve as ladder fuels. Encourage regeneration and establishment of ponderosa pine. Install fuel breaks along land ownership changes, roadways, and ecological transition zones between forest types. Manage for variation in oak growth forms, sizes, age-classes, densities, and spatial distribution. Maintain large, old oak trees.	Fuelbreaks	101.89	Tree cutting Chainsaw use Tracked masticators Tracked chippers Lop and scatter Pile burning Prescribed Burn
Gambel Oak				Oak Brush Mitigation	726.2	Tree cutting Chainsaw use Tracked masticators Tracked chippers Lop and scatter Pile burning Prescribed Burn
Riparian Corridors	Riparian swales are distributed throughout the project area typically in valley bottoms bounded by upland forests and cover types. The vegetation is highly variable ranging from mixed aspen stands at higher elevations to willow/shrub communities at mid elevations, and mesic	Promote hydrologic function. Modify fuel loading and types Promote riparian vegetation types Improve soil stabilization within the water influence zone	Remove/alter conifer encroachment Reduce/alter ladder fuels Regenerate and expand aspen and willow cover types Improve riparian, floodplain, and hydrologic function. Reduce Bare Ground	Floodplain Improvement	3940.83	Tree cutting Tree pruning Chainsaw use Tracked masticators Tracked chippers Lop and scatter Pile burning Prescribed Burning Willow planting Soil and streambank stabilization

Forest Cover	Description/Historical Conditions	Management Goals	Desired Outcomes	Proposed Action Polygons	Acres	Treatment Actions
	graminoid/forb types at lower elevations.	Manage to protect against high surface flow impacts Manage to reduce post fire negative effects	Decrease Soil Erosion			Install erosion/control structures Rip and seed
Variable	Existing powerline corridors and communications have been in place for several decades and are showing signs of advanced forest regeneration and growth	Reduce fuel type, loading, and arrangement within transmission line cooridors or adjoining communication sites.	Reduce the density, height, and concentration of forested cover types within transmission line corridors or adjoining communication sites.	Transmission Line/Communication Sites	271.59	Chainsaw Use Cut trees Remove hazard trees Tracked Mastication Construct piles
Variable	Stands selected for 1st entry burning are characteristically in more open vegetative conditions varing from upland grass types intermingled with upland shrub types having varing densities of overstory conifer types.	Reduce 1, 10, 100 hr fuels Regenerate grass and shrub vegetation types Thin conifer regeneration Thin and raise canopy of mature conifer component	Reduce levels of conifer encroachment Create more open stand conditions Reduce fuel loading and composition helping to reduce the severity of future wildfires Enhance watershed conditions by increasing groundcover	Broadcast Fire	2284.59	Chainsaw Use Cut or Limb trees Lop and scatter Construct piles Hand Line Mechanical Line Skid/masticate Broadcast burning Pile and burn
Variable	Stands include both oakbrush and mature conifer types	Reduce the density of ladder fuels in the understory Reduce the density and arrangement of oakbrush and upland shrub types	Reduce the level and composition of understory vegetation and fuel loading to expand fire fighting options in the future	Fuel Breaks/Unknown Cover	449.74	Tree cutting Chainsaw use Tracked masticators Tracked chippers Lop and scatter Pile burning Prescribed Burn
Linear Features	The Project area has several miles of existing system road and trails that	Where the existing transportion system is to be utilized to complete projects,	Properly functioning and draining roads and trails.	Transportation System	Unknown	Mechinized equipment Road/trail maintenance Clean/replace culverts

Forest Cover	Description/Historical Conditions	Management Goals	Desired Outcomes	Proposed Action Polygons	Acres	Treatment Actions
	will need to be used to achieve the goals identified in the purpose and need.	maintenance activities will be necessary to improve both the safety and operational condition of these features and any associated infrastructure.	Use tempary roads as appropriate and rehabilitate and restore in a timely manner to discourage public use.			Harden surfaces Restore/install drainage features
Palmer Lake Watershed	Vegetation types include riparian vegetation, mesic mixed conifer, dry-mesic mixed confer, and ponderosa pine/douglas fir woodland types	Promote hydrologic function Reduce ladder fuels, fuel loading, fuel density, fuel composition and arrangement in forested cover types around and upstream from water reservoirs. Enhance and expand riparian vegetation types to help reduce negative post fire effects.	Remove/alter conifer encroachment from meadows and riparian cooridors. Reduce/alter ladder fuels from conifer forest types Regenerate and expand aspen and willow cover types Improve riparian, floodplain, and hydrologic function.	East Rampart Roadless Area Total Acres treated around the reservoir (including CRA)	383.4 1021.9	Tree cutting Chainsaw use Lop and scatter Pile Burning

Table 7. Adaptive management treatment actions for the for each of the cover types.

Design Criteria and Mitigation Measures

Common to all ecological systems:

- Retain old trees of all species to the extent possible. Use morphological characteristics such as flattened crown form, furrowed and thick platy bark, deep bark fissures, and large diameter branches as distinguishing features to identify old trees. At times old trees may need to be removed for operational purposes (landing creation) but all attempts should be made to avoid these situations and cutting of old trees should be the exception rather than the rule.

- Retain snags and downed wood to the extent possible to provide structural complexity and important wildlife value. Snags should only be felled to ensure operator safety during operations.

- Preferentially retain ponderosa pine over other conifer species.

- Emphasize and expand the presence of aspen across the treatment area. Consider "day-lighting" existing aspen patches by clearing around them to increase vigor and abundance. Where aspen is present regeneration harvests may be used to encourage aspen proliferation.

- Minimize soil disturbance by utilizing low-impact silvicultural practices. Ensure that all skid trails and landings are rehabilitated (i.e. ripped and seeded with native grasses) after operations have been completed.

- Utilize implementation methods that will help facilitate the use of fire, both prescribed and natural ignitions, at the earliest time possible after treatment.

- Monitor treatment areas for the presence of noxious weeds and take measures to eradicate and/or prevent their spread should they become established.

Wildlife Habitat

Tree Retention

- Standing dead or live trees containing cavities will not be disturbed or felled, with the exception of the following provision: Trees containing cavities may be felled if the tree is a fire or safety hazard, and the cavity is not an active nest, roost, or den site, as approved by, and with guidance from, a Forest Service biologist.

- Select for retention live trees containing desirable characteristics for wildlife when available and compatible with resource objectives.

    - Desirable trees for wildlife exhibit the following characteristics: large diameter; partially dead; internal decay; sloughing or loose bark; spike-tops; broken tops or limbs; split tops; abnormal "wolfy" crowns; lightning or fire scarred; excavated cavities; squirrel foraging and middens; woodpecker foraging (e.g., sapsucker patterning); roosting activity (e.g., white-wash or droppings, owl pellets); and

sign of insect or disease infestation (e.g., Witches broom caused by dwarf mistletoe, defoliation, conks, pitch tubes, etc.).

- Retain or create individual and groups of snags of a variety of species, sizes, and decay class, on all aspects and slope positions, or where determined to be deficient or desired.
- Retain snags in all stands, with the exception of areas in which a reduction in fire hazards and the enhancement or creation of openings are the management objectives.
- Maintain a minimum of 20-30 snags (of varying size classes and stages of decay) per 10 acres of each treatment area (USDA 1984, p. III-12 and 13).
    - Retain all soft snags (class 3, 4, and 5) with the exception of those that are safety hazards.
    - In ponderosa pine, Douglas-fir, and aspen stands, provide hard snags (where feasible) of 12 inches diameter at breast height (dbh) or larger to a density of at least 5 per 10 acres; 10 inches dbh or larger to a density of at least 9 per 10 acres; and 6 inches dbh or larger to a density of at least 6 per 10 acres.
    - In spruce-fir and lodgepole pine stands, provide hard snags (where feasible) of 12 inches dbh or larger to a density of at least 2 per 10 acres; 10 inches dbh or larger to a density of at least 12 per 10 acres; and 6 inches dbh or larger to a density of at least 6 per 10 acres.

Course Woody Debris

- Retain an average length per acre of down-dead logs (where feasible) of the following minimum diameters (USDA 1984, p. III- 13):
    - In ponderosa pine, Douglas-fir, and spruce fir stands, retain 50 linear feet per acre of downed logs of at least 12 inches in diameter.
    - In aspen and lodgepole pine stands, retain 33 linear feet per acre of downed logs of at least 10 inches in diameter.

Riparian Areas

- Prohibit vegetation management in riparian areas for purposes other than restoration or enhancement.
    - Prohibit the ignition of prescribed fires in non-forested riparian (e.g., stands composed of grass and shrub), but allow backing fires into these areas.
    - Utilize manual and mechanical vegetation management, and prescribed fire treatments, to encourage aspen regeneration and develop desired stand conditions.

Wildlife Disturbance

- Mammals actively nesting, denning, roosting, or hibernating within trees, downed logs, burrows, or any other features will not be disturbed, to the extent practicable.

  - Any roosting bats discovered during implementation will not be disturbed. Incidents and roost sites will be reported to a Forest Service biologist.

- When encountered, birds with active ground nests, and mammals with offspring will not be disturbed or harassed.

Bighorn Sheep

- Exclude all management actions within known Rocky Mountain bighorn sheep lambing sites during the period of April 15th through June 30th, at a minimum.

- Implementation of the proposed bighorn sheep habitat improvements will be conducted in coordination with Colorado Parks and Wildlife specialists in order to identify and minimize undesirable impacts to this species.

Birds of Conservation Concern

- When feasible, defer mechanical vegetation management and prescribed burning from April 1st to July 15th in order to avoid disturbance to breeding birds.

  - For mechanical treatments conducted during this period, report any inadvertent removal of trees containing bird nests to a Forest Service biologist.

Raptors/Birds of Prey (eagles, falcons, hawks, owls, etc.)

- Surveys for select breeding raptors will be conducted in the proposed management areas prior to implementation.

- If a raptor nest site is discovered or suspected due to agitated behavior of a raptor, the feature or incident will be reported to a Forest Service biologist; appropriate protection measures will be implemented as determined by a Forest Service biologist.

- Spatial and temporal restrictions will be established for active and inactive nest sites. Any treatment within these restricted areas will be designed based on the species of interest, and in coordination and agreement with a Forest Service biologist. Operating restrictions may be adapted from guidelines outlined in the most recent version of the Colorado Division of Wildlife recommended nest buffer zones and seasonal restrictions for raptors.

- If a raptor nest site occurs in a prescribed fire management unit, or is discovered during the implementation of prescribed fire, management actions will be taken as necessary to protect the nest tree. Examples include:

  - Minimize human presence at active nest sites to only those actions necessary to protect the nest tree from prescribed fire treatments.

  - Remove excess fuels from the base of the nest tree and any adjacent trees that may pose a hazard to the nest.

  - Employ ignition methods that minimize smoke, fire intensity, and/or fire duration within active nest sites. Ensure smoke from the burn does not disturb the nest while the adults are incubating eggs, or while young are confined to the nest tree.

  - Exclude fire from the nest site when management actions are unable to effectively mitigate adverse effects to individual raptors or the nest tree.

Management Indicator Species

Abert's Squirrel

- In ponderosa pine stands, protect or provide for one Abert's squirrel nest tree clump per six acres (USDA 2005, p.83)
    - Where feasible, protect or provide for 0.1 acre of 9 to 22 inches dbh ponderosa pine with an interlocking canopy and a basal area of 180 to 220.

Rocky Mountain Elk

- Protect elk calving concentration areas from habitat modification and disturbance from May 15 - June 30 (USDA 2005, p. 83).

Federally Listed Species

Mexican Spotted Owl

- The Forest Service will undergo consultation with the U.S. Fish and Wildlife Service when, and if:
    - Vegetation management treatments within MSO habitat exceed 7,644 acres.[2]
    - Non-silvicultural treatments are necessary to protect MSO habitat (e.g., chemical control of insect and disease outbreaks).

Protected Habitat

- In the event that a Mexican spotted owl nest site or primary roost area is discovered, and a Protected Activity Center (PAC) is established, the Forest Service will undergo consultation with the U.S. Fish and Wildlife Service prior to any management actions within the designated PAC.

Recovery Nest/Roost Habitat

- Prior to vegetation management treatments in proximity to potential nesting features, perform Mexican spotted owl surveys according to U.S. Fish and Wildlife Service protocols.
- To the extent practicable, defer mechanical and prescribed fire treatments during the breeding season of March 1 through August 31.
- In stands meeting desired nest/roost threshold conditions outlined in Table C.3 of the Revised Recovery Plan (USDI FWS 2012, p. 278), adhere to the following minimum management requirements:
    - Do not treat stands in such a manner as to lower that stand below threshold conditions until ecosystem assessments can document that a surplus of these stands exist at larger landscape levels.

- Do not remove trees greater than 18 inches dbh unless there are compelling safety reasons to do so, or if it can be demonstrated that tree removal will not be detrimental to owl habitat.
- Maintain a tree density of 12 trees per acre that are > 18 inches dbh.
- Maintain a tree basal area of 120 ft^2/acre of trees > 1 inch dbh.
  - >30% of the basal area in a size class of 12 to 18 inches dbh.
  - >30 % of the basal area in a size class > 18 inches dbh.

- In stands designated for development of desired nest/roost conditions, adhere to the following management recommendations:
  - Utilize prescriptions that minimize the loss of key habitat components for spotted owl and prey species (e.g., large trees, snags, and logs).
  - Design thinning prescriptions to promote the growth of large trees.
  - Strive for a diversity of patch sizes with a minimum contiguous patch size of 2.5 acres.
  - Strive for species diversity and spatial heterogeneity within patches.
  - Limit the size of created openings in forested stands to 2.5 acres.
  - Maintain a minimum of 60% canopy cover in mixed conifer stands.
  - Maintain ≥ 50% of the stand basal area in a size class of ≥ 16 inches dbh.

Riparian Recovery Habitat

- In stands designated for the maintenance or restoration of riparian recovery habitat, adhere to the following management recommendations:
  - Manage for Proper Functioning Condition (PFC) to attain the highest ecological status and potential natural community structure (i.e., mid- to late-seral conditions) possible within the capability and potential of the site.
  - Manage for a diversity of species, age, and size classes of native riparian trees and shrubs, as well as a diversity of understory herbaceous species.
  - Minimize tree and shrub removal. Utilize prescriptions that maintain key habitat components (e.g., hardwoods, and large trees, snags), while encouraging the restoration of PFC and protection against stand-replacing fire.
  - Minimize negative impacts of ungulate grazing on riparian vegetation, if needed.
  - Avoid construction activities except on a case-specific basis where pressing management needs can be demonstrated.

Recovery Foraging/Non-breeding Habitat

- Emphasize the retention of large trees, logs, and snags at the stand level. Short-term reductions of key habitat components is acceptable, but management should strive to maintain some of these components within the stand.
    - Retain all trees > 24 inches dbh, unless overriding management situations require their removal to protect human safety and/or property (e.g., the removal of hazard trees along roads, in campgrounds, and along power lines), or in situations where leaving large trees precludes reducing threats to owl habitat (e.g., creating a fuel break).
    - Minimize the potential mortality of large trees (i.e., >24 inches dbh) during prescribed fire treatments.
    - Retain most large snags > 18 inches dbh, large downed logs (>18 inches in diameter at any point), and trees (>18 in dbh), unless retention conflicts with forest restoration and/or owl habitat enhancement goals.

Preble's Meadow Jumping Mouse

- Vegetation management treatments within the critical habitat of the Preble's meadow jumping mouse are prohibited.
    - Treatments performed adjacent to Preble's critical habitat must avoid indirect effects to this habitat.
- The suitability of stands modeled as Preble's potential habitat will be assessed by a Forest Service biologist on a project-specific basis. The following standards apply only to the suitable habitat of this species:
    - The entry or crossing of riparian habitat by equipment off of system roads or trails is prohibited.
    - The removal of coniferous trees and the planting of willow within riparian habitat is permitted for the purpose of restoration or enhancement of this habitat.
    - The ignition of prescribed fires in non-forested riparian (e.g., stands composed of grass and shrub) is prohibited, but backing fires are permitted in these areas.
    - The use of ground-disturbing equipment within upland habitat will be confined to the hibernation period of November 1st through May 1st.

Recreation Resources

- Maintain visual screening along road and trail corridors to reduce the risk of increased off-road and off-trail use resulting in new non-system routes. Add physical barriers along routes to deter off-road vehicle use.
- Close treatment areas to recreation during implementation for public safety.
- Restrict treatment activities from 6:00 pm on Fridays through 6:00 am on Mondays (6:00 am on Tuesdays when a Monday is a federal holiday) during high recreation season.

- Favor winter logging to reduce resource impacts.
- All temporary roads should be physically closed and completely rehabilitated following treatment to reduce the potential for new social routes being developed.
- Use boulders, berms, fencing, slash, etc. to discourage access if monitoring shows that off-road use is occurring.
- Clear all slash and debris from roads and trails following treatment activities. Restore trail profiles if damaged by machinery.
- Painting in treatment areas should face away from roads and trails.
- Unit, boundary and skid trail flagging should be removed after treatments are completed.

Hydrology

Design criteria to limit disturbance includes compliance with Forest Plan guidance, National and State Best Management Practices, Watershed Conservation Practices criteria, and all other relevant laws, regulations, and policies.

Forest management activities in any wetland, riparian area, and flood plain, will be designed to prevent long and short-term adverse impacts, in accordance with Executive Orders 11988 and 11990, the direction outlined in Forest Service Manual, sections 2526, 2527, and 2633, and in Management Prescription 9A.(Forest Plan)

Watershed Conservation Practices Handbook (FSH 2509.25) provides standards for activities on the Pike National Forest. Colorado State Best Mangement Practices (BMP's), National Best Management Practices for Water Quality Management on National Forest System Lands, and "Watershed Conservation Practices" (WCP's) are intended to control non-point source pollutants.

The Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Commission has assigned beneficial or protected uses of the surface waters in the UMC Project Area through Regulation No.31 - The Basic Standards and Methodologies for Surface Water (5 CCR 1002-31). Beneficial uses may include: recreation, water supply, agriculture, industrial uses, and the protection and propagation of fish and wildlife. These beneficial uses are protected by water quality standards. Waters are classified by the uses for which they are presently suitable or intended to become suitable.

"For all state waters existing classified uses and the level of water quality necessary to protect such uses shall be maintained and protected. No further water quality degradation is allowable which would interfere with or become injurious to these uses. The classified uses shall be deemed protected if the narrative and numerical standards are not exceeded."

The Clean Water Act requires all states submit a list of impaired and threatened waters (stream/river segments, lakes) for US Environmental Protection Agency (EPA) approval every two years. CDPHE Water Quality Control Commission publishes the Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List (Regulation 93: 5 C.C.R. 1002-93). The regulation identifies all waters where required pollution controls are not sufficient to attain or maintain applicable water quality standards, and establish priorities for development of Total Maximum Daily Loads (TMDLs), monitoring, and evaluation. This is based on the severity of the pollution and the sensitivity of water uses, among other factors. Impairments affect water quality

and the US Forest Service must ensure proposed actions and mitigations are consistent with CDPHE anti-degradation rules to limit further water quality degradation.

The Forest Plan requires that: “All activities occurring on the Forest must be mitigated if necessary in order to meet state water quality standards as well as threshold sediment levels.” (USDA Forest Service PSICC Forest Plan)

The most recent Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List is effective 03/01/2016. Lists are updated regularly therefore, actions within the project area or near the project area can affect the current status of listed or unlisted waters. At this time there are no 2016 303d listings within the project area. BMPs will be used to avoid any potential impacts to water quality including those unlisted in Colorado’s Section 303(d).

Work in the project area should be completed with the overall project objectives and watershed health in mind. Work should be completed in a manner that best limits the disturbance on the landscape. Forest management activities in any wetland, riparian area, and floodplain, will be designed to limit and prevent short and long-term adverse impacts. BMPs will be implemented to minimize the probability of degrading waters within and downstream of the project area. Monitoring will be used to determine if there are adverse effects occurring necessitating a change to project implementaion strategies (Forest Service, 2012).

Adaptive management strategies will be used in conjunction with monitoring to achieve desired improvements in watershed condition and health. Watershed health can be measured in the Watershed Condition Classification using indicators described in the Watershed Condition Framework. As the project is implemented, watershed and core indicator conditions will be monitored. Monitoring and reporting will be used as a tool to provide flexibility to account for inaccuraies in initial assumptions, to adapt to changes in environmental conditions, and/or to respond to monitoring information indicating that desired objectives are not being met. If monitoring indicates that management actions are not achieving desired conditions, then changes to the implementation strategy will be taken. All implementation action will be modified using one or more of identified design criteria or BMPs in order to achieve the intended effects.

Treatment Monitoring

A monitoring report was developed as part of the collaborative process (Adaptive Management and Monitoring Recommendations for the UMC landscape, 2016). The report can be found in the appendix. The monitoring report outlines an adaptive management process for evaluating and monitoring results and progress towards desired conditions, metrics for monitoring at both the stand and landscape level, identifies monitoring initiatives for vegetation treatments, fire effects, and watershed condition monitoring. The forest is commited to continued collaboration through implementation, monitoring, and adaptive management of the landscape. Also, the forest will implement Best Management Practices Monitoring protocol during and after management activities occur through contract administration and partnership agreements.

Treatment Sequencing

Treatment sequencing is primarily based on watershed distribution, wildfire risk, availability of partners to assist with work, and funding. Every attempt will be made to sequence treatments across an entire watershed. Doing so would help the Forest Service and collaborative partners monitor both at the stand and the landscape level.

Alternative Development Process

As a result of extensive collaboration over a multi-year timeframe and additional analysis, the proposed action was modified as allowed by 36 CFR 220.7(b)(2)(iii), which states that "the description of the proposal and alternative(s) may include a brief description of modifications and incremental design criteria developed through the analysis process to develop the range of alternatives considered." Changes and modification made to the proposed action are listed in Chapter 1.

Alternatives Considered but Eliminated from Detailed Study

Three Forest Plan Amendments were evaluated and eliminated from detailed study.

1. Wildlife amendment for Elk hiding cover. It was determined this project would meet the intent of the wildlife hiding cover described in the Forest Plan.

2. Allowing fire to burn on the landscape. Letting fire burn on the landscape is a function of time or year, location, and whether treatments have occurred to provide safe anchor points.

3. Timber openings: Currenlty a maximum size of 40 acre openings can be created and maintained in all management areas other than timber management areas 7A and 7D, with the exception of aspen enhancement in those timber management areas. NFMA standards require certification or replanting within five years in suitable timber management areas 7A and 7D. The amendment would require changing the management area and the suitability of timber.

The proposed plan amendments specific to this project could impose direction on ongoing or future project analyses. Therefore, it was determined that these amendments have a greater implication beyond the current project and these management considerations should be reevaluated during the Forest Plan revision process. The Pike and San Isabel National Forest is scheduled to begin revising the Forest Plan in the next few years. Also, project implementation without any plan amendment would still meet the purpose and need and bring the landscape closer to the desired conditions.

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in the table is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 8. Comparison of alternatives.

	Treatment Type	Vegetation/Cover type	Acres
Alternative 1	None	****	0
Alternative 2	Removal	Dry-Mesic Mixed Conifer	2073.20
		Lodgepole Pine Forest	2214.53

	Treatment Type	Vegetation/Cover type	Acres
		Mesic Mixed Conifer	1787.25
		Ponderosa Pine/Douglas-Fir Woodland	2180.69
	Non-removal	Dry-Mesic Mixed Conifer	3733.67
		Lodgepole Pine Forest	682.54
		Mesic Mixed Conifer UMC	3309.42
		Ponderosa Pine/Douglas-Fir Woodland	5625.99
	Broadcast Burn	Ponderosa Pine/Douglas-Fir Woodland	875.25
		Dry-Mesic Mixed Conifer	769.98
		Mesic Mixed Conifer	235.80
		Montane Riparian Systems	353.95
		Non Vegetated/Water	40.1
		Gambel Oak-Mixed Montane Shrubland	9.50
	Transmission Line	Ponderosa Pine/Douglas-Fir Woodland	68.72
		Dry-Mesic Mixed Conifer	82.59
		Mesic Mixed Conifer	82.82
		Montane-Subalpine Grassland	2.07
		Montane Riparian Systems	14.86
		Gambel Oak-Mixed Montane Shrubland	15.46
		Non Vegetated/Water	5.05
	Fuel Breaks	Dry-Mesic Mixed Conifer	240.15
		Gambel Oak-Mixed Montane Shrubland	101.89
		Ponderosa Pine/Douglas-Fir Woodland	361.98
		Unknown	449.74
	Oakbrush Mitigation	Dry-Mesic Mixed Conifer	316.37
		Gambel Oak-Mixed Montane Shrubland	726.20
		Ponderosa Pine/Douglas-Fir Woodland	84.03
	Bighorn Sheep Habitat Improvement	Dry-Mesic Mixed Conifer	320.06
	Floodplain Improvement	Riparian swale/Mixed Conifer	3940.83

Chapter 3. Affected Environment and Environmental Consequences

Introduction

This chapter summarizes the physical, biological, social, and economic environments of the project area and the effects of implementing each alternative by the issues outlined in chapter 1 and 2. It also presents the scientific and analytical basis for the comparison of alternatives presented here. The analyses presented in this document are only for those resources that were identified as issues in chapter 1 and 2. The details analyses can be found in the specific specialists resource reports that are hereby incorporated by reference.

Affected Environment

The adaptive management approach for this project has identified potential treatment acres and is displayed in the proposed action map. However, the adaptive approach cannot identify exactly where, when and at what magnitude these actions will occur. However, accurate assumptions and idealized treatment scenarios have been developed. Thus procedures to identify the effects of the actions have been developed for the each resource. To display the effects of treatment on approximately 31,700 acres, the silvicultural actions were generally assumed to have been implemented as prescribed.

Vegetation

Analysis Methods

Data for this section was taken from corporate data bases (spatial and tabular) maintained by the Forest Service. A detailed preliminary analysis using the same corporate data was compiled by a team from the Upper Monument Creek Landscape Restoration Initiative which included participants from the Forest Service, The Nature Conservancy, Colorado State University, and other state and private organizations. This analysis provides a comprehensive discussion of existing conditions within the UMC project area and was used heavily in summarizing existing conditions for this report.

Topography

The topography of the UMC landscape is typical of areas along the Colorado Front Range. The Rampart Range is an uplift that that trends north and south, extending from Pikes Peak on the south to the Platte Canyon on the north (Moore 1992). It is essentially a block bounded by a fault on the east and the South Platte River on the west (Moore 1992). It is an exogenic, moderately dissected, sloping and rolling landform (Moore 1992). Elevations range from 7,000 feet to 10,000 feet above sea level. The terrain moves from rolling foothills along the eastern slope to steep mountainous hillsides incised by deep gulches in the transition zone between foothill and montane landforms. The majority of the project area is comprised of mountainous terrain that consists of valley bottoms, ephemeral and perennial channels, and a mix of gradual and steep hillsides broken by a relatively continuous network of ridgelines. Slopes are generally between 0 and 30 percent, but can also be greater than 40 percent along the eastern side of the project area and in gulches and deep draws.

Soils

Granite and associated igneous rocks of the Pikes Peak batholith are dominant through the UMC landscape (Moore 1992). The main rock type is Pikes Peak granite. It is pink to reddish, medium grained to coarse grained biotite or hornblende-biotite granite (Moore 1992). Fan alluvium, valley alluvium, and colluvium are throughout the area (Moore 1992). There are 31 different soil map units within the UMC project area, yet 67 percent of the total project area falls within the Sphinx-Rock Outcrop series.

Sphinx soils are typically found on mountainsides where slopes are generally 15-80 percent (Moore 1992). The Sphinx soils area shallow and somewhat excessively drained. Typically the surface layer is gravelly coarse sandy loam and below this is very gravelly loamy coarse sand. Ponderosa pine annual production on these soils typically ranges from 25-29 cubic feet per acre (Moore 1992). Rock outcrops are formed from Pikes Peak granite. Minor amounts of Aquolls and Guffey area also found in mixed in with this series at the base of slopes (Moore 1992).

This soils series is best suited to wildlife habitat, watershed, recreation, and limited timber production (Moore 1992). This series is very susceptible to erosion if the cover of vegetation and little is disturbed. The major limitations affecting the production and harvest of timber are a high susceptibility to erosion, low natural fertility, and depth to bedrock (Moore 1992). The coarse nature and lack of cohesion also makes these soils highly susceptible to post-fire erosion and debris flows.

Climate

The climate of the UMC landscape is heavily influenced by the mountainous terrain that defines the Colorado Front Range. Changes in elevation and topographical features have an impact on temperatures, wind patterns, and storm tracks in all seasons of the year (Doesken et al. 2003). Large seasonal and diurnal temperature swings are common throughout the area. At times during the summer months (June-July-August) winds shift to the southwest and bring hot, dry air from the desert southwest over the State (Doesken et al. 2003). Such hot spells are usually of short duration. Average summer maximum and minimum temperatures for the UMC project area are around 81ºF and 46 ºF respectively (HPRCC 2014). During winter months (December-January-February) diurnal temperature fluctuations are similar to summer pattern, but are often amplified by strong temperature inversions that occur throughout the winter (Doesken et al. 2003). Average winter maximum and minimum temperatures are around 46 ºF and 12 ºF respectively (HPRCC 2014). Annually project area average maximum and minimum temperatures are around 62 ºF and 29 ºF respectively (HPRCC 2014).

Distance from major sources of moisture (the Gulf of Mexico and the Pacific Ocean) is a limiting factor for precipitation (Doesken et al. 2003). Additionally, precipitation patterns are largely controlled by mountain ranges and changes in elevation. In summer, mountain peaks and ranges are effective thunderstorm generators whenever regional air masses are sufficiently moist (Doesken et al. 2003). Localized thunderstorms can form nearly every afternoon in and near the mountains. The last half of July and much of August are particularly prone to mountain thunderstorms while June is typically a much drier month in the high country. Snow and soft hail are possible from mountain storms even in July and August (Doesken et al. 2003). Average annual precipitation is approximately 16 inches, with 42 percent of this rainfall coming in the summer months (HPRCC 2014).

Precipitation increases with elevation in both winter and summer but the elevation effect is greatest in mid-winter. High peaks and mountain ranges generally receive the majority of their precipitation during with winter months in the form of snowfall (Doesken et al. 2003). The UMC receives on average approximately 56 inches of snow a year, with significant snow fall accumulations from November to April (HPRCC 2014). However, historically the heaviest snow months are March and April (HPRCC 2014).

Wind patterns in the mountains are predominantly controlled by topography. Mountain-valley circulations are common with winds often blowing up the valley from lower to higher elevation during the day as air masses warm, subsequently reversing and blowing down the valleys at night as air masses cool (Doesken et al. 2003). Mountains form a substantial block to regional air motion causing winds in most valleys west of the Continental Divide to be very light, while winds along and east of the Continental Divide are much stronger and typically blow from a westerly direction much of the cool half of the year (Doesken et al. 2003).

Tornadoes have been found to be quite common with the improvement in severe storm detection in recent decades (Doesken et al. 2003). Tornadoes are relatively rare in the mountains and western valleys but do

occur. Typically 40 tornadoes are confirmed annually throughout Colorado (Doesken et al. 2003). Most of these tornadoes are small and short lived, and usually reach only F0 or F1 intensity (Doesken et al. 2003). However, occasional strong tornadoes have been reported. In 2014 a tornado touched down just outside of Lake George, Colorado (approximately 3 air miles east of the project area) and blew down approximately 30 acres of mature trees.

Lightning is one of the greatest weather hazards in Colorado. Unlike tornadoes that are most common in selected areas of the state, lightning occurs throughout the state (Doesken et al. 2003). Lightning strike statistics indicate that the most lightning prone areas of Colorado are the high ground above tree line between Denver and Colorado Springs (Doesken et al. 2003). However, lighting strikes within forested landscapes is also quite common. Within the UMC project area the counties of Doulas, Teller and El Paso receive on average 11, 6, and 28 thousand air to ground lighting strikes per year respectively (NOAA 2014).

Disturbances

Snow

Snow can disturb forest vegetation is a variety of ways. Deep snows that persist late into the growing season can limit plant regeneration (Butler et al. 1992). Delayed spring snowmelt may also favor the development of blackfelt snowmold which can limit the success of coniferous tree species (Knight 1994). Heavy snowstorms can cause breakage in limbs and tops of large conifer and can also cause groups of dense young conifers or aspen to collapse under weight stress (Veblen and Donnegan 2005).

Avalanches can be import localized disturbances in steep slopes and at higher elevations. Movement of snow in slide paths can damage and/or remove existing vegetation, and at times perpetuate the presence of shrubs (Knight 1994). Infrequent avalanches that can extend the typical terminus zone can damage areas unaccustomed to these disturbances, and would favor the regeneration of aspen if found previously on site (Veblen and Donnegan 2005).

There are no major avalanche slide paths within the UMC landscape. It is likely that small areas of snow sliding and sloughing occur throughout the project area, especially on steeper slopes and northern aspects. The effects of these slides to forest vegetation are likely minimal and highly localized. Minor amounts of snow breakage and collapse are like distributed throughout the project area as well, but are likely small and highly localized.

Floods

Spring flooding can result from the melting of snow pack at higher elevations. In a year of near-normal snow accumulations and normal spring temperatures, river stages typically increase but there is generally no flooding (Doesken et al. 2003). In above average snow years, or when there is widespread lower elevation snow accumulation and a sudden warming in the spring, there may be extensive flooding (Doesken et al. 2003). The greatest threat of flooding in Colorado is not snowmelt, most damages a product of flash flooding from localized intense thunderstorms. The most flash-flood prone regions of Colorado are found along the base of the lower foothills east of the mountains and typically mostly affects riparian vegetation (Doesken et al. 2003).

Changes and/or removal of forest vegetation has been implicated in increased stream damage after fire (Veblen and Donnegan 2005). When vegetation is mostly or completely removed by high-severity wildfire the corresponding decrease in interception, transpiration, and increase in rain-splash erosion can increase initial runoff (Wagenbrenner et al. 2006). Additionally, water-repellant layers within the soil profile generated from wildfire can also increase runoff (Imeson et al. 1992). Changes in the runoff can increase the rate and volume of runoff, which in turn not only increases the risk of flooding, but also the risk to property and life downstream (Robichaud et al. 2000). These effects can last for years until forest vegetation can become successfully reestablished on these sites.

Flooding from the Waldo Fire has been and is still occurring in parts of the watershed downstream from the burn scar. The effects of this flooding are currently found along the southwest corner of the project area. There is evidence of erosion and channelization for increased flow in many of the watersheds in this area. Vegetation is beginning to become established in drainages, on favorable microsites, and within close proximity to remnant islands of unburned vegetation. Increased surface runoff and erosion will continue to decrease as more vegetation becomes established and as more erosion prevention measures are put in place during the Waldo Fire rehabilitation effort.

Forest Vegetation

Forest vegetation within the UMC project area is a diverse mosaic of forest structures and cover types driven by topographic, moisture, and elevational gradients. These vegetative patterns can that can be classified into recognizable ecological systems that aid in describing landscape vegetation patterns. Vegetation systems represent recurring groups of biological communities that are found in similar physical environments and are influenced by similar ecological process (Comer et al. 2003). The low lying dry foothills along the eastern edges of the project area contain a mix of gamble oak-mixed montane shrublands and pinyon-juniper woodlands. As you move west and higher in elevation the project area is comprised of a mix of montane forest vegetation, but is mainly comprised (85% of the project area) of three predominant vegetation systems: Ponderosa pine-Douglas-fir Woodland, Dry-mesic Montane Mixed Conifer Forest and Woodland, and Mesic Montane Mixed Conifer Forest and Woodland. The main ridge of the Rampart Range contains a small portion of a larger vegetation system of lodgepole pine that continues north outside of the project area. Montane Riparian Systems and Montane-Subalpine Grasslands are interspersed throughout the project and can be found on a range of physical environments. A comprehensive breakdown of all vegetation systems within the UMC landscape is provided in Table 9 below. Figure 3 following the table is a graphic representation of the vegetation systems and heir distribution within the UMC project area.

Table 9. Primary vegetation systems of the Upper Monument Creek project area.

Forested Vegetation System	Acres	% of total area
Ponderosa Pine/Douglas-fir Woodland	17,337	32%
Dry-Mesic Montane Mixed Conifer Forest and Woodland	15,426	29%
Mesic Montane Mixed Conifer Forest and Woodland	13,003	24%
Montane Riparian Systems	5,841	11%
Lodgepole Pine Forest	3,512	4%
Gamble Oak-Mixed Montane Shrubland	1,710	3%
Montane-Subalpine Grassland	1,605	3%
Pinyon-Juniper Woodland	67	< 1%

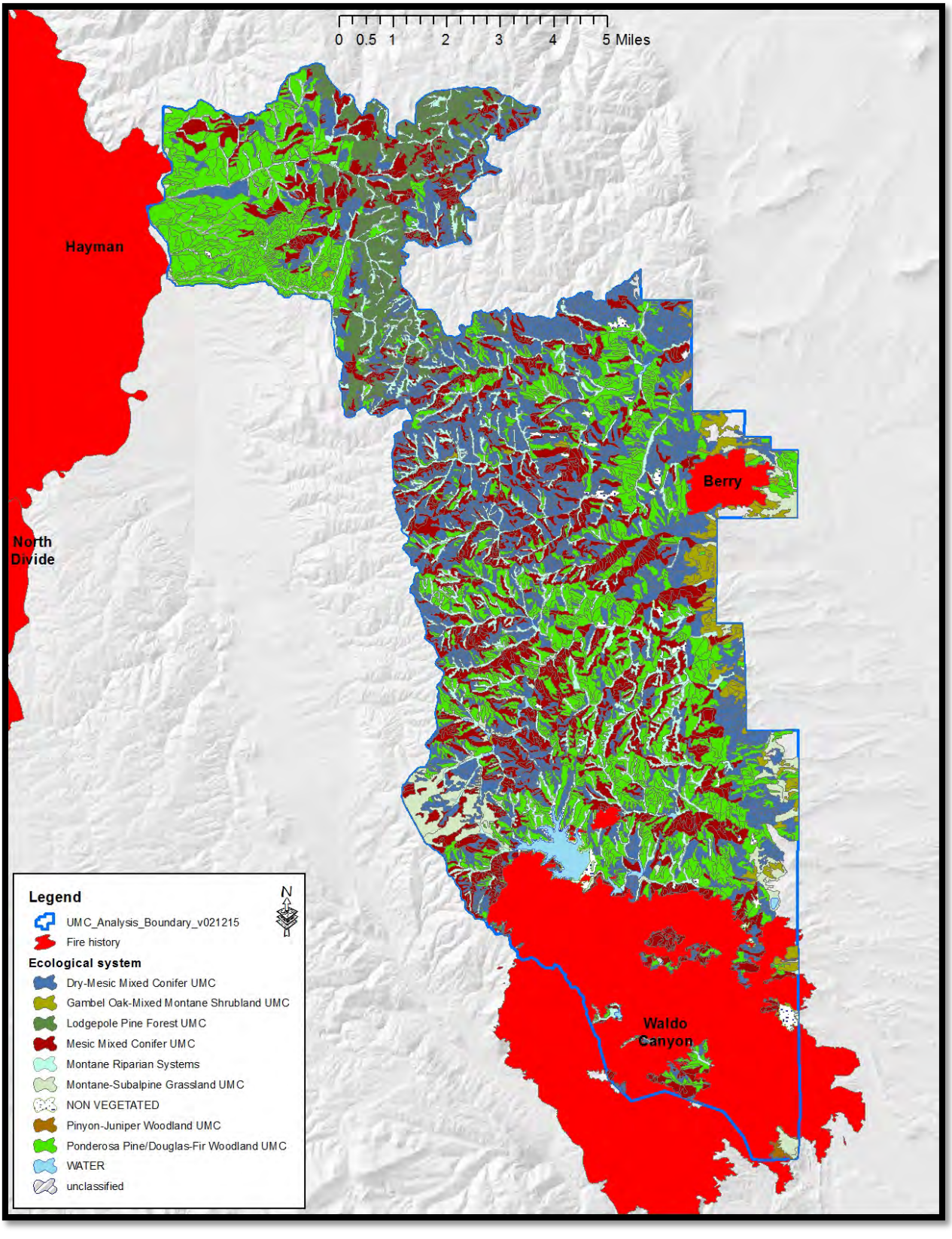


Figure 6. The vegetation system distribution for the UMC project area.

Forested vegetation systems have a variety of defining characteristics such as vegetation type, age, development stage, structure, and distribution. These characteristics form a complex web of interactions that define forested landscapes and lead to a shifting mosaic of forested conditions over time and space. In order to better understand the potential historic distribution and development of forest vegetation on

the UMC landscape model simulations were run using the Vegetation Dynamics Development Tool (VDDT). These VDDT runs were compiled to generate and establish a natural range of variation (NRV) for each vegetation class for the vegetation systems within the UMC project area. The following tables describe the three predominant Forest Vegetation Systems in more depth to provide a better understanding of the existing conditions within the UMC landscape.

Ponderosa pine/Douglas-fir Woodland

The lower montane zone is dominated by ponderosa pine (historically < 30% canopy cover below 6600 feet), more dense stands of Douglas-fir on north-facing slopes with occasional large Douglas-fir on other aspects (Tables 10 and 11). In the upper montane zone the ponderosa pine cover type occurs both as relatively pure stands and with significant components of Douglas-fir. There is typically a striking contrast in stand density and species composition on south- as opposed to north-facing slopes. Douglas-fir is prominent on north-facing slopes. Structural changes will vary greatly depending on disturbance history. Limber pine occurs in higher elevations in groups and as scattered individuals. Understory species can include Gambel oak, mountain mahogany, Arizona rescue, mountain muhly, kinnikinnick, and yucca. Surface, mixed, and stand replacing fire types are part of the historic fire regime.

Table 10. Ponderosa pine/Douglas-fir woodland forested vegetation system distribution and characteristics.

NRV (%)	Vegetation Class	Description	Canopy cover (%)	Height (ft) **DBH (in)**
10	Early	Openings with up to 10% remnant overstory trees dominated by ponderosa pine and sometimes Douglas-fir. Some persistent openings.	0-70	0-15 **< 5**
10	Mid-Closed	Greater than 40% canopy closure, often in small patches with some persistent openings. Uneven aged structure developing.	41-70	15-50 **5-16**
15	Mid-open	< 40% canopy cover. Mosaic composition with pockets of regeneration, shrubs, grass, and openings. Uneven aged structure developing.	10-40	15-50 **5-16**
45	Late-open	< 40% canopy cover. Mosaic composition with pockets of regeneration, shrubs, grass, and openings. Uneven aged structure developing.	10-40	50-80 **17-30**
20	Late-closed	> 40% canopy cover. Mosaic composition with pockets of regeneration, shrubs, grass, and openings. Old trees likely present Uneven aged structure dominates.	41-70	50-80 **17-30**

Table 11. Existing distribution of Ponderosa pine/Douglas-fir woodland vegetation classes compared to the natural range of variation.

Class	Early	Mid Closed	Mid Open	Late Open	Late Closed	Total
Acres	387	8,124	3,810	1,897	3,119	17,337
NRV %	10	10	15	45	20	100
Current % in class	2	47	22	11	18	100

Dry-Mesic Mixed Conifer Forest and Woodland

The composition and structure of the overstory varies based on the temperatures and moisture relationships of the site (Tables 12 and 13). Ponderosa pine, Douglas-fir, limber pine, and aspen make up the warm/dry mixed conifer. Gambel oak is often the dominant shrub in lower elevations. Ponderosa pine regeneration typically occurs after fire. Limber pine regeneration happens continuously between fires. Douglas-fir regeneration can happen in between and after fires. Douglas-fir can be a canopy dominant with ponderosa pine. Generally found between 6900-9500 feet, it can be found at higher elevations on south-facing slopes than north-facing slopes. This type has a variable distribution on east and west aspects. Surface, mixed, and stand replacing fire types are part of the historic fire regime.

Table 12. Dry-mesic mixed conifer forest and woodland forested vegetation system distribution and characteristics.

NRV (%)	Vegetation Class	Description	Canopy cover (%)	Height (ft) **DBH (in)**
10	Early	Succession after lethal fire will depend on prior vegetation. In general conifer dominated, with some remnant ponderosa pine. Fire favors ponderosa pine regeneration. Gambel oak will resprout if available. If aspen cover is 50% or greater prior to disturbance, stand will regenerate to aspen.	n/a	0-15 **< 5**
5	Mid-Closed	If aspen is dominant the stand will achieve a mid-closed stage. Conifers such as limber pine and Douglas-fir could be regenerating with it. Any surviving conifers would be canopy dominants.	41-80	15-65 **5-16**

20	Mid-open	Ponderosa is the canopy dominant with an understory dominated by Douglas-fir. Limber pine is present and some is entering main canopy. If aspen is present self-thinning would lead to an open canopy. Conifer needle cast creates a litter layer that could carry fire. Any fire would further open the stand by thinning aspen and fir.	11-40	15-65 **5-16**
40	Late-open	Ponderosa pine is the canopy dominant. Douglas-fir can also be a canopy dominant. If aspen is present its number are few. Low levels of suckering may keep it in the stand. Open aspen stands are not common in this class in warm/cry mixed conifer.	11-40	66-100 **17-30**
25	Late-closed	Conifer stand with minor aspen component. Mature to over-mature with heavy understory of conifers. Mainly composed of ponderosa pine, Douglas-fir, and limber pine.	41-80	66-100 **17-30**

Table 13. Existing distribution of dry-mesic mixed conifer forest and woodland vegetation classes compared to the natural range of variation.

Class	Early	Mid Closed	Mid Open	Late Open	Late Closed	Total
Acres	648	7,923	4,073	1,326	1,456	15,426
NRV %	10	5	20	40	25	100
Current % in class	4	51	27	9	9	100

Mesic Montane Mixed Conifer Forest and Woodland

The mixed conifer is driven by elevation and aspect. The cool moist mixed conifer will have much less ponderosa pine than the warm/dry. However, ponderosa pine is found in small groups or isolated patches usually in open areas, on meadow edges, and ridges. Douglas-fir and spruce are often canopy dominants with aspen present in most stands. The other major tree species found in the cool/moist are limber pine, Englemann spruce, and white fir can be quite common. Lodgepole pine is uncommon but can be found. This type is found on northerly aspects, generally on steep slopes, and from 7500 to 9500 feet in

elevation. Surface, mixed, and stand replacing fire types are part of the historic fire regime Tables 14 and 15).

Table 14. Mesic montane mixed conifer forest and woodland forested vegetation system distribution and characteristics.

NRV (%)	Vegetation Class	Description	Canopy cover (%)	Age (years)	Height (ft) **DBH (in)**
10	Early	Succession after lethal fire will depend on prior vegetation. Aspen may or may not be present and depends on pre-disturbance population. The site will start as grass/forb/shrub and aspen if present. Fire can prolong this stage. Remnant conifers may be present and can be a seed source.	0-100	0-39	0-15 **< 5**
25	Mid-Closed	If present aspen will be dense and over 10 feet in height. Seedling-to-medium sized conifers can be found mixed with aspen. Understory may include mountain snowberry, common juniper, wild rose, grasses, and forbs.	41-80	40-149	15-50 **5-16**
20	Mid-open	If present aspen will be dense and over 10 feet in height. Seedling-to-medium sized conifers can be found mixed with aspen. Understory may include mountain snowberry, common juniper, wild rose, grasses, and forbs. Overall stocking is low.	10-40	40-149	15-50 **5-16**
15	Late-open	Aspen will be rare and in subordinate canopy positions if found. Understory is diverse mix of grasses, forbs, and shrubs. Conifer stocking is scattered and low.	10-40	150-190	50-80 **17-30**
30	Late-closed	Dense conifer stand. Blue spruce and Engelmann spruce can be found. Aspen present but in small numbers. Dead and down wood proliferate.	41-100	150+	50-80 **17-30**

	Understory is likely to be depauperate.	

Table 15. Existing distribution of Mesic mixed conifer forest and woodland vegetation classes compared to the natural range of variation.

Class	Early	Mid Closed	Mid Open	Late Open	Late Closed	Total
Acres	155	9,232	631	299	2,686	13,003
NRV %	10	25	20	15	30	100
Current % in class	1	71	4	3	21	100

Lodgepole Pine Forest

Rocky mountain lodgepole pine forests are typically found in upper montane and subalpine elevations and are typically above 9000 feet. Lodgepole pine is generally persistent, although aspen may be seral to it in areas. Understory vegetation can vary from sparse shrub cover, to grass, to barren. The fire regime for these forest types is typically high severity and can burned in mixed to stand replacement patterns (Tables 16 and 17).

Table 162. Lodgepole pine forested vegetation system distribution and characteristics.

NRV (%)	Vegetation Class	Description	Canopy cover (%)	Age (years)	Height (ft) **DBH (in)**
20	Early	Grasses, forbs, low shrubs and lodgepole seedlings and saplings; aspen maybe present. Even-aged, canopy closure will tend to exceed 30-40% after seedlings area established at moderate to high densities and are well distributed. The majority of the trees are small sapling size, > 1.0” dbh.	0-80	0-39	0-33 **< 5**
20	Mid-Closed	Moderate to dense pole-sized trees, sometimes very dense (dog-hair); aspen usually not present. Even-aged.	61-100	40-159	33-66 **5-9**
20	Mid-open	If present aspen will be dense and over 10 feet in height. Seedling-to-medium sized conifers can be found mixed with aspen. Understory may include mountain snowberry,	10-40	40-149	15-50 **5-16**

		common juniper, wild rose, grasses, and forbs. Overall stocking is low.			
15	Late-open	Aspen will be rare and in subordinate canopy positions if found. Understory is diverse mix of grasses, forbs, and shrubs. Conifer stocking is scattered and low.	10-40	150-190	50-80 **17-30**
30	Late-closed	Dense conifer stand. Blue spruce and Engelmann spruce can be found. Aspen present but in small numbers. Dead and down wood proliferate. Understory is likely to be depauperate.	41-100	150+	50-80 **17-30**

Table 17. Existing distribution of lodgepole pine forest vegetation classes compared to the natural range of variation.

Class	Early	Mid Closed	Mid Open	Late Open	Late Closed	Total
Acres	76	871	662	543	1,360	3,512
NRV %	20	20	20	15	30	100
Current % in class	2	25	19	15	39	100

The data provided above indicate that changes in land use patterns and effective fire suppression over the last 100+ years have modified vegetation systems within the UMC landscape. Current vegetative conditions within the UMC landscape differ, in both structure and distribution, from historic forest conditions, which is common place throughout the Front Range (Agee 1993). The Mid-closed vegetation class dominates the UMC landscape and is significantly higher than NRV distributions in all three of the dominant vegetation systems. Summary data indicate that late vegetation classes in ponderosa pine, dry and mesic mixed conifer types, are found in smaller percentages than the NRV. The early vegetation classes for all three dominant forested vegetation systems are the only classes found that are currently closer to historical conditions.

Studies from researchers such as Dr. Merrill Kaufmann and others (Brown et al. 1999, Kaufmann et al. 1999, Kaufmann et al. 2000, Kaufmann et al. 2001, Dickinson 2014) indicate that the historic forest was older, more open, and more structurally diverse than today's conditions. Openings of a variety of sizes were commonly found across the landscape and were highly dependent on fire to create and maintain these breaks in the canopy (Brown et al. 1999, Kaufmann et al. 2001, Dickinson 2014). Large openings with few or no conifers were persistent across a greater percentage of the Front Range landscape (Kaufmann et al. 2000). More recent research also shows smaller and less persistent canopy gaps at the stand level are also significantly lower than historic conditions (Dickinson 2014). The data provided for each of the three dominant vegetation systems of the UMC verify that typically denser and contain fewer openings than occurred historically.

In order to better understand the differences between existing and historical forest conditions an analysis was run using the ecological departure metric developed by the LANDFIRE program and an additional metric of open forest canopy departure (Low 2013). Ecological departure incorporates species composition, vegetation structure, and disturbance regimes to estimate an vegetation systems' departure from its natural range of variability (Low 2013). Ecological departure from NRV and open forest canopy departure and are measured on a scale of 0 to 100, where higher numbers indicate a greater departure (Low 2013) (Table 18). An additional metric of open forest departure was developed and applied because the ecological departure metric did not sufficiently address the changes in achieving an open canopy condition (Low 2013). The open forest departure metric isolates the degree of canopy closure as compares to the more open historical conditions (Low 2013). Key findings from these evaluations indicate that the three dominant Vegetation Systems within the UMC landscape are all moderately departed from their natural historic conditions and there is currently approximately twice as much forest in a closed canopy condition than occurred historically (Low 2103). This translates into a shortage of approximately 15,000 acres in the open canopy forest conditions (Low 2013).

Table 18. Summary of vegetation system departure for the UMC landscape.

Ponderosa pine/Douglas-fir Woodland		Dry-Mesic Montane Mixed Conifer Forest		Mesic Montane Mixed Conifer Forest	
Ecological Departure	Open Forest Departure	Ecological Departure	Open Forest Departure	Ecological Departure	Open Forest Departure
40	43	52	43	42	57

These findings affirm that forest vegetation conditions within the UMC project have indeed shifted from historic conditions similar to those found and described by researchers throughout Front Range and greater Rocky Mountain region.

The structure and distribution of forest vegetation across a landscape can have profound impacts on forested environments. Of particular concern in the UMC landscape is the complex interaction between fire and forest vegetation. The majority of the Forested Vegetation Systems within the UMC project area historically and currently burn under mixed severity conditions that are highly dependent on climatological cycles (Rocca et al. 2014, Sherriff et al. 2014, Williams and Baker 2012, Veblen and Donnegan 2005, Huckaby et al. 2001, Brown et al. 1999). For instance, lower montane forests experienced more frequent low severity surface fires but also have a component of passive crown fires (Rocca et al. 2014, Sherriff and Veblen 2008, Brown et al. 1999). Upper montane forests typically experienced a gradient of surface fires at lower elevations and in drier aspects to a mix of surface fire, patchy crown fire, and large areas of active crown fire as moisture and elevation increase (Rocca et al. 2014). Fires in subalpine and lodgepole pine (on drier sites) forests were typically rare and would burn with high severity over hundreds to thousands of acres (Sibold et al. 2006, Shoennagel et al. 2005).

Fire regimes of the majority forested vegetation systems within the UMC landscape have undergone changes that correspond to changes in forest vegetation and structure attributed to fire exclusion (Huckaby et al. 2001, Brown et al. 1999, Agee 1993). Currently many montane forests have greatly increased tree densities that have altered fuel load and structure, two factors that greatly influence fire regimes and have the potential to shift conditions outside of the NRV (Agee 1993). There is also concern that changes in climate have the potential to confound existing concerns with the role of fire, or lack thereof, on forested landscapes (Rocca et al. 2014).

The existing condition of forest vegetation within the UMC landscape has changed substantially over last 100 years. Old trees and stands are rare features within the landscape and are unevenly distributed throughout the project area. When comparing the existing forest structure and density to conditions prior

to large scale settlement there has been a clear loss of openings (both large and small) within the forest canopy and a corresponding increase of tree stocking within most of the stands within the project area. The dense forest conditions that characterize the landscape today have increased levels of competition which reduce tree vigor, are more prone to insect outbreaks, and are capable of carrying large active crown fires in all forested vegetation systems. Large crown fires within the UMC project area could have profound negative effects on forest vegetation, wildlife habitat, soils, infrastructure, personal property, and municipal watersheds.

Forest Health

Most forest insects and diseases area native to and important players in Rocky Mountain forest ecosystems (Allen at al. 2010). Some impacts on forest ecosystems include reduced tree growth, tree mortality, reductions in timber productivity, changes in wildlife habitat, modifying fuel conditions and amounts, reductions in scenic quality, and changes to water quality (Allen et al. 2010). Insects and diseases can also greatly impact forest age distributions, structure, species composition, and density. In terms of mortality and growth loss, the impacts of insects and disease are far greater than any other forest disturbance, including fire (Allen et al. 2010). In the majority of forest ecosystems native insect and disease populations occur at endemic levels. However, when conditions are favorable outbreaks can be severe and large scale. Changes in forest density and structure as well as climatic conditions can trigger such outbreaks.

The following section describes the current forest health conditions within the UMC project area.

Western spruce budworm

Western spruce budworm (*Choristoneura occidentalis*) is a common defoliator in western forests. Female western spruce moths typically lay their eggs on needles in mid and upper crowns of dominant and co-dominant host trees. Host trees in the area are predominantly Douglas-fir, although the insect will also feed on true firs and spruces. Eggs will hatch in late summer with larvae seeking overwintering sites to commence feeding on the host the following spring. The larvae will first mine into buds and then feed on new needle growth into early summer (Cain 2014). Defoliation typically occurs at tree tops and outer branches, but can occur lower and further in the crown when infestations are heavy (Allen et al. 2010).

Budworm larvae have a tendency to drop from branch to branch on long silk threads when disturbed. If host trees are dense and multi-storied, budworm survival is enhanced and intermediate, suppressed or healthy young understory trees may be killed by heavy defoliation caused by dispersing larvae. Dominant and co-dominant trees are also heavily defoliated but these stronger trees are generally able to withstand budworm defoliation. Trees with heavy defoliation or several years of defoliation my show reduced radial growth and/or top killing. Douglas-fir beetle and Douglas-fir pole beetles may also cause mortality in trees stressed by western spruce budworm feeding (Cain 2014).

The UMC landscape is currently experiencing a range of western spruce budworm defoliation. Data from the Forest Health and Protection aerial surveys indicate that the largest areas of defoliation within the project area were initially detected in 2009 when approximately 31,000 acres were identified as having high levels of defoliation (i.e. greater than 50% defoliation). The 2009 defoliation is mainly comprised of fairly large and contiguous drainages ranging in size from 3,000 to 10,000 acres, but also contains smaller localized pockets of budworm defoliation. Subsequent surveys in 2010 and 2011 identified additional areas affected by budworm defoliation but the expansion was relatively minor totaling only about 1,200 acres between the two years. It seems that the severity rather than extent of budworm defoliation has increased since 2009 as currently many areas, especially Upper Monument Creek watershed, are currently experiencing severe defoliation (see Figure 7 below). In some of these stands defoliation is causing high (70-80%) level of mortality and is especially prevalent in areas with high stocking of intermediate and overtopped Douglas-fir with overlapping crowns. The scattered localized areas of budworm activity

typically have lower levels of defoliation when compared to the larger epicenters and are more indicative of endemic levels of defoliation where mortality is not expected to occur or will occur in limited amounts.

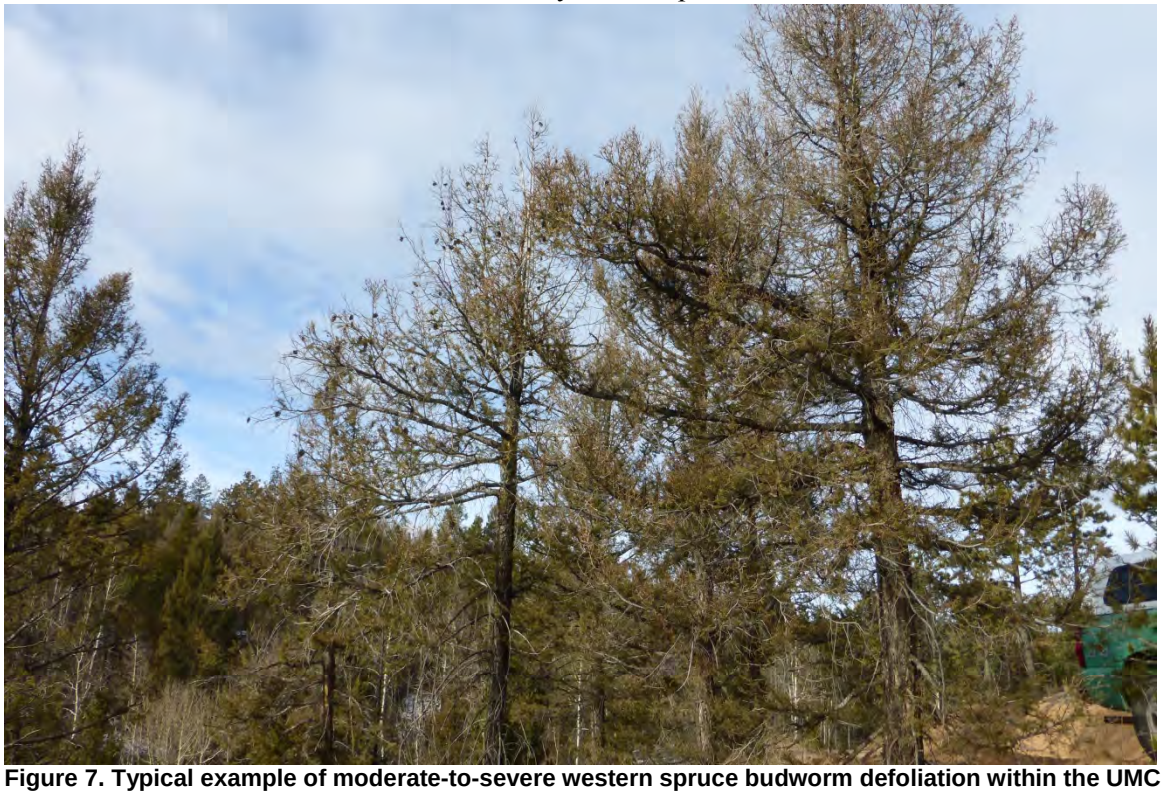


Figure 7. Typical example of moderate-to-severe western spruce budworm defoliation within the UMC project area.

Bark Beetles

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

Mountain pine beetle (MPB) attacks and kills lodgepole, ponderosa, sugar, and western white pines. Outbreaks frequently develop in dense stands of pole-sized ponderosa pine. When outbreaks are extensive, millions of trees may be killed each year, influencing the forest ecosystem (McCambridge et al. 1979). For example, the MPB kills proportionately more large-diameter trees than small-diameter trees and thus alters the diameter distribution (Schmid and Amman 1992). In general lodgepole pine stands that are over 80 years in age, have average diameters greater than 8 inches and are at lower elevations have a higher risk rating. For ponderosa pine, high risk stands have a high stand basal area (high density) and an average diameter at breast height of 10 inches or greater (Chojnacky et al. 2000).

Mountain pine beetles primarily attack lodgepole and ponderosa pines. However, limber pine and bristlecone pine may also become infested and killed. Outbreaks of this insect frequently develop in lodgepole pine stands that contain large diameter trees or in dense pole-sized ponderosa pine. When outbreaks are extensive, large areas of forest may be killed and beetles may attack smaller and smaller trees as well as less desirable tree species. However, under high beetle populations even low risk stands may become infested. Aerial surveys have identified only minimal MPB activity with the UMC landscape, totaling only 30 acres. Areas of MPB mortality are scattered throughout the project area and predominantly small in extent (typically 0.1 acres), but range up to 11 acres. Regionally mountain pine beetle outbreaks have ended or decreased as the supply of available hosts has declined dramatically from epidemic level mortality in recent years.

Spruce beetle predominantly attack Englemann spruce and blue spruce, but can also infest lodgepole pine during large outbreaks when preferred hosts are limited in areas. The spruce beetle is the most significant mortality agent of mature spruce (USDA FS 2010b). Outbreaks can cause extensive tree mortality and can alter stand composition and structure. Since mature and over-mature spruce are preferred hosts average tree diameter, tree height, and stand density are all reduce following large outbreaks (USDA FS 2010b).

Spruce beetles prefer down spruce to standing trees, so areas with recent windthrow can be catalysts for spruce beetle outbreaks. Typically stands most susceptible to attack are located along drainage bottoms in stands where basal areas are 150 ft² per acre and greater, and where average diameters at breast height are 16 inches or greater (USDA FS 2010b). When outbreaks reach epidemic proportions large scale landscape level mortality is realistic and virtually impossible to stop with management activities.

Aerial surveys from 2014 indicate that the current spruce beetle epidemic is expanding rapidly in Colorado, and the state's southern forests are experiencing the largest as fastest growth. In 2014 and additional 253,000 acres of new spruce beetle infestations were detected (USDA FS 2010b). Aerial surveys indicate that the Pike National Forest and the UMC project currently have no detectible or epidemic level spruce beetle outbreaks. However, current trends indicate that most recent spruce beetle outbreaks populations are getting closer to the UMC landscape and it is likely that increased beetle outbreaks could occur within the next few years.

The Douglas- fir beetle is similar to other *Dendroctonus* bark beetles and typically attacks larger, dominant trees (Veblen and Donnegan 2005). Populations can reach epidemic proportions when forests are stressed from overstocking, from drought, fire, or following outbreaks of Douglas-fir tussock moth. Western spruce budworm defoliation may also increase Douglas-fir susceptibility to attack, and Douglas-fir beetle epidemics appear to have arisen during and expanded following outbreaks of western spruce budworm (Hadley and Veblen 1993, Schmid and Mata 1996). Residual trees in and along fires perimeters are also likely hosts for the Douglas-fir beetle as they are near potential source populations and commonly have damages and reduced vigor from fire effects. Forest Health aerial surveys over the last five years have identified small endemic levels of Douglas-fir beetle activity in the northwestern portions of the project area, totaling only about 330 acres. Most of pockets of mortality are small, typically less than 15 acres, and are typically affecting anywhere from 1 to 20 trees per acre.

Douglas-fir Tussock Moth

Douglas-Fir tussock moth (*Orgyia pseudotsugata*) is defoliator and feeds upon tree foliage. Outbreaks develop explosively and after about 3 years, abruptly subside. Douglas-fir tussock moths along the Front Range are typically not as widespread as western spruce budworm but the damage and mortality across all host size classes tends to be more severe in a more localized area or limited to individual drainages. Between outbreaks, this insect is seldom seen (Furniss and Carolin 1977).

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

In 1983, a major outbreak of DFTM occurred in the South Platte watershed on the Pike National Forest that lasted through the end of the decade (Veblen and Donnegan 2005). The outbreak defoliated 7,000 acres of Douglas-fir scattered over a 19,000-acre area, resulting in significant mortality. This was one of the largest outbreaks of DFTM ever recorded in the state of Colorado.

Douglas-fir tussock moth was not seen at with the UMC project area on a recent field visit by entomologists, but it is active further south on Cheyenne Mountain and trap catches in 2013 along Rampart Range Road were elevated in 2013 (Cain 2014). Defoliation from Douglas-fir tussock moth in

this area is likely at endemic levels but the potential for future epidemic cannot be ruled out as a potential species of concern as evidence from the surrounding landscape indicates.

Dwarf Mistletoe

Dwarf mistletoe (*Arceuthobium vaginatum*) is a parasite that affects ponderosa pine throughout the UMC project area. Mistletoe infections weaken trees and make them more susceptible to attack by other pathogens, such as mountain pine beetle (Frye and Landis 1975). Dwarf mistletoe causes swelling in pine branches, which ultimately reduces a tree's growth rate in both height and diameter once the upper half of the tree's crown is infected. Severe infection eventually kills the tree. The time required for the parasite to kill a tree varies considerably and depends on many factors.

At large scales, trends in mistletoe infection are uncertain. The montane zone is characterized by a variable severity fire regime and heterogeneity of stand ages, it is likely that infection has probably been continuously high over the past several centuries (Veblen and Donnegan 2005). The increase of stand replacing fires in recent time may temporarily reduce infection rates in the young post-fire stands (Veblen and Donnegan 2005). However if infected overstory trees survive a fire they can serve as a source for subsequent infections in regenerating stands. Alexander and Hawksworth (1975) suggest that dwarf mistletoe abundance has increased throughout the Western U.S., as well as the severity of infection.

Methodology

Feasibility Analysis

The bulk of this effects analysis was derived from corporate Forest Service geographical information system (GIS) data, but professional judgement and experience were also used. Treatment areas were identified by forest cover type and subsequently broken into subsets based on the type of implementation tool/s that could be realistically used in an area. Feasibility categories were established based on data from mechanical and manual work that has been accomplished on the Forest by contractors.

The feasibility breakdown is as follows:

Mechanical feasible – Slopes from 0-30%

Mechanical marginal – Slopes 30-40%

The category defined as "mechanically feasible" implies that for any forest type in this classification that whole tree skidding and/or mastication is possible in all or the majority of a stand. However, it is highly likely that there are areas within these forest types where slope steepness precludes the use of mechanical equipment and will therefore require adjustments on the ground during project layout. Typical types of equipment utilized in these areas will be track or rubber tire feller bunchers, track or rubber tire masticators, track or rubber tire grapple skidders, processors, stroke-delimbers, and loaders. However, there could be any number or variety of these types of equipment used in operations which will depend on availability and contractor capabilities.

The category defined as "mechanically marginal" indicates that within a forest vegetation type that the possibility of using mechanical equipment is highly unlikely but that there could be portions of a stand where the use of mechanical equipment is possible. These areas will typically be treated by manual methods such as hand work with chainsaws but there could also be tracked masticators and/or tracked chippers used in favorable areas. Activity fuels that are not masticated will typically be lopped and scattered or piled.

Forest stands where average slopes were greater than 40 percent were considered to only be capable of being treated by manual means, i.e. handcrews with chainsaws. Activity fuels in these areas will be lopped and scattered or piled. There are currently no areas with average slopes greater than 40 percent that are scheduled for treatment with the UMC project area.

Vegetation Class Redistribution

A central goal of this project is to modify and treat forest vegetation in order to achieve a distribution of forest development stages (vegetation classes) that more closely reflects the natural range of variation and to increase openness (interspatial and stand scale) within the project landscape. Management actions were assigned success rate, i.e. the rate at which treatment types are able to achieve desired open forest conditions, and are based upon professional judgement of Forest Service staff (Low unpublished).

A critical limiting factoring in thinning treatment effectiveness for all montane forest types is that there are very few large trees within forest stands of all types across the landscape. This lack of large trees limits the ability mid-closed and mid-open vegetation classes to move into the late-open vegetation class. Thinning in the mid vegetation classes will increase interspatial openings, lower basal area, and increase the quadratic mean diameter, but without having abundant existing large trees within these treatment blocks it is very unlikely that these area will move into the late-open vegetation class. This effect is most prominent in mid-closed vegetation class, as compared to the mid-open vegetation class, where competition for growing space is high and few trees are able to express dominance and out-grow the surrounding tree vegetation. This high level of competition combined with the low site indices that are characteristic of the majority of the soils with the UMC landscape makes it very difficult to develop large trees within the montane forest types.

To estimate the ability for mid-closed and mid-open vegetation classes to move into the late-open vegetation class stand exam data from the ponderosa pine-Douglas-fir woodlands and the dry-mesic mixed conifer forest types were analyzed. It was determined that only a small portion of stands within the mid vegetation classes are capable of moving into the late-open vegetation class due to the lack of large trees. This analysis shows that approximately only about 25 percent of the mid vegetation class in these forest types are capable of moving from the mid to late vegetation class. It was also assumed that only the mid-open, and not the mid-closed, vegetation class is capable of moving into the late-open vegetation class based on reasons mentioned above. On the ground experience in this project area has also shown that lodgepole pine forests within this landscape follow similar trends.

Forest stands where mechanical equipment can be used have a higher probability of changing S-classes because mechanical equipment allows for a greater first entry impact when compared to areas where only hand work can be used. This is because typically more and larger trees can be removed from a treatment area which can increase the size and frequency of small and large scale canopy openings. These stands are also capable of having a variety treatment options and prescription types because the full suite of implementation options is available for use in manipulation of forest vegetation.

Thinning treatment effectiveness used to redistribute S-classes after treatment within mechanized feasible ground are as follows:

- Ponderosa Pine/Douglas-fir Woodland and Dry-mesic Mixed Conifer Forest
    - Assumed to have a thinning treatment success rate of 100% within vegetation size classes (i.e. moving from mid-closed to mid-open or late-closed to late open).
    - Assumed to have a thinning success rate of 25% moving from mid-open to late-open
- Mesic Mixed Conifer
    - Assumed to have a thinning success rate of 50% for all thinning treatments in all vegetation classes.
- Lodgepole Pine Forest
    - Assumed to have a thinning success rate of 100% within vegetation size classes (i.e. moving from mid-closed to mid-open or late-closed to late open).

  - Assumed to have a thinning success rate of 25% moving from mid-open to late-open

- Gambel Oak-Mixed Montane Shrubland
  - Assumed to have a thinning success rate of 100% for all thinning treatments in all vegetation classes.

Treatments not considered to be thinnings would create large openings (2 acres and greater in size) were assumed to have a 100 percent success rate in all forest types. It should be noted that large openings can only occur in mechanized feasible ground because all treated vegetation will be removed from the treatment area.

Forest stands where manual or marginal mechanical treatment is possible these treatment types typically have a lower first entry impact when compared to favorable mechanized areas. This is because these treatments can only affect portions of a stand and/or because the size and amount of forest vegetation that can be treated is limited due to tree size constraints. Concerns with activity fuel loading can also limit the scale of these treatments because treated vegetation is left on site. For analysis purposes the following success rates were used for mechanized marginal ground:

- Ponderosa Pine/Douglas-fir Woodland and Dry-mesic Mixed Conifer Forest
  - 60% success rate of moving from a closed to open canopy condition within a vegetation class (i.e. moving from mid-closed to mid-open and late-closed to late open)
  - 25% success rate of moving from mid-open to late-open
  - 0% success rate of moving from mid-closed to late-open
- Mesic Mixed Conifer Forest
  - 40% success rate for all treatments
- Lodgepole Pine Forest
  - 60% success rate for all treatments
- Riparian Swale
  - 50% success rate for all treatments

Incomplete and Unavailable Information

Geospatial vegetation data, while mostly reliable, contains a fair amount of incorrect or unreliable data mostly driven by assumptions used during development and classification. The majority of these errors are relatively benign (i.e. small inconsistencies in stand boundaries) but a few are more substantial (i.e. misclassifying vegetation classes) and can affect treatment outcomes/impacts. Some assumptions were made during the classification of vegetation classes for the existing forest types, therefore actual distribution of these classes within the different forest types is likely different than those analyzed here. This errors could affect how or if treatments are capable of meeting the desired forest type distributions, but not to a large degree.

A slope analysis for treatment type and feasibility was performed on all identified treatment areas. A 30 meter digital elevation model (DEM) was used to calculate average slopes for a 10 meter raster grid across the landscape. This was done to identify potential areas where mechanical equipment could and could not be used. Slope analysis is critical when trying to determine mechanical treatment feasibility when compared to manual types of treatments (i.e. handwork) as the potential operational constraints and resource damage concerns are far fewer with manual treatments. There are some inherent in inaccuracies

when performing such an analysis as DEMs accuracy at 30 meters is not particularly precise and therefore the affects accuracy of the average slope calculations for the treatment areas is not exact. Due to the imprecision inherent in this modling type there may be additional areas within the identified treatment areas that are more or less conducive to mechanical treatment and adjustments will be made during the unit layout process. Typically in projects the actual amount of operable mechanical ground declines during the layout process and field review of feasibility. In fewer cases additional operable mechanical ground is identified and "picked up" by crews during layout. In sum there will likely be adjustments made on the ground during the layout process to identified treatment areas when actual mechanical feasibility can be field verified. An acceptable tolerance for "picking up" additional mechanically operable ground should be no more than 15% of the original treatment area. The end result of treatment unit field verification could be a slight increase or decrease in mechanical operable ground and/or in manually operable ground not to exceed 15%.

Road access for machinery and equipment needed for treatment implementation is difficult to assess at the scale of this project. It is likely that some temporary and specified roads will be needed to obtain access to treatment area locations. These roads will be designed with the assistance of Forest Service engineering personnel as needed. Road design will follow all applicable best management practices (BMPs), National Handbook and Manual direction, and applicable Forest Plan standards and guidelines. Typically these roads are obliterated and rehabilitated upon project completion.

Spatial and Temporal Context for Effects Analysis

For this analysis effects are characterized for the approximate life of the UMC project, approximately 10 years. This length of time was used because it is reasonable, thereby avoiding unnecessary speculation and it also allows for the integration of a variety of detailed analyses undertaken by the Front Range Collaborative group which provide a critical description of current and future conditions.

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

The past activities within the UMC project area are described in detail in the existing condition section of this document.

Projects occurring presently include:

-130 acres of reforestation is being accomplished within the Waldo burn perimeter.

- Hillslope stabilization is also continuing within priority watersheds in the Waldo burn area.
- Small scale firewood removal is also occurring with select portions of Waldo.

Projects that could occur within a reasonably foreseeable future include:

- Fuel reduction treatments on private land surrounding the Palmer Lake reservoir.
- Fuel reduction treatments on Air Force Academy lands.
- Additional plating within the Waldo burn area will likely continue, 130 acres is planned for 2016 around Rampart Reservoir.
- Prescribed fire in previously treated areas along the Rampart Range road near the Rampart Reservoir.

Palmer Lake Upper and Lower Reservoir Area Agreement

As part of this project an additional analysis was performed on Forest Service managed lands surrounding the Palmer Lake Upper and Lower Reservoirs. This area was initially removed from consideration for treatment due to the steep terrain that limits operability and because of poor access. Further discussion between UMC planning team members, the Coalition of the Upper South Platte (CUSP), and the concerned citizens of Palmer Lake prompted a secondary look at this area. A downscaled analysis was

done around the Upper and Lower Reservoirs to determine the mechanical feasibility as well as the possibility for using more unconventional treatments such a helicopter and cable yarding. CUSP assisted the Forest Service in providing a land assessment with potential treatment areas surrounding the reservoir See Figure 8 below. Treatments to the west of the Town of Palmer Lake reservoir are located in the Rampart East Colorado Roadless Area, and those effects were analyzed (Figure 9).

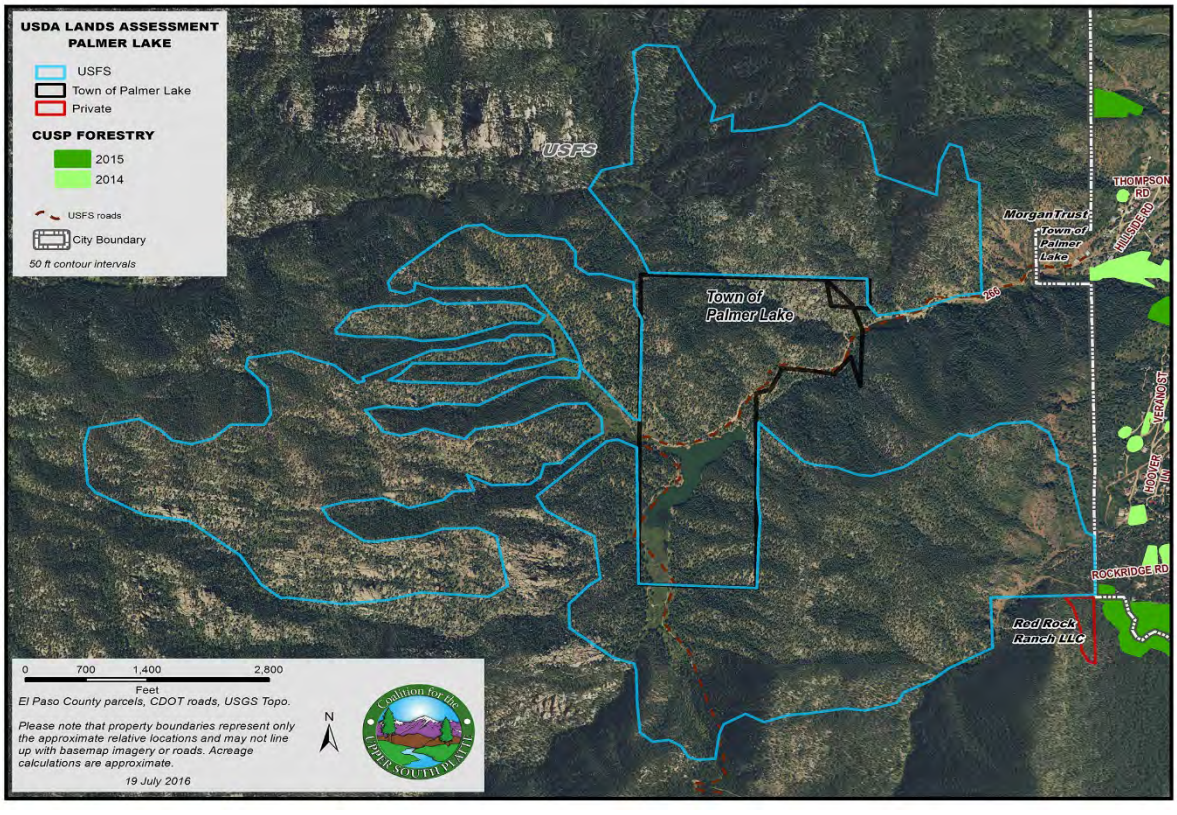


Figure 8. CUSP Lands Assesment of potential treatments around Palmer Reservoir

The Rampart East CRA is located on the South Platte and Pikes Peak Ranger District's and lies along the eastern side of the Rampart Range north of Monument Hill. The Rampart East CRA lies along the eastern side of the Rampart Range northwest of Monument Hill, and is located in Douglas and El Paso counties, nine miles north of Woodland Park, Colorado. The CRA can be accessed from NFSRs 300 (Rampart Range Road), 324, 325, 327, and 563 (Dakan Road).

This CRA is an important watershed for Front Range communities. This CRA encompasses the Monument Creek watershed located in northwestern El Paso County, Colorado. Elevation ranges from 6,800 feet at the mouth of Starr Canyon to 9,200 feet at Storm Peak. The Monument Creek watershed is part of the Arkansas River drainage. This CRA is within a state defined source water assessment area (municipal water supply). The CRA is in Upper South Platte Watershed, the primary water source for the Denver Metro area. Portions of the CRA south of Cook Creek are designated and managed as Palmer Lake Watershed. In 1916 the Secretary of Agriculture established an agreement with the Town of Palmer Lake for protection of approximately 10,425 acres for preserving and protecting the water supply. "Monument Creek Watershed region was inhabited seasonally by several indigenous people groups, including the Utes, Comanches, Kiowas, Cheyenne, Arapahos', and Sioux. Present-day Highway 24 occupies what was known as the Ute Trail, the natural pass that provided access to the rich hunting grounds of South Park. In 1892 the Pikes Peak and Plum Creek Timber Reserves were established that included 184,320 acres and 179,000 acres respectively. The Reserves were consolidated to form the Pike National Forest in 1907." (Excerpts taken from the Monument Creek Watershed Landscape Assessment, 2002.)

The steepness of slopes, limited landing locations and limited existing road access restricted the use of mechanized and cable logging systems, and while the use of helicopter yarding is feasible it was determined to be prohibitively expensive for this area. Manual treatments such as handthinning and piling or lopping of treated fuels are the most likely treatments within this area. Due to the complexity and costliness of potential treatments around the reservoirs an agreement was reached between Forest Service leadership and the citizens of the Palmer Lake area that treatment of Forest Service managed lands would only occur if residents of the Palmer Lake area treated their private inholdings and areas surrounding the reservoir as well.

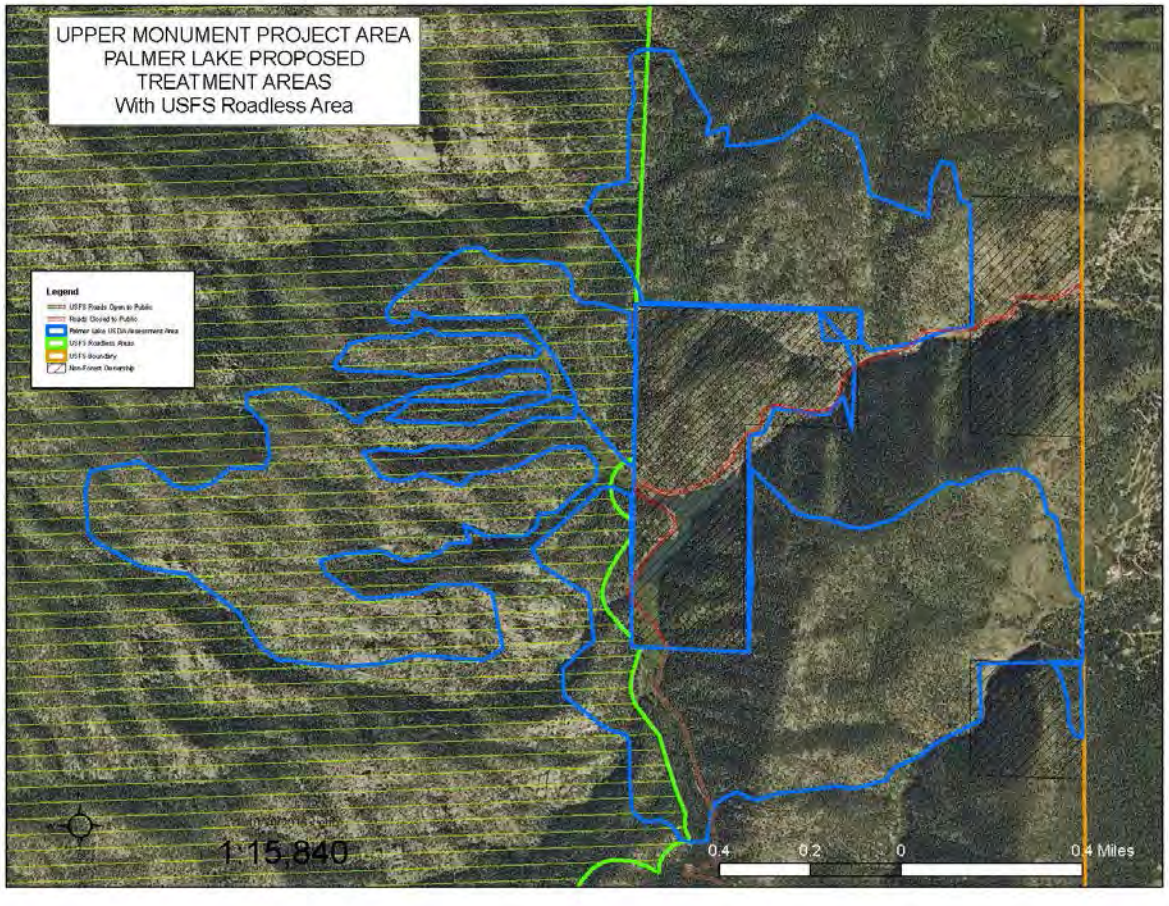


Figure 9. CUSP Lands Assesment of potential treatments around Palmer Reservoir with the Rampart East Colorado Roadless Area.

Alternative 1 (No Action): Vegetation

Direct and Indirect Effects

There are no direct effects of choosing the no action alternative.

Recent wildfire activity on Pike National Forest lands (Hayman 2002, Waldo 2012) have demonstrated the risks that current forest conditions pose to communities and homes within the Front Range. A comprehensive analysis of a no action alternative indicates that the current conditions will continue to be perpetuated in the absence of management (Low unpublished).

Left untreated the Upper Monument Creek analysis area would continue to develop under current trajectories. Forest vegetation densities would continue to be high in many areas, resulting in high levels of competition for nutrients, light, and water which will reduce the vigor of these stands. Unnaturally high levels of shade tolerant conifers will remain on the landscape and aspen populations will likely decline

from competitive stresses and senescence. As vigor continues to decline forest vegetation will be increasing susceptible to drought stress, damage and mortality from insects and disease, and will continue to have structural characteristics that can allow for severe crown fire activity to take place across the landscape.

The lack of small and large scale forest canopy openings will continue under the no action alternative. The low severity fires that once created and maintained small scale canopy openings are unlikely to occur in the UMC landscape since forest vegetation densities will remain high and are more likely to support crown fire activity. Landscape level closed canopy conditions will also prompt fire crew to focus on immediate suppression of fires in the landscape in order to limit the possibly of a large active crown fire event. Large openings, from wildfire, could occur within the next ten years in the UMC landscape but they would most likely mimic openings created in the Hayman and Waldo fires and would therefore be uncharacteristically large and would likely have some negative long-term ecological and social impacts (i.e. loss of wildlife habitat, forest type conversion, destruction of private property).

No fuelbreaks would be installed in the UMC landscape nor would treatment of oak brush occur, which would negatively impact firefighter safety and limit the suppression and holding capacity of fire crews should a wildfire occur.

Watersheds within the analysis area will continue to be at risk for deleterious effects from severe wildfire activity and epidemic scale forest pest outbreaks. Without treatment forest canopy density and continuity will be capable of carrying crown fire over large portions of the landscape. Reservoirs and other critical water provider infrastructure will be at high risk to damage from high severity fire during active burning as well as longer-term negative effects, such as sedimentation and soil destabilization, should a high severity fire occur.

Cumulative Effects

Under the no action alternative the reasonably foreseeable fuels projects on private land and on the Air Force Academy lands would take place, as well as the additional reforestation efforts within the Waldo burn perimeter. The effectiveness of the aforementioned fuels projects would be limited as the Forest Service managed lands within the UMC landscape would continue to be susceptible to high severity crown fire and would be conduits to carry wildfire into surrounding lands.

Prescribed burning would occur in the next ten years along the Rampart Range road near the Rampart reservoir, but without further treatment in the UMC landscape these burns would be limited in their size and ability to influence the potential fire behavior in this area.

Areas within the Waldo burn perimeter would continue to develop and reforestation will occur, but this area will remain in the early seral stages of development in the next ten years and will provide little to the spatial heterogeneity of the UMC landscape.

Summary of Effects

The no action alternative will not meet the purpose and need of the UMC project. The landscape will still be at high risk for having uncharacteristically large severe crown fire that could significantly affect watershed health and function. Dense forested stands will continue to be at risk of epidemic scale mortality from forest insects. There is a high likelihood that under the no action alternative that a similar fire of size and severity of both Hayman and Waldo Canyon would occur within the UMC project area.

Alternative 2 (Modified Proposed Action): Vegetation

Direct and Indirect Effects

Thinning of forest vegetation is a technique used to reallocate growing space to preferred individuals or groups of trees (Smith et al. 1997, Tappeiner et al. 2007). Trees are preferentially harvested or left

untreated based on desired outcomes for a given treatment area. Currently forest thinnings that seek to mimic and recreate historic forest structures and densities (restoration based methods) are regarded as best management practices for dry coniferous forests in the West where there is a desire to return fire to the landscape (Abella and Springer 2015, Stoddard et al. 2015, Dickinson 2014, Churchill et al. 2013, Fiedler et al. 2007, Kauffman et al. 2001, Covington and Moore 1994). Additionally, thinnings and forest restoration based treatments have been shown to significantly influence wildfire severity (Yocom Kent et al. 2015, Waltz et al. 2014, Stephens et al. 2009, Agee and Skinner 2005). Specific guidelines for thinning treatments for each of the vegetation systems within the UMC project area will follow the aforementioned design criteria in this document.

Thinning of forest trees directly impacts: the average stand diameter (increase in a thin from below, and decrease in a thin from above), species composition, stand density (i.e. trees per acre and basal area), the amount and distribution of diseased and pest infested trees, stand canopy cover, the average live crown ratio, crowning indices (i.e. the minimum windspeed for maintaining crown fire activity), the average crown base height (i.e. thin from below), canopy and crown bulk density, and can release occupied growing space to residual trees or to non-tree understory vegetation like grasses, herbs, and forbs (Abella and Springer 2015, Cram et al. 2015, Strahan et al. 2015, Yocom Kent et al. 2015, Churchill et al. 2013, Stephens et al. 2009, Agee and Skinner 2005).

The amplitude effect from thinning depends on the intensity to which forests are thinned. Less intense thinnings where few trees or trees in lower strata are removed can have a minimal effect on the tree and stand characteristics. More intense thinnings where trees are removed from all of the existing strata will yield more significant effect to treated areas. The design criteria developed for this project will provide for a variety of forest structures and densities across the landscape by utilizing a spectrum of treatment intensities.

Growing space released by forest thinnings can have a variety of indirect impacts on forest vegetation. Low intensity thinnings where little growing space is release will likely only produce nominal increase in understory biomass (grasses, forbs and herbs) and most of the released growing space will be reoccupied but remaining trees and/or established understory vegetation. More moderate and intense levels of thinning can release enough growing space where remaining vegetation cannot easily sequester newly available nutrients and sunlight. In these areas there will be an increase in understory response and grasses, forbs, and herbaceous vegetation will become established. Tree regeneration is can also occur in these treatments, especially where aspen is found, and a variety of species could become established.

Areas where larger openings are installed or enhanced the effects of released growing space will be more pronounced. Initially these areas will begin to fill in with grasses, shrubs, forbs, and herbaceous vegetation. If aspen originally occupied the opening site or if clones are located along the perimeter of the openings then a flush of aspen suckers will also initialize into these sites. Any overstory conifers left in openings will see a major reduction in competitive stressors which will increase the vigor of these trees to some degree. Broad scale conifer regeneration will eventually occur in these openings, the timing which will depend on distance to seed source, seedbed availability, and favorable climatic windows.

Increases in spatial heterogeneity and tree vigor will also affect forest insects and pathogens. Western spruce budworm populations will likely decrease as Douglas-fir densities decrease across the project area. Increases in spatial heterogeneity and in the pine and aspen component of treated areas will limit the suitable habitat and dispersal potential of tussock moth populations. Increases in the overall vigor of residual trees will help limit the potential for epidemic out breaks of bark beetle populations. There will also be an overall reduction in the dwarf mistletoe infected trees across the project area as they will be targeted for removal.

There are additional indirect effects that could occur by implementing the proposed action. During project implementation there will likely be restricted road usage and noise from machinery that could lessen recreational experiences in the area. More open conditions in project area forests could add to the user created trail issues that currently plague the Forest. Existing user created trails that lie within project areas

would be rehabilitated after project completion. Wildlife could also be deterred from project areas during implementation, but these effects would be should term.

Direct effects to vegetation class distribution

Forest vegetation treatments utilizing the aforementioned design criteria would directly affect the distribution and arrangement of vegetation classes within the major vegetation systems found in the UMC landscape. The feasibility analysis described in the Methods section above was used to generate an anticipated number of potential treatment acres for each of the vegetation systems. It should be noted that not all of the acreages listed in the table below will be treated, and further discussion of treatment intensities and effects is provided in the sections below. There will also be adaptive on the ground adjustments made to treatment unit boundaries as actual site-specific feasibility limitations and opportunities are better identified. An estimation of acres that can potentially be treated within the UMC project area for each of the vegetation systems is provided in chapter two, modified proposed action

Ponderosa Pine – Douglas-fir Woodlands

Under the proposed action approximately 2,624 acres would be available for mechanized treatment and an additional 2,180 acres of marginal mechanized ground would be available for treatment. Prescribed treatments will follow the design criteria for this forest type so that stand structure and distribution will move toward the natural range of variation (Table 19). The focus of treatments within the mechanized ground would be to create and enhance interspatial openings, tree groupings at varying densities, and large openings within the ponderosa pine-Douglas-fir woodland type.

Acres currently in the early vegetation class would remain following treatment. Treatments within this vegetation class would enhance the already established low density and openness in these areas. Advanced regeneration could be removed as well as ladder fuels that could serve as conduits for fire along stand edges or that could pose a threat to old established remnant trees that could exist. Treatments would encourage understory growth of grasses, forbs, and herbaceous plants by removing competing tree vegetation. Treatments would allow for fire to play a more natural role in these stands once treatments established a more natural lower density and distribution of established trees.

The mid vegetation classes would receive the full suite of treatments under the proposed action. Approximately half of the mid-closed class and one-third of the mid-open class would be converted to the early vegetation class by installing large openings (2 acres and greater) across the landscape. Openings will vary in size and arrange across the project area and will be larger than 2 acres but less than 40 acres and on average 5-10 acres in size. Residual large diameter and old trees would be left at varying densities within these openings to serve as seed sources for future regeneration, as critical structural components for forest vegetation, and as future standing soft snags and eventually large woody debris for the forest floor. Eventually openings would foster the development of new early seral forest stands that would be comprised of conifer and aspen regeneration. Regeneration of these openings could occur as soon as five years after treatment depending on climate and seed availability. Openings will be allowed to regenerate within the 7D management area where timber production standards require full stocking within five years after such treatments to meet Forest Plan and NFMA requirements. If natural regeneration is found to be insufficient in 7D management areas artificial regeneration, planting, could be necessary to ensure that Forest Plan direction and NFMA requirements for stocking are met. There are stands within the Upper Monument Creek watershed that were planted in the early 20th century with questionable tree stock that appear to be offsite and are performing poorly and are potential sources of poor genetics. These areas are ideal for both clearcutting of offsite poor genetic stock and replanting of native onsite superior genetic stock to ensure regeneration of these openings.

The other half of the existing mid-closed and all of the remaining mid-open class would be treated with restoration based treatments that emphasize interspatial openings and tree groupings to disrupt canopy continuity. According to the Forest Plan standards and guidelines these openings are limited in size to a maximum of 40 acres. These areas would see an overall reduction in basal area, and increase in openings

between groups of trees, a reduction in ladder fuels, an increase in crown base height, and increase in understory grasses, forbs, and herbs. The distinction between large openings and interspatial openings and tree group enhancement would not be discrete structures on the landscape. Rather, they would all flow seamlessly together to form a complex distribution of forest structures across the project area. It is estimated that 50 percent of the existing mid-closed class and 75 percent of the mid-open class not put into large openings will be in the mid-open vegetation class after treatment. Approximately 25 percent of the mid-open acreage not put into openings and that will receive the restoration based treatments will move in to the late-open vegetation class due to an increase in the average tree diameter after treatment.

The late-open vegetation class is the only late class to receive treatment in the proposed action. No large openings will be established in this class. The treatments will instead focus on increasing interspatial openings between tree groups, breaking up canopy continuity, and enhancing the aspen component of these areas. These areas would see an overall reduction in basal area, and increase in openings between groups of trees, a reduction in ladder fuels, and increase in understory grasses, forbs, and herbs. The treated acres in this class will remain in the late-open condition they are currently in after treatment but will be at a much lower density than the existing condition.

In the marginal mechanized ground approximately all of the 2,180 acres would receive some form of treatment. The steepness of the ground in these area will present operational limitations to what can be accomplished during a first entry. Stands within the early vegetation class will remain in this after treatment as silvicultural goals in these areas will be to enhance and maintain the early seral structural qualities that define this class by removing advanced regeneration or other established trees.

Changes to the mid vegetation classes will mostly occur in the mid-late component. Thinnings in these areas will expand on and create more openness between groups of trees to mimic more historic structures. Treatments will emphasize maintaining and protecting large old trees, removing much of the shade tolerant seedling and sapling size trees that have filled in interspatial openings, and removing coniferous competition within and surrounding aspen clones. When possible a mix of tree ages and sizes will be maintained to move toward a more uneven-aged structure within these stands. These areas will see a reduction in canopy cover that will move them into the mid-open vegetation class at a frequency described in the methods above.

Within the mid-open class it is expected that approximately 25% of treated stands will increase in average diameter size, by cutting trees from smaller size classes, which will move them into the late-open vegetation class. Treatments in this class will be similar to those in the mid-closed class but at a lesser intensity due to the lower amount of tree stocking that characterizes this vegetation class.

The late vegetation classes would follow a similar trajectory to the mid vegetation class in that the late-closed class would receive much of the treatment. The late-closed vegetation class would be thinned to increase the interspatial openings between tree groups so that tree group structure could be emphasized and breaks in the canopy could be created. Thinnings and breaks in the canopy would be created so that some of these stands would move into the underrepresented late-open class. Intermediate and suppressed trees would be removed between groups of dominant and codominant trees so that the overall canopy cover is reduced and the average stand diameter would increase, thus moving a portion of these stands into the late-open class. Despite the fact that the late-closed vegetation is underrepresented the proposed action assigns treatment to this class to move some of this acreage into the more underrepresented late-open class. This was done for a couple of reasons, namely it will help break up the canopy continuity in portions of the landscape and since there is a lack of opportunity to move mid-open stands into late-open it seemed logical to move late-closed to late-open where large trees and operational feasibility allow.

Table 19. Ponderosa pine/Douglas-fir woodland distribution summary.

Class	Early	Mid-closed	Mid- open	Late-open	Late-closed	Total
Existing (ac)	387	8,124	3,810	1,897	3,119	17,337
Treatment (ac)	164	1,873	1,145	381	1,241	4,804

Outside of treatment (ac)	223	6,251	2,665	1,516	1,878	12,533
Post treatment (ac)	1,106	6,602	4,382	2,475	2,772	17,337
Post treatment (% of total)	6	38	25	14	16	100
NRV (%)	10	10	15	45	20	100

Dry-mesic Mixed Conifer Forest

Under the proposed action approximately 2,627 acres would be available for mechanized treatment and an additional 2,393 acres of marginal mechanized ground would be available for treatment. Prescribed treatments will follow the design criteria for this forest type so that stand structure and distribution will move toward the natural range of variation (Table 20). The focus of treatments within the mechanized ground would be to create and enhance interspatial openings, tree groupings at varying densities, and large openings within the dry-mesic mixed conifer forest type.

Areas currently in the early vegetation class would remain following treatment. Treatments within this vegetation class would enhance the already established low density and openness in these areas. Advanced regeneration could be removed as well as ladder fuels that could serve as conduits for fire along stand edges or that could pose a threat to old established remnant trees that could exist. Treatments would encourage understory growth of grasses, forbs, and herbaceous plants by removing competing tree vegetation. Treatments would allow for fire to play a more natural role in these stands once treatments established a more natural density and distribution of established trees.

The mid vegetation classes would receive the full suite of treatments under the proposed action. Approximately half of the mid-closed class would be converted to the early vegetation class by installing large openings (2 acres and greater) across the landscape. Openings will vary in size and arrange across the project area and will be larger than 2 acres but less than 40 acres and on average 5-10 acres in size. Residual large diameter and old trees would be left at varying densities within these openings to serve as seed sources for future regeneration, as critical structural components for forest vegetation, and as future standing soft snags and eventually large woody debris for the forest floor. Eventually openings would foster the development of new early seral forest stands that would be comprised of conifer and aspen regeneration. Regeneration of these openings could occur as soon as five years after treatment depending on climate and seed availability.

Openings will be allowed to regenerate within the 7D management area where timber production standards require full stocking within five years after such treatments to meet Forest Plan and NFMA requirements. If natural regeneration is found to insufficient in 7D management areas artificial regeneration, planting, could be necessary to ensure that Forest Plan direction and NFMA requirements for stocking are met. There are stands within the Upper Monument Creek watershed that were planted in the early 20th century with questionable tree stock that appear to be offsite and are performing poorly and are potential sources of poor genetics. These areas are ideal for both clearcutting of offsite poor genetic stock and replanting of native onsite superior genetic stock to ensure regeneration of these openings.

The other half of the existing mid-closed and all of the mid-open class would be treated with restoration based treatments that emphasize interspatial openings and tree groupings to disrupt canopy continuity. These areas would see an overall reduction in basal area, and increase in openings between groups of trees, a reduction in ladder fuels, an increase in crown base height, and increase in understory grasses, forbs, and herbs. The distinction between large openings and interspatial openings and tree group enhancement would not be discrete structures on the landscape. Rather, they would all flow seamlessly together to form a complex distribution of forest structures across the project area. It is estimated that 50 percent of the existing mid-closed class and 75 percent of the mid-open class not put into large openings will be in the mid-open vegetation class after treatment. Approximately 25 percent of the mid-open will move in to the late-open vegetation class due to an increase in the average tree diameter after treatment.

The late-open vegetation class is the only late class to receive treatment in the proposed action. No large openings will be established in this class. The treatments will instead focus on increasing interspatial openings between tree groups, breaking up canopy continuity, and enhancing the aspen component of these areas. These areas would see an overall reduction in basal area, and increase in openings between groups of trees, a reduction in ladder fuels, and increase in understory grasses, forbs, and herbs. The treated acres in this class will remain in the late-open condition they are currently in after treatment but will be at a much lower density than the existing condition.

In the marginal mechanized ground approximately all of the 2,393 acres would receive some form of treatment. The steepness of the ground in these area will present operational limitations to what can be accomplished during a first entry.

Areas currently in the early vegetation class would remain following treatment. Treatments within this vegetation class would enhance the already established low density and openness in these areas. Advanced regeneration could be removed as well as ladder fuels that could serve as conduits for fire along stand edges or that could pose a threat to old established remnant trees that could exist. Treatments would encourage understory growth of grasses, forbs, and herbaceous plants by removing competing tree vegetation. Treatments would allow for fire to play a more natural role in these stands once treatments established a more natural density and distribution of established trees.

Changes to the mid vegetation classes will mostly occur in the mid-late component. Thinnings in these areas will expand on and create more openness between groups of trees to mimic more historic structures. Treatments will emphasize maintaining and protecting large old trees, removing much of the shade tolerant seedling and sapling size trees that have filled in interspatial openings, and removing coniferous competition within and surrounding aspen clones. When possible a mix of tree ages and sizes will be maintained to move toward a more uneven-aged structure within these stands. These areas will see a reduction in canopy cover that will move them into the mid-open vegetation class at a frequency described in the methods above.

Within the mid-open class it is expected that approximately 25% of treated stands will increase in average diameter size, by cutting trees from smaller size classes, which will move them into the late-open vegetation class. Treatments in this class will be similar to those in the mid-closed class but at a lesser intensity due to the lower amount of tree stocking that characterizes this vegetation class.

The late vegetation classes would follow a similar trajectory to the mid vegetation class in that the late-closed class would receive much of the treatment. The late-closed vegetation class would be thinned to increase the interspatial openings between tree groups so that tree group structure could be emphasized and breaks in the canopy could be created. Thinnings and breaks in the canopy would be created so that some of these stands would move into the underrepresented late-open class. Intermediate and suppressed trees would be removed between groups of dominant and codominant trees so that the overall canopy cover is reduced and the average stand diameter would increase, thus moving a portion of these stands into the late-open class. Despite the fact that the late-closed vegetation is underrepresented the proposed action assigns treatment to this class to move some of this acreage into the more underrepresented late-open class. This was done for a couple of reasons, namely it will help break up the canopy continuity in portions of the landscape and since there is a lack of opportunity to move mid-open stands into late-open it seemed logical to move late-closed to late-open where large trees and operational feasibility allow.

Table 20. Dry-mesic mixed conifer forest and woodland distribution summary.

Class	Early	Mid-closed	Mid-open	Late-open	Late-closed	Total
Existing (ac)	648	7,923	4,073	1,326	1,456	15,426
Treatment (ac)	474	2,794	1,173	152	427	5,020
Outside of treatment (ac)	174	5,129	2,900	1,174	1,029	10,406
Post treatment (ac)	1,285	5,737	5,329	1,718	1,357	15,426

Post treatment (% of total)	8	37	35	11	9	100
NRV (%)	10	5	20	40	25	100

Mesic Mixed Conifer Forest

Under the proposed action approximately 1,787 acres would be available for mechanized treatment and an additional 3,309 acres of marginal mechanized ground would be available for treatment. Prescribed treatments will follow the design criteria for this forest type so that stand structure and distribution will move toward the natural range of variation (Table 21).

Treatments within the mechanically feasible ground component will focus mainly on the mid-closed and the late-closed vegetation classes. The overrepresentation of the mid-closed vegetation class in the UMC landscape provides an opportunity to create additional early vegetation class structure via large openings (2 acres and greater in size) with the mid-closed stands within the project area. Openings will vary in size and arrange across the project area and will be larger than 2 acres but less than 40 acres and on average 10-20 acres in size. Residual large diameter and old trees would be left at varying densities within these openings to serve as seed sources for future regeneration, as critical structural components for forest vegetation, and as future standing soft snags and eventually large woody debris for the forest floor. Eventually openings would forester the development of new early seral forest stands that would be comprised of conifer and aspen regeneration.

Approximately half of the late-closed vegetation class will be treated in mechanically feasible ground. Treatments will focus on reducing the existing basal area, breaking up canopy continuity, retaining large and old overstory tree, and emphasizing complex uneven-aged structure when possible. Areas with moderate-to-high levels of insect damage (i.e. western spruce budworm defoliation) and areas where vigorous aspen clones can be released or provided expanded growing space will be targeted for treatment. These treatments will focus on increasing the within stand spatial heterogeneity and are expected to move approximately half of the existing late-closed vegetation class into the underrepresented late-open vegetation class.

Treatments within the marginal mechanized ground will focus entirely within the mid vegetation class. Treatments will focus on the understory and mid-story canopy classes with goals of reducing the existing basal area, breaking up canopy continuity, retaining large and old overstory tree, and emphasizing complex uneven-aged structure when possible. Areas with moderate-to-high levels of insect damage (i.e. western spruce budworm defoliation) and areas where vigorous aspen clones can be released or provided expanded growing space will be targeted for treatment. Treatments with the mid-closed vegetation class area expected to move 40 percent of the existing acreage into the mid-open class. Treatments within the mid-open class will enhance and maintain the existing open structure of these areas and will not shift the distribution of this vegetation class.

The table below provides a summary of the anticipated distribution of vegetation classes within the UMC project area after treatments are completed. The “Existing” field is the current distribution of vegetation classes for the forest type for the entire UMC project area. The mechanically feasible and mechanically marginal treatment acres are combined in the “Treatment acres” field. The “Outside of treatment” field corresponds to all of the acreages within the forest type that lie within the UMC project area boundary but do not fall within either the mechanically feasible or mechanically marginal designations. The “Post treatment” field is the anticipated distribution of vegetation classes after the project is complete, and the percentages of this distribution can be compared to the natural range of variation (NRV) in the final field of the table.

Table 21. Mesic mixed conifer distribution summary.

Class	Early	Mid-closed	Mid-open	Late-open	Late-closed	Total
Existing (ac)	155	9,232	631	299	2,686	13,003

Treatment acres (ac)	2	3,692	164	127	1,111	5,096
Outside of treatment (ac)	153	5,540	467	172	1,575	7,907
Post treatment (ac)	1,263	7,090	1,665	567	2,418	13,003
Post treatment (% of total)	10	55	13	4	19	100
NRV (%)	10	25	20	15	30	100

Lodgepole Pine Forest

Under the proposed action approximately 2,214 acres would be available for mechanized treatment and an additional 681 acres of marginal mechanized ground would be available for treatment. Prescribed treatments will follow the design criteria for this forest type so that stand structure and distribution will move toward the natural range of variation (Table 22).

Treatments within the mechanically feasible ground in this forest type would focus on creating openings within the mid- and late-closed vegetation classes to increase the amount of the underrepresented early vegetation class. Patch clearcuts ranging from 3-20 acres would be used to a large degree within the mid-closed vegetation class and to a lesser degree within the late-closed vegetation class. In addition, treatments would create both small (less than1 acre) and large (1-5 acres) openings via an uneven-aged, group selection approach typically in the late-closed vegetation class where complex forest structures can be found and emphasized. Openings and group selections will lower the acreage of mid- and late-closed vegetation classes while increasing the amount of underrepresented early vegetation class.

Treatments within the mechanically marginal ground of this forest type will focus on mid-and late-open and late-closed vegetation classes. Treatments will focus on the understory and mid-story canopy classes with goals of reducing the existing basal area, breaking up canopy continuity, increasing the average stand diameter, retaining large and old overstory trees, and emphasizing complex uneven-aged structure when possible. It is anticipated that 60 percent of the existing late-closed acreage within the mechanically marginal ground will move into the late-open vegetation class following treatment. Treatments within the mid- and late-open classes will enhance and maintain the existing open structure of these areas and will not shift the distribution of these vegetation classes.

The table below provides a summary of the anticipated distribution of vegetation classes within the UMC project area after treatments are completed. The “Existing” field is the current distribution of vegetation classes for the forest type for the entire UMC project area. The mechanically feasible and mechanically marginal treatment acres are combined in the “Treatment acres” field. The “Outside of treatment” field corresponds to all of the acreages within the forest type that lie within the UMC project area boundary but do not fall within either the mechanically feasible or mechanically marginal designations. The “Post treatment” field is the anticipated distribution of vegetation classes after the project is complete, and the percentages of this distribution can be compared to the natural range of variation (NRV) in the final field of the table.

Table 22. Lodgepole pine forest distribution summary.

Class	Early	Mid-closed	Mid-open	Late-open	Late-closed	Total
Existing (ac)	76	871	662	543	1,360	3,512
Treatment acres (ac)	17	838	618	420	1,001	2,894
Outside of treatment (ac)	59	33	44	123	359	618
Post treatment (ac)	591	671	662	677	911	3,512
Post treatment (% of total)	17	19	19	19	26	100
NRV (%)	20	20	20	15	30	100

Gambel Oak-Mixed Montane Shrubland

Under the proposed action approximately 826 acres would be available for mechanized treatment and there are no identified acres of marginal mechanized ground for this vegetation system. While the main

goal in other forest types is to reach a vegetation class distribution that more closely follows a natural range of variation the desired condition for the oak-mixed montane shrubland is to establish fuel breaks while creating more favorable structural conditions and age distributions.

Treatments within this forest type would be implemented to break up dense mid-closed vegetation class that is found mostly within WUI areas of the project. The mid-closed vegetation class has developed after fire events and currently makes up the majority of this forest type. Treatments would typically utilize group selection methods and would create small openings (<1 to 5 acres) within these areas to begin to build in some diversification in age classes, protect any remnant ponderosa pine trees and large rare oak trees, and to break up ladder and understory fuel continuity. It is anticipated that treatments could move all of the mid-closed vegetation class into the early vegetation class.

Rampart East CRA

Treatments inside the Rampart East CRA would occur on approximately 383 acres. Treatments would occur as an exception to the prohibition of cutting, selling, or removing trees from Colorado Roadless Area (36 CFR 294.42(c)(1)). The exception allows for tree cutting, sale, or removal within the community protection zone to reduce hazardous fuels to an at-risk community or municipal water supply. Treatments within the CRA are focused on creating shaded fuel breaks by thinning mature stands from below on forest types surrounding and upstream from the Palmer Lake reservoirs. The treatments would reduce the stocking density of conifers within the treatment areas and would help to remove ladder fuels from treated stands. Work would primarily be accomplished through the use of chainsaws, handwork, and pile burning. Incidental skidding of material maybe allow on slopes less than 30% in order to increase the effectiveness of thinning treatments on Palmer Lake lands immediately adjacent to the reservoirs and having existing roaded access on the private lands making the removal of material a viable option. Treatments also include hand cutting and pile burning of encroaching conifers from upstream riparian corridors and existing natural openings with well developed understory vegetation. An analysis was conducted on the impacts to the nine roadless area characteristics.

1. **High quality or undisturbed soil, water, and air:** Only minor, short term impacts would occur to soil, water, and air characteristics while management activities are ongoing. Long-term, the activities proposed are expected to augment and further protect the values associated with these resource characteristics by helping to reduce the risk of high severity fires within the watershed.

2. **Sources of public drinking water:** The Upper Monument Creek watershed is critical as a source of municipal drinking water for the community of Palmer Lake. Treatments in the CRA will directly help to reduce the risk of large scale disturbances helping to provide long term beneficial impacts to soil and drinking water characteristics.

3. **Diversity of plant and animal communities:** No adverse effects to plant and animal diversity are predicted. Short term disturbance impacts are possible during ongoing treatments, however, the use of design criteria and mitigation discussed in chapter 2 will serve to minimize those impacts. Long-term, proposed treatments are expected to protect these values by helping to develop stand conditions that more closely resemble NRV for these vegetation types.

4. **Habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land:** The project would not contribute to a trend towards federal listing or cause a loss of viability to populations of sensitive species.

5. **Primitive, semi-primitive nonmotorized and semi-primitive motorized classes of dispersed recreation:** There would be no change in the opportunities for primitive recreation given the remote nature of the treatment units. The proposed treatments are designed to restore a more primitive and resilient stand condition focused on improving watershed conditions and minimizing the risk of large-scale wildfires. No changes in public access are expected as a result of the proposed management activities.

6. **Reference landscapes:** The Rampart East CRA polygons proposed for treatment are along the eastern edge of the roadless area, bordering private land containing a municipal water reservoir. The area is in the wildland urban interface, and is critical for watershed management. This area has not been managed significantly in the past and therefore retains its value as a reference landscape. The proposed treatments are expected to protect Reference Landscape values by helping to develop stand conditions that more closely resemble NRV for these vegetation types, while helping to reduce the risk for large scale high intensity fires within the watershed.

7. **Natural appearing landscapes with high scenic quality:** Design features are incorporated into the proposed action to protect the scenic quality of the CRA while allowing for forest restoration treatments that will eventually lead to a more open less congested forest with high scenic quality. This project would have a short term adverse impact on scenic quality due to evidence of project activity. However, long term it would improve scenic quality by helping to maintaining meadows and reducing undergrowth from legacy forest stands. Therefore, this CRA characteristic would be maintained and improved following management activities.

8. **Traditional cultural properties and sacred sites:** There would be no impact to cultural properties or sacred sites; therefore, this CRA characteristic would be maintained

9. **Other locally identified unique characteristics:** No other unique roadless characteristics were identified for the Rampart East Inventoried Roadless Area.

When completed, the treatments will help to protect the integrity of wildlife habitat and the designated Palmer Lake Watershed which were listed as critical elements of this CRA. The treatments will directly result in modification in forest cover and structure to help move these stands closer to NRV by helping to protect and retain larger trees common for these vegetation types. Collectively the treatments identified will also help to reduce both the risks and the effects of high intensity wildfire events. This will be accomplished by creating modifications in forest structure that help to reduce the intensity and behavior of wildland fires as it moves across the treated acres. In addition, treatments promoting the establishment of riparian vegetation along stream corridors will to help filter and stabilize sediment flows from large scale fires occurring upstream from these treatments. Any user created roads trails within identified treatment area will be, were necessary and prudent, used for vegetation removal and ripped and seeded once vegetation removal is complete. Using design criteria and mitigation measures, CRA treatments shall be designed to prevent new user created trails and deter off-road vehicle access.

Cumulative Effects

Completion of the UMC project, the Palmer Lake project, and projects recently competed on Air Force Academy lands will increase the overall complexity of the UMC landscape. These projects will tie into previously completed treatments on along the western edge of the UMC project area and will help decrease the potential for active crown wildfire to carry across the landscape. A substantial barrier to crown fire spread will be established along the western boundary of the Roadless area in the norther portion of the project area.

Summary of Effects

The proposed action will have a substantial effect on the UMC project area. Spatial heterogeneity will increase at both at the stand and landscape levels as small and large openings are created. These openings combined with newly created fuel breaks and an overall reduction in the level of forest fuels will significantly lower the ability for uncharacteristically severe crown fires to spread in treated areas. Reduction in uncharacteristic crown fire potential will benefit watershed health and function and will have positive downstream effects to community source water protection areas.

At the stand level thinning treatments will increase the vigor of residual trees, enhance important grouping structure, protect old rare overstory trees, reduce the density of shade tolerant species, maintain

and enhance the aspen cover types, increase the amount of non-tree understory vegetation, and shift age distribution to younger age classes so that stand development is more sustainable in the long-term.

Treatments will move toward a more balanced distribution of vegetation classes that will allow for vegetation systems to better persist on the landscape. This complex mosaic of vegetation classes will limit the potential impacts from disturbances such as severe wildfire and epidemic pest outbreaks and will be more resilient should these disturbances occur.

Riparian treatments will increase the vigor of remaining vegetation, protect the rare structural features that define many of these areas, and will maintain the ecological integrity and hydrological function these systems provide to watersheds.

Increases in vigor in forest vegetation at the tree, stand, and landscape scale will place the UMC landscape in a better position for dealing with climate changes in the future.

The mosaic of forest structures and openings within the UMC project area and in surrounding treated areas will allow for fire to play a more natural role in this landscape. By allowing fire to play a more natural role on the landscape, either through prescribed burning or natural ignitions, much of the fine and landscape scale heterogeneity will be maintained or increased. Forest floor vegetation and fuels can be moderated to prevent unnatural build ups of either. Passive crown fires and torching can remove additional overstory trees thereby adding to interspatial heterogeneity and creating new openings for tree regeneration. Tree regeneration that successfully recruits into the overstory will be governed by the stochastic nature of fire driven mortality. All of these effects combined will continually shift vegetation classes and forest type distributions in ways that are more representative of historic conditions and provide greater flexibility in helping to perpetuate the role of fire on the landscape.

Fire

Fire is the dominant force that shapes and influences forested landscapes in the Rocky Mountains (Romme and Knight 1981, Peet 1988). Fire plays a critical role in shaping forest structure and composition by modifying overstory and understory distribution. Fire is also an important driver of ecosystem function, the effects from fire can modify/remove fuels, remove individuals or groups of overstory vegetation, prepare seed beds for regeneration, stimulate forage production, create snags, and facilitate nutrient cycling in soils (DeBano et al. 1998). However, fire can also produce detrimental effects to forest ecosystems such as soil hydrophobicity, increased erosion, habitat destruction, carbon release, increased water temperatures and turbidity, and habitat destruction (DeBano et al. 1998). In more recent times fire has had significant impacts on human development, infrastructure, and water sources as the wildland urban interface continues to expand.

Fires can burn with a variety of intensities (low-to-high) and can produce a range of ecological effects (fire severity) on forested ecosystems (DeBano et. al 1998). Fires intensity (typically measured in flame length) is the amount of energy released which is directly correlated to the amount, arrangement, and condition of forest fuels. Fire severity is a measure of the negative effects that a fire has on forest vegetation, soils, water, wildlife habitat, human communities, etc (Tappeiner et al. 2007). Table 23 below lists and describes typical historical fire severity classifications.

Table 23. Definitions of fire severity taken from Agee 1993.

Term	Definition of fire effects
High-severity fire	A fire that had high mortality of live, standing vegetation, > 80% of the existing basal area or overstory trees removed

Low-severity fire	A fire that had low to no mortality of live, standing vegetation, < 20% of the existing basal area or overstory trees removed
Mixed-severity fire	A fire that had effects that are intermediate, < 70% and > 20% of the existing basal area or overstory trees removed

Fire regimes are defined by the common fire type, intensity, severity, frequency, size and seasonality that naturally occur within a given region and forest type. Some important drivers of fire regimes are the accumulation of fuels, fuel type (fine to coarse woody), climate (dry vs. moist periods), and imacts to forest health (insect and pathogen damages) (Veblen and Donnegan 2005). Since forest types differ by species, structure, stocking, and site the previously mentioned drivers will affect each forest type differently in both space and time. Historic fire regimes for forest cover types for the UMC project area are as follows:

Table 34. Characteristics of fire regimes for forest cover types found on the UMC landscape (adapted from Kaufmann et al. 2007, Veblen and Donnegan 2005, LANDFIRE).

Forest type	Interval (yrs), Fire type	Severity	Typical patch (ac)
Lower Montane (6,500 to 8,500ft) Ponderosa pine/Grass	2-15, Surface	Low	0.1-0.2
Mid and Upper Montane (8,500 to 9,500ft) Ponderosa Pine/Douglas-fir Woodland	10-45, Surface 150-300, Mixed	Low to Mixed	0.2-30
Mid and Upper Montane (8,500 to 9,500ft) Dry-Mesic/ Mixed Conifer Forest and Woodland	10-75, Mixed	Low to Mixed	3-100s
Mid and Upper Montane (8,500 to 9,500ft) Mesic Mixed Conifer Forest and Woodland	6-60, Mixed 100+, Crown	Mixed to High	3-100s

Subalpine (9,500-11,500ft) Lodgepole pine	100-400+, Crown	High	100s-1000s

Both human and lightning caused fires have been common on the Front Range landscape for centuries (Vale 2002). Prior to large scale permanent settlement, circa 1860, fires were predominantly lightning caused except around areas of high indigenous use where fire frequency was typically higher (Vale 2002). Fire frequency began to gradually change as settlement increased, but the most dramatic change came in 1910 when large fires in the Pacific Northwest and Inland Empire spawned the beginning of large-scale fire suppression across the nation (Pyne 2001). From 1910 to current times suppression of both lightning and human caused fires has been the central focus the management of National Forest System lands, effectively modifying the fire regime in many areas. The UMC project area is a reflection of these suppression efforts as only two large fires have influenced the structure and development of the landscape. Had pre-settlement fire regimes been allowed to occur across the UMC landscape, the project area would have a higher occurrence and evidence of fire.

Methodology

Fire behavior was modeled using FlamMap 5.0 (Finney 2006), with fuels and vegetation data provided by LANDFIRE (Rollins 2009). Fuel moisture and weather variables representing 90th percentile conditions were used as model inputs (Table 25). Values represent 90th percentile conditions averaged from May 1 to September 30 (to represent the wildfire season) using data from 1990 to 2015 at the Polhemus and Manchester Remote Automated Weather Stations (RAWS). Polhemus data were given a weight of 65% and Manchester data were weighted at 35%. A wind speed of 25 mph blowing from the southwest (220°) was used. Model outputs included crown fire, flame lengths, and spotting distance.

Table 25. Fuel moisture and weather parameters used in FlamMap. Data were synthesized using Fire Family Plus software.

Variable	90th Percentile Condition
1-hr fuel moisture (%)	2
10-hr fuel moisture (%)	6
100-hr fuel moisture (%)	9
Herbaceous live fuel moisture (%)	30
Woody fuel moisture (%)	68
Air temperature (F)	81

LANDFIRE data were adjusted in ArcFuels to represent treatment effects (Table 26). Adjustment factors for canopy cover, canopy base heights, canopy heights, crown bulk densities, and fuel models were based on similar values provided in Vaillant et al. (2013) and Ager et al. (2014). Original values are multiplied by the adjustment factor in order to approximate post-treatment conditions in the model input variables. Abbreviations are as follows: CC = canopy cover (%); CBH = canopy base height (m); CH = canopy height (m); CBD = canopy bulk density (kg m^{-3}); FM = fuel model (post treatment).

Table 26. Adjustment factors for different treatment types in the Upper Monument Creek landscape.

Treatment Type	CC	CBH	CH	CBD	FM
Removal/Thinning/Fuelbreak	0.4	1.8	1.2	0.3	TL1 (181)
Non-removal	0.6	1.4	1.0	0.6	SB1 (201)
Oakbrush	0.8	1.0	1.0	0.8	GR2 (102)
Prescribed fire	0.9	1.2	1.0	0.9	GR2 (102)

Alternative 1 (No Action): Fire

Direct and Indirect Effects

There are no direct effects of choosing the no action alternative.

Recent wildfire activity on Pike National Forest lands (Hayman 2002, Waldo 2012) have demonstrated the risks that current forest conditions pose to communities and homes within the Front Range. A comprehensive analysis of a no action alternative indicates that the current conditions will continue to perpetuat in the absence of forest management (Low unpublished). Left untreated the Upper Monument Creek analysis area would continue to develop under current trajectories with a high potential for large scale disturbance by fire.

Alternative 2 (Modified Proposed Action): Fire

Direct and Indirect Effects

Proposed treatments reduced the potential for active crown fire (Figure 10). Projected crown fire decreased from 29,600 acres prior to treatment to 16,857 acres after treatment. Areas that remain in active crown fire condition represent those areas that cannot be effectively treated due to terrain and inaccessibility (Figure 11). Projected surface fire increased from 16,137 acres to 24,005 acres as a result of treatment.

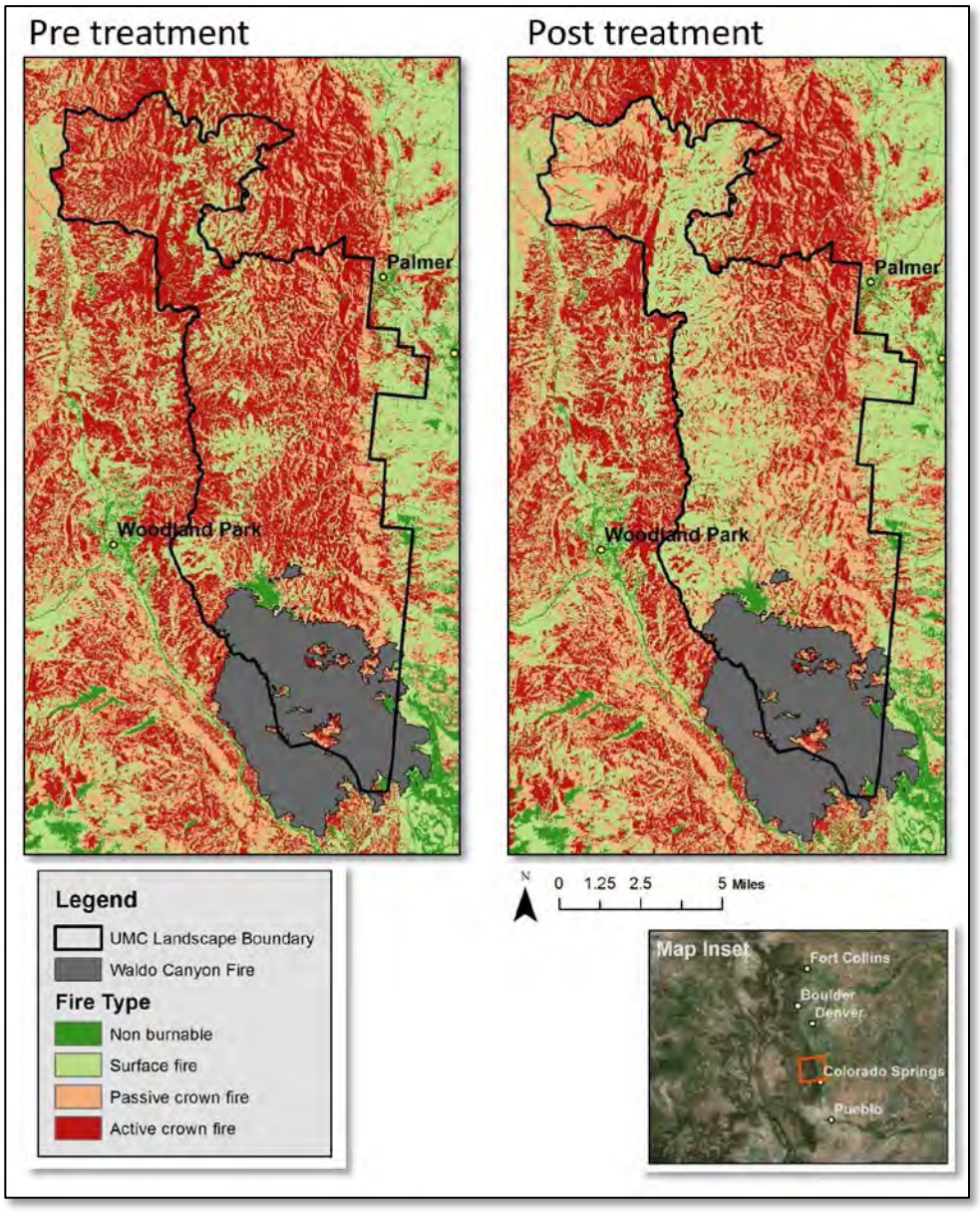


Figure 10. Change in active crown fire from pre to post treatment.

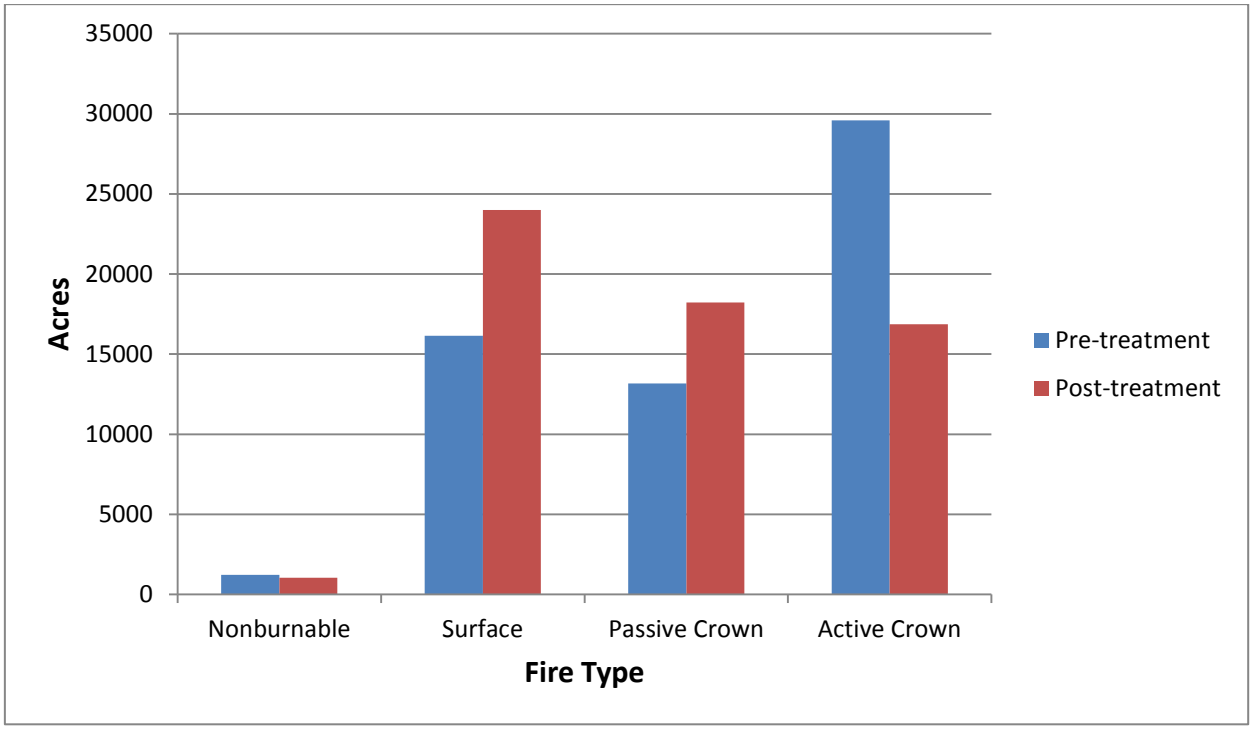


Figure 11. Change in fire behavior due to treatment in the Upper Monument Creek landscape.

Treatments reduced flame lengths (Figure 12). Acres projected to burn with flame lengths greater than 12 feet decreased from 42,127 to 31,045 acres as a result of treatments. Similarly, acres projected to burn with flame lengths less than 4 feet increased from 13,757 to 21,802 due to treatment. Reducing flame lengths to less than 4 feet is an important outcome of treatments, as lower flame lengths provide fire fighters with tactical advantages for fighting wildfire.

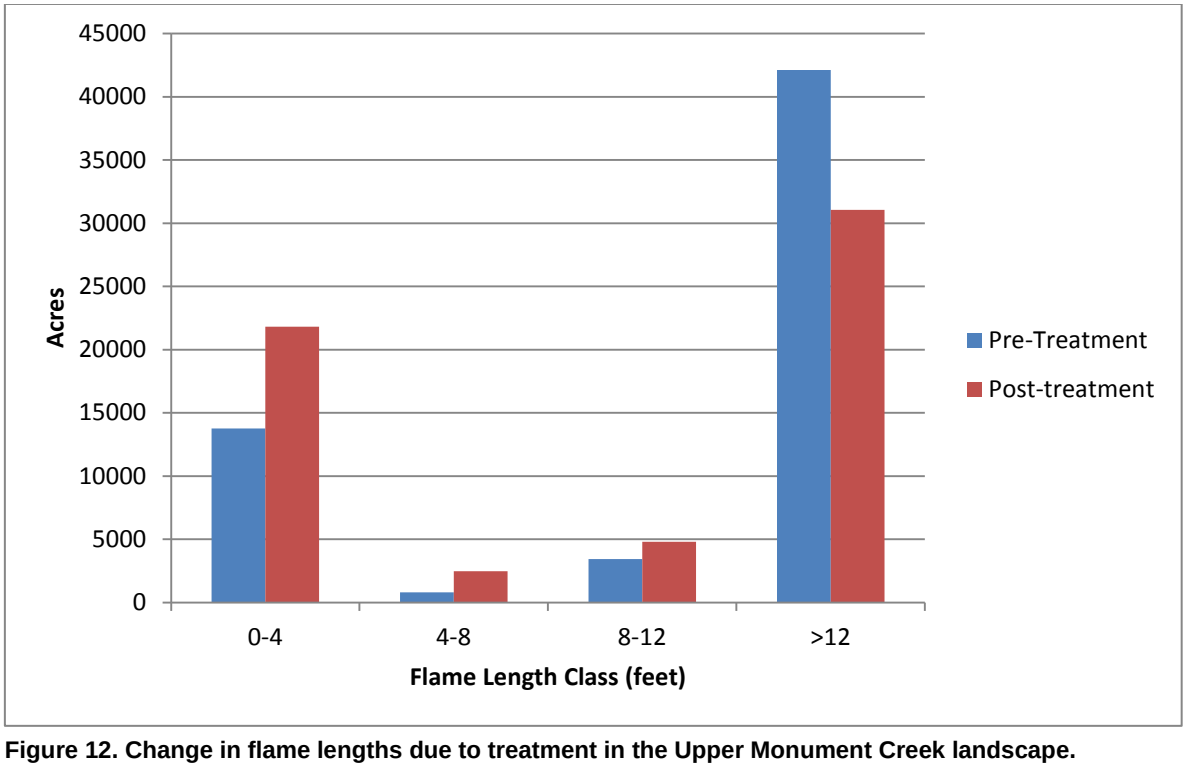


Figure 12. Change in flame lengths due to treatment in the Upper Monument Creek landscape.

Fire spread is facilitated by embers spotting to unburned areas ahead of the flaming front. Maximum projected spotting distance of fire decreased as a result of treatment as well (Figure 13). Prior to treatment, 36,640 acres exhibited spotting distances of more than a quarter mile whereas after treatment 29,235 acres exhibited spotting distances of more than a quarter mile.

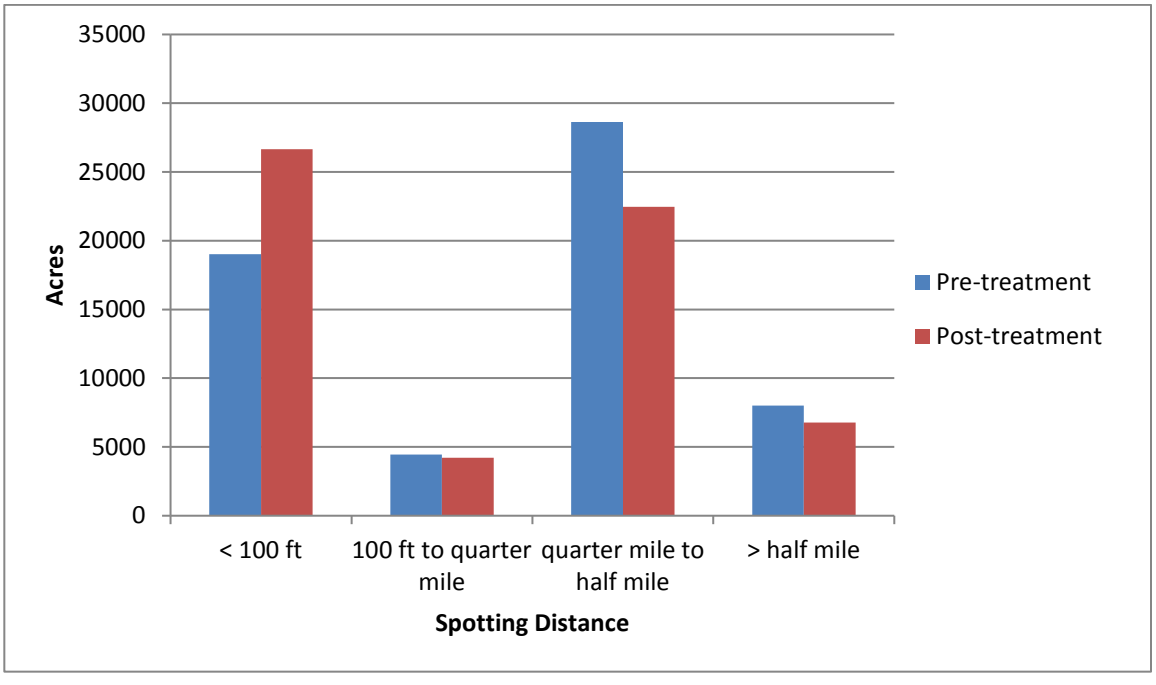


Figure 13. Change in spotting distance due to treatment in the Upper Monument Creek landscape.

Prescribed Fire

Prescribed fire as considered in this analysis focuses on the use of under burning to help remove or modify fuels within stands or vegetations types. Prescribe fire may be used a primary tool for achieving those objectives on a limited number of stands that are currenty in fuel models 2, 9, and 10 which can be burned without significant need for mechancal manipulation of existing overstory or fuel loading. A larger percentage of acres targeted for the use of prescribed fire are associated with stands or vegetation types where other silivicultural treatments will be required to first meet the objecties of reducing the overall density of the overlaying forest cover.

Areas targeted for prescribed burns focus on removing litter, duff, grass, and smaller diameter 1, 10, 100 hr fuels, while some heaver1000 hr fuels may only be partially consummed by fire. Burning prescriptions target burn windows that should result in mosaic burn patterns where 50-90 percent of the ground fuels are burned. Grass cover types will burn readily but regenerates quickly in spring burns and within the next growing cycle for fall burns. Approximately <15 percent of the residual forested stands are expected to be killed with prescribed fire and only slightly higher in a natural fuels burn. Most prescribed fires are expected to result in approximately 75 percent of established burning objectives being met.

Cumulative Effects

See Cumulative Effects Common to All section below.

Hydrology

Watersheds

Watersheds are critical components of ecosystem and municipality function and health. Water from Colorado's forest supports a variety of uses including public drinking water, agriculture, industrial uses (including mining), recreation and habitat for aquatic life (USFS 2008). Forests exert a strong influence on the quantity and quality of water within watersheds by protecting soil and preventing erosion, enhancing soil moisture storage and groundwater recharge, reducing flooding, filtering contaminants and maintaining the plant communities that also contribute to this process (CSFS 2009). Most of the watersheds within the project area are designated in the Colorado Statewide Forest Resource Assessment as a high priority for drinking water and as high risk for post-fire soil erosion (CSFS 2009). High-severity forest fires impact soils and hydrological integrity by removing the protective layer of leaves, branches, and needles thereby increasing surface runoff and increased peak flows during heavy precipitation events (CSFS 2009). Increases in peak flows and erosion can mobilize large amounts of sediment and debris that can affect water quality and negatively impact hydrological infrastructure.

The US Forest Service completed an assessment of all 6th Level watersheds on National Forests in 2010. Several watersheds within the project area were re-assessed and ratings updated after the 2012 Waldo Canyon wildfire. Ratings utilized the 2010 Forest Service Watershed Condition Classification Technical Guide, which is available at:

http://fsweb.wo.fs.fed.us/wfw/watershed/classification/watershed_classification_guide-oct-25-2010.pdf

Watershed condition classification is the process of describing watershed condition in terms of discrete classes that reflect the level of watershed health or integrity. The Forest Service Manual uses three classes to describe watershed condition:

- Class 1 – **Functioning Properly** - watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition.
- Class 2 – **Functioning at Risk** - watersheds exhibit moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition.
- Class 3 – **Impaired Function** - watersheds exhibit low geomorphic, hydrologic, and biotic integrity relative to their natural potential condition.

The 2010 and post-Waldo Canyon Fire assessments document the overall function of each watershed, with the condition of each watershed rated as Properly Functioning, Functioning at Risk, or Impaired Function. The watersheds are also given ratings for 12 condition indicators by an interdisciplinary team of forest resource specialists (Table 26). The existing conditions classes for each of the analyzed UMC project area watersheds are listed in Table 28. Indicators and attributes for each watershed can be viewed in the Appendix. The UMC Ecological Restoration Project list of proposed actions are expected to reduce the overall risks to water quality, aquatic habitat, riparian/wetland vegetation, roads/trails, and soils in response to high severity fire. Collectively these actions expected to promote improvements in overall forest and watershed health.

Table 27. Watershed condition indicators.

AQUATIC PHYSICAL INDICATORS	
1. Water Quality	This indicator addresses the expressed alteration of physical, chemical, and biological components of water quality.

2. Water Quantity	This indicator addresses changes to the natural flow regime with respect to the magnitude, duration, or timing of the natural stream flow hydrograph.
3. Aquatic Habitat	This indicator addresses aquatic habitat condition with respect to habitat fragmentation, large woody debris, and channel shape and function.
AQUATIC BIOLOGICAL INDICATORS	
4. Aquatic Biota	This indicator addresses the distribution, structure, and density of native and introduced aquatic fauna.
5. Riparian/Wetland Vegetation	This indicator addresses the function and condition of riparian vegetation along streams, water bodies, and wetlands.
TERRESTRIAL PHYSICAL INDICATORS	
6. Roads and Trails	This indicator addresses changes to the hydrologic and sediment regimes due to the density, location, distribution, and maintenance of the road and trail network.
7. Soils	This indicator addresses alteration to the natural soil condition, including productivity, erosion, and chemical contamination.
TERRESTRIAL BIOLOGICAL INDICATORS	
8. Fire Regime or Wildfire	This indicator addresses the potential for altered hydrologic and sediment regimes due to departures from historical ranges of variability in vegetation, fuel composition, fire frequency, fire severity, and fire pattern.
9. Forest Cover	This indicator addresses the potential for altered hydrologic and sediment regimes due to the loss of forest cover on forest land.
10. Rangeland Vegetation	This indicator addresses impacts to soil and water relative to the vegetative health of rangelands.
11. Terrestrial Invasive Species	This indicator addresses potential impacts to soil, vegetation, and water resources due to terrestrial invasive species (including vertebrates, invertebrates, and plants).
12. Forest Health	This indicator addresses forest mortality impacts to hydrologic and soil function due to major invasive and native forest pest insect and disease outbreaks and air pollution.

Figure 14 lists all the watersheds in and around the project area. Four watersheds would be minimally impacted by the proposed action, with less than 1% of the watersheds falling within the project analysis boundary. Therefore, these watersheds are not included for further analysis. Two additional watersheds are excluded from the affected environment because the Waldo Canyon Fire burned through most of these

watersheds thus eliminating the need for vegetation treatment as part of this analysis. The excluded watersheds are Bear Creek, Headwaters Fountain Creek, Headwaters Trout Creek, Carpenter Creek, Lower Monument Creek, and Garden of the Gods. Table 28 identifies the watersheds included in the project analysis area. The West Monument Creek and Upper Monument Creek watersheds are particularly critical as they are sources of municipal drinking water for Colorado Springs and Palmer Lake respectively. Colorado Springs Utilities also has a pipeline supply network from the West Monument Creek watershed to feed the Rampart Reservoir in the southwest corner of the project area. This reservoir provides up to 80 percent of Colorado Springs drinking water at any given time. The Waldo Canyon Fire burned a significant portion of the West Monument Creek watershed contributing to the impaired hydrological function of this landscape.

Table 28. Upper Monument Creek Project Area watershed condition class – Included Watersheds.

6th Level - Watershed	HUC 12	Acres	% Within Project Area	Watershed Condition Class	Status
Beaver Creek	110200030101	17060.3	84	1.4	Functioning Properly
Horse Creek-Trout Creek	101900020105	32001.0	21	2.5	Impaired Function
Middle Monument Creek	110200030105	36143.3	11	1.4	Functioning Properly
Upper East Plum Creek	101900020502	18942.4	12	1.5	Functioning Properly
Upper Monument Creek	110200030102	27573.6	60	1.6	Functioning Properly
West Monument Creek	110200030103	15064.7	85	2.4	Impaired Function
Headwaters West Plum Creek	101900020602	22113.0	8	1.5	Functioning Properly
Long Gulch-Trout Creek	101900020103	28086.0	15	2.3	Impaired Function

Existing Conditions by 6th Level Watershed

Watershed existing condition is detailed below and is further summarized in the Appendix.

Beaver Creek Watershed Existing Conditions

The Beaver Creek sixth level watershed is 17,060 acres. Beaver Creek is a perennial stream that runs through this watershed. It has a number of small tributaries including North Beaver Creek, South Beaver Creek and Hell Creek joining to form Beaver Creek as it flows east from the Rampart Range divide down towards I-25 and the confluence with Monument Creek. The Beaver Creek watershed is in the Arkansas River Basin. 83.9% of the watershed (14,308 acres) is within the project analysis area. There are 38.73 miles of road in the watershed. Elevations range from about 6,900 near Monument to 9,270 feet at the top of the watershed near Rampart Range Road. The proposed treatment polygons are in the upper and central parts of the watershed.

The Beaver Creek watershed condition class was rated as Category 1.4 – Functioning Properly (Forest Service, 2010). Aquatic Biota is classified as having impaired function.

Horse Creek-Trout Creek Watershed Existing Conditions

The Horse Creek – Trout Creek sixth level watershed is 32,001 acres. Within this watershed, Trout Creek is a perennial stream with a number of small tributaries joining the river as it flows from Woodland Park towards Deckers along State Highway 67 north. The Horse Creek-Trout Creek watershed is in the South Platte River Basin. As Trout Creek flows north, the name changes to Horse Creek at the confluence with West Creek. 21% of the watershed (6,707 acres) is within the project analysis area. There are 27.22 miles of road in the watershed. Elevations range from about 7,700 feet near Rainbow Falls to 6,800 feet at the confluence with West Creek. The proposed treatment polygons are in the south east portion of the watershed near Rampart Range Road and Rainbow Falls recreation area.

The Horse Creek – Trout Creek watershed condition class was rated as Category 2.5 – Impaired Function. Water Quality, Aquatic Habitat, Aquatic Biota, Riparian Vegetation, Soil, Rangeland and Terrestrial Invasive Species are all classified as having impaired function.

Middle Monument Creek Watershed Existing Conditions

Middle Monument Creek sixth level watershed is 36,143 acres. Within this watershed Monument Creek is a perennial stream located east of USFS managed lands. Goat Camp Creek and Deadmans Creek are tributaries to Monument Creek in the Middle Monument Creek watershed. The Middle Monument Creek watershed is in the Arkansas River Basin 10.9% of the watershed (3948.8 acres) is within the project analysis area. There are 3.62 miles of road in the watershed. Elevations range from about 7,100 feet at the US Air Force Academy to 9,200 feet at the headwaters. The proposed treatment polygons are in the upper portion of the watershed near Rampart Range Road.

The Middle Monument Creek watershed condition class was rated as Category 1.4 – Functioning Properly. Aquatic Biota and Fire Effects & Regime are classified as impaired function.

Upper East Plum Creek Watershed Existing Conditions

Upper East Plum Creek sixth level watershed is 18,942 acres. Within this watershed, East Plum Creek is a perennial stream that runs through Stone Canyon and joins up with Cook Creek southwest of Larkspur. The Upper East Plum Creek watershed is in the South Platte River Basin and the river flows north into Chatfield Reservoir. 12.4% of the watershed (2,344 acres) is within the project analysis area. There are 13.53 miles of road in the watershed. Elevations range from about 6,659 at Larkspur to 9,200 feet near Saylor Park. The proposed treatment polygons are in the upper portion of the watershed near Rampart Range Road.

The Upper East Plum Creek watershed condition class was rated as Category 1.5 – Functioning Properly. Aquatic Biota is classified as impaired function.

Upper Monument Creek Watershed Existing Conditions

Upper Monument Creek sixth level watershed is 27,573 acres. Within the watershed, Monument Creek is a perennial, municipal water supply stream that runs through the watershed with a number of tributaries, including North Monument and Ice Cave Creek, joining the river as it flows east from Rampart Range down to Palmer Lake and Monument. The municipal water supply reservoir is west of the Town of Palmer Lake. The main-stem of Monument Creek continues south from Monument to Colorado Springs along Interstate Highway 25. The Upper Monument Creek watershed is in the Arkansas River Basin. 60.7% of the watershed (16,734 acres) is within the project analysis area. There are 34.42 miles of road in the watershed. Elevations range from about 6,975 near Monument to 9,400 feet at Rampart Range Road. On US Forest Service managed lands the proposed treatment polygons are in the upper portion of the watershed near Rampart Range Road. Adjacent to this area are proposed treatments on US Air Force property, in the central portion of the watershed.

The Upper Monument Creek watershed condition class was rated as Category 1.6 – Functioning Properly. Aquatic Biota, Fire Effects & Regime and Terrestrial Invasive Species are all classified as impaired function.

West Monument Creek Watershed Existing Conditions

West Monument Creek sixth level watershed is 15,064 acres. Within this watershed, West Monument Creek is a perennial, municipal water supply stream that runs through the watershed. There are a number of small ephemeral tributaries originating in Northfield Gulch, Devil's Kitchen and Blodgett Peak joining the stream as it flows from Monument to Colorado Springs along Interstate Highway 25. The Beaver Creek watershed is in the Arkansas River Basin. 85.5% of the watershed (12,874 acres) is within the project analysis area. There are 27.66 miles of road in the watershed. Elevations range from about 6,900 at the US Air Force Academy to 9,400 feet at the Rampart Range dividing road. The proposed treatment polygons are in the upper portion of the watershed near Rampart Range Road.

The West Monument Creek watershed condition class was rated as Category 2.4 – Impaired Function, reflecting the impact of the 2012 Waldo Canyon Fire. (Forest Service, 2010 updated). Aquatic Biota, Fire Effects & Regime and Terrestrial Invasive Species are all classified as impaired function.

Headwaters West Plum Creek Existing Conditions

Headwaters West Plum Creek sixth level watershed is 22,113 acres. Within the watershed, Stark and Gove Creeks are perennial flowing streams. The Headwaters West Plum Creek watershed is in the South Platte River Basin and flows north to the confluence with East Plum Creek and into Chatfield Reservoir municipal water supply. 8.1% of the watershed (1799.8 acres) is within the project analysis area. Most of the US Forest Service managed lands in this watershed are in the roadless management area.

The Headwaters West Plum Creek watershed condition class was rated as Category 1.5 – Impaired Function. Aquatic Biota, Fire Effects & Regime and Terrestrial Invasive Species are all classified as impaired function.

Long Gulch-Trout Creek Watershed Existing Conditions

Long Gulch - Trout Creek sixth level watershed is 28,806 acres. Within the watershed, Trout Creek is a perennial stream that runs through the watershed with a number of small tributaries joining the river as it flows from Woodland Park towards Deckers along State Highway 67 north including Long Gulch, Ryan Gulch, Quinlan Gulch, Johns Gulch and Hotel Gulch. 15.2% of the watershed (4,255 acres) is within the project analysis area. There are 11.83 miles of road in the watershed. Elevations range from about 7,700 feet near Rainbow Falls to 8,400 feet at the headwaters of Ryan Gulch. The proposed treatment polygons are in the upper portion of the watershed near Rampart Range Road.

The Long Gulch - Trout Creek watershed condition class was rated as Category 2.3 – Impaired Function. Water Quality, Aquatic Habitat, Aquatic Biota and Riparian Vegetation are all classified as impaired function.

The Town of Palmer Lake Watershed is approximately 10,425 acres and located mainly within the project boundary on National Forest managed lands. Proposed actions will comply with relevant laws, regulations, and policies including the cooperative agreement for the purpose of conserving and protecting the water supply of Palmer Lake, the City of Monument, the City of Colorado Springs and all relevant water supplies.

Soils

Research reports, consultant reports, field reconnaissance, Natural Resource Conservation Service (NRCS) soil surveys, and GIS analysis were utilized to determine existing soil resources and condition in the Upper Monument Creek project analysis area. Soils within the Upper Monument Creek Project Area are derived mostly from decomposed granite parent material. The parent rock is deeply weathered Pikes Peak Granite composed of large crystals. These large crystals then form a mass of coarse-grained material

with little clay to serve as binding material or as exchange medium for soil nutrients. These soil particles are highly erodible and may be relatively unproductive due to a lack of soil nutrients.

The analysis area is largely characterized by rocky, shallow, coarse textured decomposing Pikes Peak granite with thin organic layers. These soils are particularly vulnerable to rill and gully erosion, if protective ground cover is removed. Exposed surface area (bare ground) and a lack of vegetation leads to accelerated drainage flows with increased stream power. Erosion potential is higher on steep slopes and adjacent to less permeable surfaces such as rock outcrops or roads, trails, and travelways.

Fifteen percent of the analysis area lies on <10% slope, twenty-seven percent lies on 10-20 % slopes, twenty-four percent lies on 20-30% slopes, fifteen percent lies on 30-40%, and twenty percent lies on >40% slopes (Table 29).

Table 29. Slopes within the UMC Project Area.

Slope %	0 – 10%	10 – 20%	20 – 30%	30 – 40%	>40%
Project Area %	15%	26%	24%	15%	20%

Generally rocky, coarse textured soils are not susceptible to deep compaction except on heavily used travelways. Studies have found that these decomposed, granitic soils maintain high infiltration rates even when used for skid trails (Libohova 2004). However, existing National Forest System and user-created travel ways are heavily compacted due to high use and have low rates of infiltration causing increased surface-water runoff. Soil erosion can occur when surface-water flows over areas with reduced ground cover and where compaction has decreased soil infiltration rates.

Other existing impacts to soil within the UMC project area affecting (or potentially affecting) watershed health include: environmental influences, dispersed shooting areas, dispersed camping, Waldo Canyon burn scar, grazing allotments, mining activities, activities on private inholdings, existing National Forest System travel ways, and Non-system off-road vehicle use.

In general scheduled road maintenance occurs every one to seven years depending on the condition of the road, the assigned maintenance level, and the maintenance priority. Other scheduled maintenance occurs as specific needs are identified. Portions of the existing road system will be used in this project and may require upgrading roads based on safety and resource concerns. Resource concerns were identified during the Travel Analysis Process (TAP) and specific impairments are known to District operations personnel, staff, hydrologists, engineers, and other resource specialists. All roads in the project area were given risk ratings during the TAP process. A rating of 3 (High) was assigned to roads with significant length within the watershed, length within 300’ of a watershed, length within highly erodible soils, or high number of stream crossings. A rating of 2 (Moderate) was assigned to roads where the numbers were lower for: length within watershed, length within 300’ of a stream, length within highly erodible soils, and number of stream crossings. A rating of 0 (Low) was assigned to roads where there were few to no stream crossings, and having low percentage in erodible soils and watersheds. As part of the adaptive management strategy, all high risk roads within a watershed will be reviewed during layout to address site specific concerns including: poor drainage; stream crossings, downcutting or aggrading road ditches; undersized culverts; and storm flows that further degrading the road prism.

Linear features like roads can convert subsurface runoff to surface runoff and then route the surface runoff to stream channels, increasing peak flows. Therefore, watersheds with higher road densities have a higher sensitivity to increases in peak flows following wildfires. Road density in miles of road per square mile of watershed area was used as an indicator of watershed risk in the TAP. Table 30 displays the road density ratings within the analysis area for the Upper Monument Creek watersheds.

Table 30. Road Densities by Watershed.

Watershed Name	Road Density (mi./sq. mi)
Beaver Creek	1.73
Headwaters West Plum Creek	2.46
Horse Creek-Trout Creek	2.60
Long Gulch-Trout Creek	1.78
Middle Monument Creek	0.59
Upper East Plum Creek	3.69
Upper Monument Creek	1.32
West Monument Creek	1.37

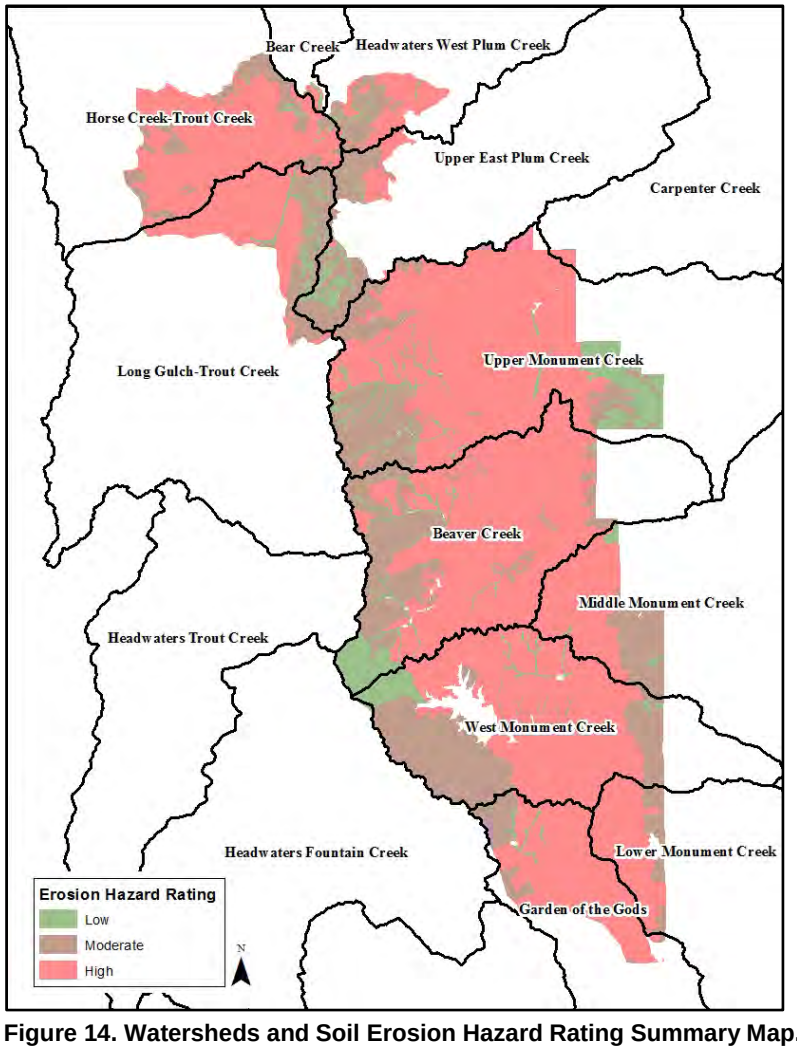


Figure 14. Watersheds and Soil Erosion Hazard Rating Summary Map.

Soil productivity and soil erosion are considered in the Watershed Condition Class framework to have functioning at risk and impaired function condition classes within the project area (see Appendix B). Soil

nutrient and hydrologic processes are considered to have functioning at risk or impaired function conditions for the majority of the project area. Soil condition indicators for each watershed within the project area are summarized in the Appendix.

Erosion hazard ratings were used as a comparative analysis to determine locations vulnerable to erosion. Ratings are based upon slope, soil series (or geology, soil depth, and soil texture) and a climatic stress factor which is a function of mean annual precipitation. An erosion hazard rating is the potential erosion hazard multiplied by the climatic stress factor. Approximately 67.2% of the project is categorized to have a higher erosion hazard rating, 24.8% is categorized to have a moderate rating, and 6.6% has a low rating. The erosion hazard rating is not analyzed for 1.3% of the project area.

Water

There are perennial, intermittent, and ephemeral stream channels throughout the project area (Table 31). Perennial streams flow continuously. Perennial streams are generally associated with a water table in the localities through which they flow. Intermittent or seasonal streams flow only at certain times of the year when they receive water from springs or surface source such as melting snow in mountainous areas. Ephemeral streams flow only in direct response to precipitation, and channels are all times above the water table (Meinzer, 1923).

Monument Creek and Trout Creek are the largest streams in the project area. Using the Rosgen stream channel classification system they are considered C type streams (Rosgen 1994), which are lower gradient, sinuous, fish bearing and have greater stream base flow compared to other streams in the watershed. The other streams in the project area are generally steep gradient, tightly confined ephemeral or intermittent first or second order, Rosgen type A or B streams.

Some ephemeral and intermittent channels in the project area have impaired function due to storm water flow off from adjacent roads and trails. These channels are hydrologically connected to motor vehicle use on system and non-system routes (authorized and unauthorized). Many of the channels have eroded into entrenched gullies with active channel headcutting and lateral bank movement resulting in increased erosion and downstream sediment deposition.

Ephemeral streams are important for hydrological function of watersheds and provide oppurtunities of unique habitats. Streams downcutting into deep gullies have lost their floodplain connectivity and functionality. Without access to the surrounding floodplain, high energy storm flows cause increased down cutting within the confined channel, lateral migration and increased erosion and sediment delivery to downstream perennial streams and water supplies. Additionally downcutting also results in loss of water storage capacity in subsurface soils. This loss in subsurface water storage results in a corresponding loss in riparian vegetation further degrading both the quality of wildlife habitats and the ability of riparian corridors to deal with high surface flows in the future.

The most recent Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List is effective 03/01/2016. Lists are updated regularly therefore, actions within the project area or near the project area can affect the current status of listed or unlisted waters. Currently there are no 2016 303d listings within the project area. Both design criteria and BMPs will be used to avoid any potential impacts to water quality of both listed and nonlisted streams as part of the adaptive management strategies utilized during layout and implementation.

Table 31. Miles of stream (by flow) within each watershed.

6th Level - Watershed	Miles of Perennial within Analysis Area	Miles of Intermittent within Analysis Area	Miles of Ephemeral within Analysis Area
Beaver Creek	20.81	74.42	105.46
Horse Creek-Trout Creek	5.08	38.86	52.24
Long Gulch-Trout Creek	6.65	19.26	24.82
Middle Monument Creek	0.00	15.32	13.11
Upper East Plum Creek	1.82	15.20	20.42
Upper Monument Creek	22.06	98.84	130.53
West Monument Creek	4.42	69.01	76.54
Headwaters West Plum Creek	0.86	12.01	18.32

Additional Considerations

Local landowners, land managers and stakeholders are collaborating with the Forest Service to achieve common goals and desired conditions concerning the UMC project. A few of these land management areas include: the Waldo Canyon Burn Area, Manitou Experimental Forest, United States Air Force, Colorado Springs Utilities, City of Monument (City of Monument Storm Water Protection Plan) and the Town of Palmer Lake (Municipal Watershed). The Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Commission has assigned beneficial or protected uses of the surface waters in the UMC Project Area through Regulation No.31 - The Basic Standards and Methodologies for Surface Water (5 CCR 1002-31). Beneficial uses may include: recreation, water supply, agriculture, industrial uses, and the protection and propagation of fish and wildlife. These beneficial uses are expected to be protected by monitoring water quality standards, applying appropriate design criteria and use of BMPs.

Alternative 1 (No Action): Hydrology and Soils

Direct and Indirect Effects

The UMC landscape contains nine 6th level watersheds (see Figure 14) and with the exception of the West Monument Creek watershed which has been the most heavely altered by the Waldo Burn footprint, the remaining 8 watersheds will remain at risk from large scale high intensity fire events. Within the Upper Monument Creek watershed no treatments will occur around and upstream from critical municipal drinking water sources for the communities of Monument and Palmer Lake. The no action alternative would not provide any oppurtunities to change the way and scale at which fire events move across the landscape under extreme weather conditions.

Alternative 1 (No Action) would have no positive direct or indirect effects on watersheds, soil, or water of the Upper Monument Project Area. No vegetation or adaptive management treatments would be implemented under this alternative. Many of the non-system travel ways and unimproved National Forest System travel ways would remain on the landscape for extended periods and persist as a source of sediment contributing to degraded soil and water conditions. Indirect effects include continued adverse impacts to watershed health, soil, and water; and an increase in forest density over time that would have an increased risk of catastrophic wildfire compared to the existing conditions. The lack of project implementation will increase the probability of catastrophic fire, thus increasing risks to watershed health and soil and water resources.

Cumulative Effects

This section presents the potential cumulative effects of the past, present and future foreseeable actions in the watersheds of the Upper Monument Creek Project Area. Under Alternative 1, there would be no vegetation treatments on National Forest System (NFS) lands in the Upper Monument Creek Project Area. While the recent and on-going vegetation treatments on private lands, near Palmer Lake and Monument within the UMC Project Area would help to reduce stand densities and create a more diverse landscape, NFS lands cover twice the area compared to private lands. Without any treatments on these lands, a large portion of the UMC Project Area would be characterized by relatively dense stands of ponderosa pine and mixed conifer.

The cumulative effect of the past, present and reasonably foreseeable future actions on the condition of the forest vegetation in the UMC Project Area under Alternative 1, would be an area dominated by forest stands that are generally healthy but relatively homogenous in age and structure and increasingly at risk to insects, disease, and catastrophic wildfire. Watershed health and soil and water resources are adversely affected by catastrophic wildfire. The no action alternative is expected to result in cumulative impacts to watershed health and soil and water resources produced by future high intensity wildfires.

The cumulative effect of the past, present and reasonably foreseeable future actions in the UMC Project Area under the No Action Alternative, would be an area with persistent adverse effects precipitated by non-system travel ways and unimproved National Forest System travel ways. Under the No Action Alternative, degradation in the UMC Project Area is expected to continue causing increased resource damage and impaired watershed health.

Alternative 2 (Modified Proposed Action): Hydrology and Soils

Direct and Indirect Effects

Under the proposed action approximately 3,940 acres would be available for treatment within mechanically marginal ground in or adjoing riparian coridors (Table 32). No identified acres of feasible mechanized ground for this ecological system were identified as part of the intial mapping excercise.

Treatments would seek to enhance riparian vegetation by thinning conifer encroachment within aspen clones, cutting or girdling decadent aspen clones to encourage sprouting, reducing the density of understory and mid-story conifers to reduce ladder fuels. Pruning of large dominant overstory trees is desireable to raise the crown base height, and to release large conifers within stream channels from competing vegetation to increase the vigor of these rare features.

Thinning treatments would reduce the overall potential for active crown fire in these areas and would increase the overall vigor of the residual overstory trees. Maintaining and enhancing the aspen component will lower the overall crown fire potential as aspen is inherently less flammable and capable of carrying crown fire when compared to conifers. Regenerating aspen clones in specific locations where clones are decadent or where additional age classes are needed to help perpetuate healthy aspen clones will benefit riparian areas and improve wildlife habitats. Aspen clones provide shade to riparian corridors, strengthen stream banks with root development, serve as sediment and debris filters from upland sites, while providing woody debris that adds to stream channel structure and function.

Reducing the density of understory and mid-story conifers and ladder fuels will reduce the active crown fire potential helping to reduce the risks of high severity fire. Similarly, raising the crown base height of large riparian conifers by pruning will lessen torching potential and limit damages caused by crown scorch from surface fires. By protecting and improving the vigor of large streamside conifers, treatments will maintain important overstory trees to provide shade for riparian areas and will also provide a source of coarse woody debris for stream structure and wildlife habitat as these trees eventually die and fall.

Treatments are anticipated to shift the vegetation class distribution for this ecological system in all classes but the early class. Both the mid- and late-closed classes are expected to have a reductions in canopy cover that will move approximately 50 percent of the existing acreages in these classes into their respective more open classes. In addition treatments within the mid-open class are expected to raise the average diameter of treated areas so that half of these acres will move into the late-open vegetation class.

Table 32. Riparian swale distribution summary.

Class	Early	Mid-closed	Mid-open	Late-open	Late-closed	Total
Treatment acres	16	2,617	935	8	364	3,940
Post treatment	16	1,309	1,776	658	182	3,940

Watersheds

The proposed activities may indirectly benefit water quality by reducing the potential for and extent of high severity wildfires. High intensity wildfires and emergency fire management have the potential to degrade water quality through the removal or modification of vegetative cover in areas know to have highly errosive soils. High intensity fires in these areas is expected to increase runoff and erosion, accelerated nutrient inputs, and allow for the transport of large volumes of sediments to downstream.

Mechanical or hand thinning would be implemented to achieve desired objectives and conditions in wetland and riparian corridors. Removing upland and encroaching species from wetland riparian corridors will improve watershed functionality. Critical riparian areas will also be identified for willow staking/transplanting activities. Willow species collected from local sites will be replanted to help expand or restablish these cover types as dictated by local site conditions. Woody riparian cover types help to buffer flood flows and provide a living response to flood events. Such improvements will result in less erosion, less sediment transport, less habitat damage, and improvements in water quality. Site-specific objectives and treatments will be finalized during project layout. Design criteria will be applied to ensure that sensitive riparian areas important for diversity and wildlife habitat are preserved.

The direct and indirect effects of Alternative 2 (Proposed Action) could, but are not likely to, result in potential increases in peak flows. Recent research findings suggest that in snow zones, thinning less than 40 percent of a watershed would result in only a 14 percent increase in the size of peak flows (Elliot et al. 2010). Increases in peak flows by themselves do not constitute an adverse impact, unless they adversely impact the beneficial uses of a stream which would trigger a violation of the current Forest Plan. None of the watersheds analyzed will receive thinning levels greater than 40%. Consequently, the proposed vegetation management activities are expected to have little effect on the overall increase in peak flows.

The proposed action alternatives would have no adverse impact on floodplains or wetlands as described in Executive Orders 11988 and 11990. Floodplains and wetlands will be protected by applicable of WIZ buffers, application of design criteria, and use of BMPs. Springs, seeps and other wetlands will be excluded from mechanized activities and will be protected by site-specific implementation of BMPs.

Hillslope and Stream Restoration

Ephemeral and intermittent stream channels by their nature do not have perennial stream flows and so do not generally have well established riparian vegetation to help hold and armor stream banks. Care to avoid removing vegetation assisting in holding streambanks together is important for ephemeral drainage floodplain function. Impaired soils and erosion may be stabilized utilizing slash, reseeding, and adding drainage features to reduce concentration of flows. Providing groundcover, establishing native vegetation and reconnecting the floodplain will improve hydrologic function and restore watershed health. Where downcutting is evident and incised channels are restricting floodplain access for storm flows, vertical incised banks may be laid back creating a bankful bench, filling in the channel/gully with native

materials, and other erosion control features maybe necessary to meet desired stabilization objectives. Desired stabilization objectives, including: reducing bare ground; improving stream function; and restoring floodplain connectivity will provide favorable conditions for downstream wetland and riparian vegetation cover types. Site-specific activities will be identified during layout phases in order to ensure appropriate design and restoration objectives are met.

The overall goal of this restoration is to restore and stabilize site conditions while providing favorable conditions for downstream wetland and riparian vegetation cover types. Concentrated flow across a hillslope increases energy thereby increasing the potential of active soil erosion. These areas may be hydrologically connected to critical systems such as perennial streams, wetlands, riparian zones, or upland hillslopes. Hillslope derived sediments reaching the stream system can stay staged in the channel for years, causing direct effects to riparian areas and downstream impacts on water quality. The proposed action recommends stabilizing hillslopes and streams that are hydrologically connected to critical systems or that have the potential to impact critical systems. These areas have evidence of erosion and loss of soil productivity. There may be ruts, rills, less vegetation or plant biomass than in adjacent areas. Mitigation for surface erosion provides an increase in ground cover/surface protection, and breaks-up continuous slope length across the bar hillslope, reducing the erosive energy. The proposed mitigation on bare soils will reduce erosion and sediment delivery into critical systems and water supplies. Stabilization of these areas would mitigate hillslope erosion, improve control of soil loss and sediment yield in riparian areas, and have positive impact on downstream water quality.

Soil Stability

Slope and soils are the factors that drive the design criteria for bare ground and openings created for landings, and temporary roads. The proposed action treatment units are limited by the erosive nature of the soils within the project area. Treatment units, temporary roads and landings will be located on lower gradient slopes to reduce risk of sediment transport. Mechanically treatable units were identified on slopes less than 30 percent and mechanically marginal treatments (or hand treatments with chainsaws and tracked masticators) were identified on slopes 30-40 percent. There are currently no areas with average slopes greater than 40 percent that are scheduled for treatment with the UMC project area.

In order to improve watershed health many of the roads in the project area require culvert and storm water drainage improvements. Roads built on erodible soils and with an improperly planned road drainage network can impair the water quality in nearby streams (USDA Forest Service 2001). The effects of road drainage can include an increase in the peak discharge, changes in the shape and timing of the hydrograph, increases in the total discharge, and a decrease in water quality (USDA Forest Service 2001). Roads that are in close proximity to streams and road-stream crossings may cause changes to a stream's hydraulic regime, reduction in water quality, and sedimentation (USDA Forest Service 2001).

Under-sized culverts or bridges can wash out, contributing to erosion and sedimentation at levels detrimental to other aquatic resources (USDA Forest Service 2001). Culvert outlets also concentrate storm water and often gullies are created leading to sediment deposition in riparian areas, sediment aggradation causing a loss of channel capacity, and sediment delivery to perennial streams. Many roads have damage where maintenance berms have limited outflows and caused concentrated flow to damage the fill-slope.

There exists user created roads and trails across the landscape. These roads have not been properly designed to be sustainable to the surrounding environment or included on our Motor Vehicle Use Map (MVUM) system as a safe travel route. These roads will be completely rehabilitated, reducing risk of future sediment transport to streams. These routes will be evaluated and improved. Abandoned roads that have revegetated naturally and are stable would likely not be disturbed.

The transportation system within the floodplain would be managed through road maintenance, use of temporary roads, and seasonal or permanent closures as needed to support public access, proposed forest management activities, wildlife habitat quality, and aquatic habitat connectivity. The majority of road-

related activities would make use of the existing system road network. During project implementation, temporary roads would be constructed, and are to be closed and restored upon completion of treatments.

Vegetation treatment activities, including felling, skidding, decking, transporting of logs off-site, masticating, and slash disposal, can affect soil resources. Potential effects to soil resources include soil compaction and displacement. Soil erosion can occur when rainstorms occur on sites where the ground cover has been removed and the infiltration rate of soils is reduced due to compaction. Ground disturbing activities associated with the proposed action may directly impact soil productivity by displacement, compaction, loss of organic matter, rutting, erosion and loss of soil porosity. Design criteria have been included for vegetation treatments to minimize soil disturbance in Alternative 2 (Proposed Action). Vegetation treatments in alternative 2 are also focused on reducing or avoiding the negative impacts of high intensity fires on soils by modifying forest structure. No new system roads would be constructed, although use of temporary roads will be necessary to allow for logging and other forest management activities.

Given the adaptive nature of this project, site-specitific implementation of BMPs, design criteria, and avoiding disturbances of sensitive soil types and steep slopes will be included as part of project layout and design. Consequently, all project activities considered would be expected to be in full compliance with the Forest Plan. The direct and indirect effects of Alternative 2 (Proposed Action) on soil productivity would be a potential slight decrease in soil productivity in the short term (less than five years) and a potential increase in soil productivity in the long term (greater than five years). Long-term increases in soil productivity could be achieved from the increases in ground cover due to the opening of the forest canopy in treated areas.

Other soil stabilizing activities including the management and improvements to road and trail systems allow for the use of techniques to improve stream crossings, storm water conveyance, culvert function, and other indirect effects associated with roads and trails in the project area. Gullies formed by concentrated flow derived from culvert outlets or large storm events may be stabilized with native rocks, trees and other vegetation. As dictated by site-specific conditions, erosion control features may be included perpendicular to storm flows across the hillslope to help reduce the potential for soil erosion. Non-system and relic routes and trails resulting in impaired soils, bare ground, or concentrated water flows would be stabilized.

Temporary roads will have design criteria added to ensure erosion and soil disturbance is mitigated. Engineers and hydrologist will assist during layout. If designed properly, these routes are relatively stable and will be completely restored after use. Other existing unsustainable user created routes in the project area will be included for restoration as part of the proposed action. Closing of these features would include re-contouring soils to align with the natural hillslope, creating an environment better able to support native vegetation, laying down slash, erosion control features, and adding drainage features to reconnect floodplains.

The combination of proposed road improvements and reduction in the number of legacy roads and trails are intended to minimize road-related erosion as a whole. Other improvements, such as culvert replacements, ditch clean outs, and surface re-contouring are also expected to have positive effects on reducing sediment yield. Improving the structure, stability and drainage of haul roads is expected to mitigate most of the erosion potential.

Cumulative Effects

Watershed cumulative effects from sediment are an important concern in managed watersheds (Megahan and Hornbeck 2000). Sediments that reach the stream system can stay in the channel for years and create instream sediment sources that may have impacts at the site and downstream. Riparian vegetation provides a wide variety of benefits to stream systems, including providing shade to control stream temperature, root strength to maintain stream banks, and input of nutrients that form the base of many aquatic food webs (Bisson et al. 1987). Riparian areas can also serve as filters for increased sediment

generated upslope. Stream buffers have been shown to be very effective in moderating cumulative watershed effects (Thomas et al. 1993 and Elliot et al. 2010).

The watersheds within the UMC project area have been identified in need of protection and restoration given concerns for meeting water quality standards and other resource objectives. Increasing land-uses, increased risk to high intensity wildfire, along with other environmental influences have resulted in cumulative impacts and alteration of watershed conditions within the project area.

Since the Hayman Fire, much has been learned about the Pikes Peak Granite and the longevity of the erosion processes following high intensity wildfire events. Based on on going monitoring by Robichaud and others from the US Forest Service Rocky Mountain Research Station (RMRS), there was still evidence of soil erosion and riling after large storm events in undisturbed areas. Incorporating appropriate drainage and other maintenance to existing transportation routes, coupled with use of best management practices in the design of roads and trails in the project area will help to generate positive cumulative effects on watershed and stream conditions by reducing levels of erosion and sediment loads. No additional road density will be added as a result of this decision, while several user created trails and roads will be rehabilitated.

The Waldo Canyon Fire occurred within the UMC project area in 2012, resulting in severe soil erosion, sedimentation, and deposition. Adverse impacts resulting from the wildfire affected streams, reservoirs, and water supply infrastructure. Mitigation work focused on curbing these adverse impacts is an on-going effort that will likely continue until natural recovery is fully established. The acres burned are within the project boundary, but are not included within treatment units of the project. The continuing restoration activities within the burn are expected to have long-term positive cumulative effects within and downstream from the Upper Monument Creek project area.

Buffers, transportation system management and other mitigations will reduce sedimentation into drainages. Rehabilitation of landings, skid trails and temporary roads can be effective. The efforts made to close off and rehabilitate illegal hill climbs and other illegal off highway vehicle (OHV) activity, and to improve system roads in the project area helps to improve the cumulative effects on watershed health. The cumulative effects should be a positive gain both in the short term and long term.

Project design criteria and associated BMPs for road obliteration and decommissioning would reduce the risk of sediment entering stream courses. The impacts to water quality caused by sedimentation due to temporary road construction, reconstruction, maintenance, or road decommissioning, if any, would be short-term and undetectable at the watershed scale. Any short term increases in sediment is expected to be negligible in comparison to the elevated sediment transport following a catastrophic wildfire.

Best management practices, monitoring and adaptive management will be implemented to minimize the probability of degrading waters within the planning area or downstream. Any effects would by short lived and only detectable at the site scale. Best Management Practice monitoring will help determine if sediment delivery is occurring necessitating a change in project implementation strategies.

At a landscape scale, significant surface erosion may result in the event of a large scale naturally occurring disturbances like high intensity wildfires and large storm events. When fully implemented the treatments proposed in Alternative 2 will help to mitigate some of this risk by restoring or altering stand structure and species composition in ways the help reduce the intensity and scale of future landscape level disturbances that would subsequently increase surface erosion and mass wasting potential.

Wildlife

The diverse mix of vegetative and non-vegetative cover within the UMC project area is reflective of the varied geography, geologic formation, soils, elevation, aspect, and hydrology found throughout the landscape. These environmental conditions provide diverse habitat types that support an assortment of wildlife species, including those that are of special management emphasis or concern. The project area is

commonly occupied by mammalian species such as black bear, cougar, bobcat, coyote, mule deer, elk, bighorn sheep, porcupine, red fox, gray fox, striped skunk, raccoon, mountain cottontail, weasels, Abert's squirrel, pine squirrel, golden-mantled ground squirrel, chipmunk, northern pocket gopher, and various mice, voles, and shrews. A variety of bat species may inhabit the montane habitats within the project area as well. These include the fringed myotis, hoary bat, little brown myotis, western long-eared myotis, long-legged myotis, and silver-haired bat. Birds that occupy the project area seasonally or year-round exceeds one hundred species. Common species include the mountain chickadee, pygmy nuthatch, white-breasted nuthatch, brown creeper, northern flicker, hairy woodpecker, gray jay, Steller's jay, American robin, dark-eyed junco, common raven, pine siskin, mountain bluebird, house wren, yellow-rumped warbler, Violet-green swallow, common raven, common crow, black-billed magpie, dusky grouse, mourning dove, and wild turkey. A variety of raptors may also nest within the project area. Species that inhabit the forested habitats include the flammulated owl, northern saw-whet owl, great horned owl, long-eared owl, northern goshawk, Cooper's hawk, and sharp-shinned hawk. Raptors associated with rock outcrops or canyon environments include the golden eagle, peregrine falcon, and prairie falcon. The fringed myotis, hoary bat, olive-sided flycatcher, flammulated owl, northern goshawk, and peregrine falcon are designated as sensitive by the Regional Forester in Region 2 of the USDA Forest Service. The project area also contains habitats types that are occupied or support the federally threatened Preble's meadow jumping mouse and Mexican spotted owl.

Wildlife Habitat

A variety of species are dependent on forested ecosystems to fulfill requirements for foraging, rest, cover, and reproduction. However, habitat quality for a variety of wildlife species is degraded across the UMC landscape as forest conditions have departed from the natural range of variability. Habitat quality is particularly reduced for species requiring habitat elements found in forests containing spatial heterogeneity in the form of mosaics of individual trees, tree clumps, and openings, and a greater proportion of early seral or older vegetation classes. The mountain bluebird, Williamson's sapsucker, Lewis's woodpecker, golden-crowned kinglet, olive-sided flycatcher, flammulated owl, wild turkey, hoary bat, silver-haired bat, Abert's squirrel, mountain cottontail, mule deer, elk, and bighorn sheep are some of the species affected by this departure from NRV.

The resiliency of the UMC landscape to the effects of largescale disturbances is also reduced. Under existing conditions, forested stands in the project area are at increased risk of disturbance events, such as wildfire and insect and disease infestation. Fire suppression, even-aged vegetation management, or the absence of forest manipulation, have produced and perpetuated these forest conditions. Dense, closed canopy forest and corresponding lack of open forest conditions has created continuous, fairly uniform canopy conditions. High stem density has reduced the vigor of trees, and structure and distribution predispose stands to insect and disease outbreaks. Stands are also at risk of sustained crown fire over large areas due to canopy continuity. These disturbance events may result in the widespread loss of key habitat elements for species in the UMC landscape that are federally listed, such as the Mexican spotted owl and Preble's meadow jumping mouse, or Region 2 sensitive, such as the northern goshawk, flammulated owl, and hoary bat.

Snags, Partially Dead Trees, and Coarse Woody Debris

Snags, live trees with snag-like features, and downed woody debris are important structural components in coniferous forest communities, providing a variety of species habitat requirements (multiple sources in Finch et al. 1997). These features provide substrate or sites for nest cavities, nest platforms, perching, feeding, plucking posts, singing or drumming, food caches, courtship, overwintering, roosting, lookout posts, hunting and hawking, fledgling, dwellings or dens, nesting under bark, communal nesting or nursery colonies, and thermal regulation (Mannan et al. 2004). Many wildlife species are cavity dependent or use cavities for various life functions. Cavities created by primary excavators, such as the northern flicker, yellow-bellied sapsucker, Lewis's woodpecker, Williamson's sapsucker, red-naped sapsucker, hairy woodpecker, and downy woodpecker, are often used by secondary cavity nesters, including bluebirds, swallows, nuthatches, chickadees, wrens, squirrels, and owls. Natural cavities and

those constructed by primary excavators in snags provide thermally-regulated sites for nesting and overwintering, as well as roost sites during inclement weather events (Neitro et al. 1985). Live trees with snag-like features, such as hollow trunks, excavated cavities, and dead branches also provide similar wildlife value. The external surface of the bark, the cambium layer, and the heartwood of snags is also used extensively as foraging substrate by birds and mammals (Neitro et al. 1985).

Species of wildlife that frequently use snags are selective as to size, decomposition stage, and the abundance of snags. The lower montane forests of the UMC project area contain fewer large snags than desired, with the exception of areas impacted by insect and disease outbreaks and wildfire. For instance, the Waldo Canyon Fire resulted in the creation of snags over most of the 18,000 acre burned area, but these features are concentrated in the southern portion of the UMC project area. This wildfire event also caused stress and damage to residual trees that may become snags over time, and eventually a source of coarse woody debris.

Dead woody material on the ground, especially large logs, serve an ecological function of storing energy and nutrients, nitrogen fixation, providing microclimate conditions for regeneration, and stabilizing soils (Maser and Trappe 1984; Mannan et al. 2004). These features are also an essential habitat component for numerous wildlife species, by harboring invertebrates for foraging woodpeckers, and providing sites for reproduction, foraging, and cover for mammals, amphibians, and reptiles (Smith 2000; Mannan et al. 2004). The quantity of large down logs per acre in the project area has not been estimated. However, existing insect and disease caused mortality has and will continue to increase the rate of occurrence of these features, especially in areas with mesic conditions and dense, uneven-aged and multi-storied stands.

Forest Openings

Forest openings are created by disturbances such as wind, fire, insects or diseases and can be a variety of ages and sizes throughout the forest (Shure and Phillips 1991). The frequency, size and severity of disturbance varies among patches, which creates a community structure with a high diversity of both flora and fauna species (Bucker and Shure 1985). Plant productivity and vegetation community structure often vary depending on the size of the opening since larger patches receive more light, moisture, and possibly even nutrients than smaller patches (Denslow 1980). As a result, wildlife populations may also vary depending on different patch sizes.

In the UMC project area, fire suppression has reduced landscape richness and patchiness, resulting in high homogeneity and an increased potential for more severe wildfires. Fire exclusion has allowed fuels to accumulate on the ground (Baron 2002). The increasing density of forest vegetation creates conditions that are more likely to support high intensity wildlife along with crown fire activity (Baron 2002). The low severity fires that once created and maintained small scale canopy openings are now unlikely to occur in the UMC landscape. Due to the absence of disturbance events, natural openings such as meadows are also being reduced due to tree encroachment, which consequently results in a loss of habitat diversity.

Ideally, the UMC landscape would have small and large openings in the forest canopy of various shapes and sizes. These forest openings can act as fuel breaks in the event of a fire, reduce the risk of crown fire, increase edge habitat, and improve habitat connectivity for a variety of species. For example, the succession of piñon-juniper forests have decreased the amount of available forage and visibility for bighorn sheep, which may be a major factor limiting their distribution (Stiver 2014). The creation of small openings may provide essential habitat that sheep can use as escape terrain and movement corridors between lambing areas.

Forest openings are valuable to many other species that occur in the UMC project area. Wild turkey often use this habitat year-round for feeding and during spring for breeding (Hoffman et al 1993). Northern goshawks have been observed nesting close to forest openings such as meadows and forest clearings, and have also been seen hunting in openings and along edges (Reynolds et al 1982; Shuster 1980). Some bat species such as the little brown bat (*Myotis lucifugus)* use the edges of forest openings as they offer some protection from predators along with easy maneuverability for foraging (Patriquin and Barclay 2003).

Forest openings typically have higher forage production than areas with dense canopy cover, providing better foraging habitat for species such as deer and elk (Lyon and Christensen 2002).

Small forest openings contribute to the structural heterogeneity of forests and may influence the composition and richness of various species. Loss of these openings may result in conditions that support large crown fires and could have profound negative effects on forest vegetation, wildlife, and even personal property.

Riparian Areas

Riparian areas are diverse ecological systems with vigorous plant growth and high species diversity. These areas are distributed throughout the UMC project area and are typically found between draws and in valley bottoms bounded by upland forests. Riparian areas and the associated vegetation serve an important ecological function in watershed health by filtering upland sedimentation, buffering the overland flow of water, and providing hydrological input into larger stream classes. The vegetation within riparian areas is highly variable and can range from nearly pure even-aged aspen stands to conditions and structures that closely mimic uneven-aged mesic mixed conifer forests. Trees are typically larger than surrounding upland sites due to the alluvial soils and mesic conditions that characterize these areas. The enhanced growing conditions can also support greater tree densities, with two to three distinct canopy classes, than more upland sites.

Riparian areas make up a small proportion of the cover within the project area, but contain vegetation and the structural diversity that are of high value to wildlife. These sites contain an abundance and variety of food sources, free standing water, nesting substrate, and refuge for a variety of species. Riparian areas also provide habitat connectivity and are utilized by wildlife as migration or dispersal corridors (Hoover and Willis 1987; WDFD; O'Connell….). Riparian vegetation also provides cover, large woody material for recruitment, and nutrients for aquatic and terrestrial fish food organisms. These areas are a component of functioning aquatic ecosystems that provide for the maintenance of current and future sources of woody material, intact riparian vegetation communities, and functional ecological processes of temperature (water, air, and soil) regulation, and buffer strip functioning.

The mesic conditions that typify riparian areas do not tend to favor frequent low intensity fire events. The productive soil conditions, capacity of maintaining high levels of tree density, and typically infrequent fire return intervals means that fuel loadings in these areas can be relatively high under normal conditions. These conditions make these areas are prone to infrequent, high intensity fires with variable burn severity. These fires tend to originate in upland sites and can carry into wetter riparian sites during optimum burning conditions and/or during extended drought periods when riparian areas are much drier than normal.

Aspen Stands

Occupying moist, nutrient-rich sites, aspen stands have very high biodiversity, exceeded only by riparian zones (White et al 1998). Aspen dominated communities are of major importance to ecosystem function, forage production, and biodiversity. When functioning properly, they provide forage and habitat for wildlife, water, esthetics, recreational sites, and landscape diversity. When not functioning properly, many of these values are compromised and can result in conifer encroachment, loss of understory vegetation, and decline of forage production (Bartos 2000). In the UMC project area, aspen stands are in decline and many are not functioning at their full potential.

Historically found in early seral stages and forest openings, aspen is a disturbance-dependent species that is well adapted to frequent fire regimes. At higher elevations, aspen would have dominated historical forest openings, but fire suppression has allowed conifers to encroach on aspen stands, ultimately outcompeting and replacing the aspen (Stam et al 2008). With fire, aspen stems die within 1-5 years, but the root system typically remains unharmed and responds by producing prolific suckers within the first growing season after the fire (Romme et al…..). Aside from stimulating suckering, fire also increases understory production of grasses and forbs and removes competing overstory and seedling conifers

(Shepperd 2001). In addition to disturbance, aspen also require direct sunlight as they cannot survive or reproduce under the shade of competing vegetation, which becomes an issue with the progressive encroachment of conifers (Stam et al 2008).

Fire suppression in the UMC project area has led to a combination of these factors resulting in the decline of aspen stand structure and function across the landscape. With the lack of fire, there is little disturbance to stimulate suckering, which results in very few aspen being produced each year. In the absence of disturbance, coniferous species frequently establish, outcompete the aspens, and ultimately dominate the site. The subsequent shade from the coniferous species also prevents aspen suckers from successfully establishing and the stand is unable to regenerate. As a result, the age structure of aspen stands has shifted towards an increasing prevalence of older, even aged stands, which are more susceptible to disease and mortality.

A concern across Colorado is the increase in diseased aspen, termed sudden aspen decline (SAD). The causes of SAD are not well known but are likely related to drought and secondary disease and insect factors. Approximately 541,600 acres of dead and dying aspen were documented in Colorado in 2008 (Colorado State Forest Service 2011). Fortunately, the areas affected by SAD have gotten progressively smaller each year since 2008. However, should the right conditions occur, potential for SAD still exists.

An additional issue regarding aspen in the UMC project area is over-browsing by ungulates. Deer and elk foraging in these stands cause significant browsing injuries to aspen suckers and small saplings. Intense, chronic browsing on aspen suckers by wildlife has also suppressed or eliminated regeneration in aspen stands thereby reducing aspen ecosystem resilience (Seager et al 2013). Browsed stems may also become infected with *cytosproa* canker and die (Shepperd 2004). While intense browsing can be detrimental to aspen stands, the aspen community type undoubtedly has very high value for native ungulates as well as other species.

Some aspen community types with tall shrubs, large aspen regeneration and a high percentage of crown closure provide hiding cover to ungulates during late spring, summer and early fall while also offering summer thermal cover (Powell 2008). Dense understories within aspen stands are also preferred by elk and deer for calving and fawning areas especially when located near water. These sites are also used as wallows by black bear and elk when surface water is available. Black bears also tend to den in aspen or aspen mixed stands because of the abundance of berries that can be found in the deciduous forested uplands (DeByle 1985; Tietje and Ruff 1980). Most beaver colonies in the Rocky Mountain area are found on streams that flow through or adjacent to aspen. Beaver often prefer aspen over willow as their source of food and construction material for dams and lodges (DeByle 1985; Packard 1942).

Other small mammals such as rabbits, pocket gophers, shrews, mice, voles, squirrels, and chipmunks also benefit from aspen stands. During summer months, snowshoe hares and cottontail rabbits rely on aspen and the accompanying understory for foraging and cover (DeByle 1985). Pocket gophers rely on aspen stands for food and burrowing. Aspen sites are often abundant with vegetation containing forbs and have soils that are well drained and seldom freeze in the winter, creating optimal habitat for pocket gophers (DeByle 1985; Powell 2008). Small rodents like shrews, mice and voles have similar habitat requirements but also rely on seeds found in aspen forests. Some squirrels like the flying squirrel and red squirrel use abandoned sapsucker cavities in aspen (DeByle 1985; Kilham 1971).

Aspen is an important habitat for many bird species often providing food, cover and nesting habitat. Woodpeckers, flickers, and other cavity-nesting birds use the abundant snags provided by white trunk rot as nest cavities. Once these nest sites are abandoned, secondary-cavity nesters like squirrels and other small birds are able to use the cavities for their own benefit (Newton 1994). Sapsuckers and woodpeckers also use the trees for courtship drumming and foraging of insects (Packard 1942). Many birds of prey are also found in aspen stands, however most raptors tend to use the open terrain for hunting purposes rather than nesting (DeByle 1985). However, northern goshawks have been found nesting in widely-spaced mature aspen trees, usually located along streams and drainages (Squires and Ruggiero 1996; Younk and Bechard 1994).

Numerous wildlife species rely on the unique features found in aspen stands including available sites for reproduction, foraging and cover. However, fire suppression, conifer encroachment, and disease have caused a landscape-wide decline in aspen stands and degradation of overall habitat quality. These conditions may result in the loss of key habitat elements for species in the UMC landscape.

Management Indicator Species

Management indicator species (MIS) are identified in the Land and Resource Management Plan for the Pike and San Isabel National Forest (Forest Plan) and the 2005 amendment to the Forest Plan (USDA 1984; USDA 2005). Management indicator species are addressed in order to implement National Forest Management Act (NFMA) regulations. MIS are selected for analysis because their population changes are believed to indicate the effects of management activities, providing insight into the effects of forest management on plant and animal communities. Selected species represent several categories such as commonly hunted or fished species, non-game, and threatened and endangered species. MIS may be used as a tool for assessing changes in specialized habitats, formulating habitat objectives, and establishing standards and guidelines to provide for a diversity of wildlife, fish, and plant habitats. The MIS analyzed for a project are selected based upon their associations with the habitat present in the project area and their suitability as indicators of habitat changes brought about by the proposed alternatives. Subsequent to the 2005 Forest Plan amendment (USDA 2005), the population trends of four MIS are considered for the Pike & San Isabel National Forests: two terrestrial species, Abert's squirrel (*Sciurus aberti*) and Rocky Mountain elk (*Cervus canadensis nelsoni*); and two fish species, greenback cutthroat trout (*Oncorhynchus clarki stomias*) and brook trout (*Salvelinus fontinalis*). For the UMC project, the population trends of the Abert's squirrel and Rocky Mountain elk are considered, while MIS fish species are not addressed due to the absence of occurrence or impacts to these species.

Population Trend and Species Viability

The Abert's squirrel and Rocky Mountain elk range far beyond a project level such as the UMC project area, which represents a small portion (i.e. 3%) of the Pike and San Isabel National Forests. In wide-ranging species, there may be a great deal of fluctuation in population numbers at a site-specific project level. Due to the relatively small scale of the project area, and the potential variability of population numbers in this area, the population level trends and viability of these species are more appropriately addressed at a scale above the project level. For National Forest Management Act implementation, this is at the scale of the Pike and San Isabel National Forest, and is accomplished through PSICC Annual Monitoring Reports.

Habitat Capability Analysis

The Forest Plan recommends that Habitat Capability (HABCAP) analysis is undertaken for projects that may impact MIS. The HABCAP model assumes that the forested habitat is capable of providing optimum habitat for each wildlife species evaluated (Hoover and Wills 1984). HABCAP analysis compares existing habitat conditions with the optimum potential habitat for each MIS. HABCAP is expressed as an index value (HCI) that may be greater than 1.0. However, HCI values above 1.0 are not necessarily desirable, as the value may indicate unsustainable forest structure. The PSICC Forest Plan requires that a minimum HCI threshold is maintained for MIS during management activities. The minimum HCI requirement varies by management prescription (USDA 1984). Management Areas are not usually bound by natural features and HABCAP is only useful at appropriate scales, such as at project level that is greater than 5,000 acres. In order for HABCAP to be evaluated at the project level, a weighted HCI requirement was employed for the entire UMC project area.

HABCAP identifies ecosystems that support part or all of the life history requirements of a species. Each ecosystem is assigned a value based on the capability of providing feeding and cover habitat. Hoover and Wills (1984) provided a suite of values for wildlife in Colorado based on an original vegetation classification scheme and habitat structural stage codes of Region 2 of the Forest Service. These HABCAP values were adapted for the UMC ecological systems and vegetation classes, as shown in Table

33. The Habitat Structural Stages (HSS) in Region 2 were replaced by vegetation classes. These vegetation classes consider the natural range of variability (NRV) in each ecological system (Low 2013). NRV values are based on the historical distribution of successional stages and age classes for a particular ecosystem, and provide an estimate of expected vegetation class distribution across the UMC landscape under a natural disturbance regime.

The NRV values are important in HABCAP analysis for describing long-term sustainable conditions on a landscape scale. An HCI value greater than 1.0 may represent a landscape in an ideal condition for one aspect of the life history requirements of a species, but may also indicate an unsustainable or unhealthy forest condition. For example, Hoover and Wills identify mature ponderosa pine stands with over 70% canopy cover as providing the optimum cover value to Abert's squirrel. This information suggests that the best management strategy for Abert's squirrel is to manage all ponderosa pine stands for dense, mature forest. However, this management strategy does not account for a sustainable, natural forest regime. If all ponderosa pine stands were managed for this condition, stands would be more susceptible to severe stand-replacing fire or insect and disease infestation. By incorporating NRV values into HABCAP analysis, site conditions, natural variability, and appropriate disturbance intervals are considered.

1) The following calculations were performed using a series of Model Builder scripts for ArcGIS 10.2.2 and the revised vegetation classification layer previously described:HABCAP was calculated separately for each species and habitat usage type (i.e. cover, forage, by season):

$$\sum_{(for\ every\ vegetation\ type\ and\ class\ code)} \{[acres] * [usage\ value]\}$$

2) Optimum habitat potential was calculated separately for each species and habitat usage type (i.e. cover, forage, by season):

$$\sum_{(for\ each\ vegetation\ type)} \left\{ [all\ acres\ in\ project\ area] * \sum_{(for\ each\ class\ code)} ([NRV] * [usage\ value]) \right\}$$

3) HABCAP index (HCI) was then calculated for each species and habitat usage type:

$$HCI = \frac{HABCAP}{Habitat\ Potential}$$

Table 33. Values employed in the HABCAP analysis for the Upper Monument Creek project.[3]

Forested Vegetation Systems	Class Code	NRV	Elk Feeding	Elk Cover (Summer)	Elk Cover (Winter)	Abert's Feeding	Abert's Cover
Ponderosa Pine / Douglas-fir Woodland	A	0.1	1	0.2	0.2	0.2	0.2
	B	0.1	0.2	1	0.5	1	1
	C	0.15	0.5	0.5	0.2	0.5	0.5
	D	0.45	0.5	0.5	0.2	1	0.5
	E	0.2	0.2	1	0.5	1	1
Dry-Mexic Montane Mixed Conifer Forest & Woodland	A	0.1	1	0.2	0.2		
	B	0.05	0.2	1	0.5		
	C	0.2	0.5	0.5	0.2		

[3] Forested vegetation systems, vegetation classes (Class Code), and natural range of variability (NRV) were adapted from the Upper Monument Creek Landscape Restoration Initiative landscape modelling (Low 2013). Feeding and cover values were adapted from Hoover and Wills (1984).

	D	0.4	0.5	0.5	0.2		
	E	0.25	0.2	1	0.5		
Mexic Montane Mixed Conifer Forest & Woodland	A	0.1	1	0.5	0.5		
	B	0.25	0.2	1	1		
	C	0.2	0.5	0.5	0.5		
	D	0.15	0.5	0.5	0.5		
	E	0.3	0.2	1	1		
Lodgepole Pine Forest	A	0.2	1	0.2	0.2		
	B	0.2	0.2	1	1		
	C	0.2	0.5	0.5	0.5		
	D	0.3	0.2	1	1		
	E	0.1	0.2	0.5	0.5		
Gambel Oak - Mixed Montane Shrubland	A	0.1	1	0.5	0.2		
	B	0.35	0.5	1	0.5		
	C	0.55	0.2	1	0.5		
Montane Riparian Systems	A	0.1	1	0.2	0.2		
	B	0.25	0.5	1	0.5		
	C	0.65	0.2	1	0.5		
Piñon-Juniper Woodland	A	0.1	1	0.5	0.5		
	B	0.35	0.5	1	1		
	C	0.55	0.2	1	1		

Abert's Squirrel

Figure 15 shows summary datat of permanent plots in potential Abert's squirrel habitat. The y-axis shows the percent of 256 square meter subplots with observed Abert's sign. Permanent plots are separated into those with no recent disturbance and those with recent disturbance (thinnings and/or prescribed burns) within the plot. Permanent plots with recent disturbances within the last ten years (largely thinning treatments, but also prescribed burns) were separated from plots with no notable disturbance. The results indicate that squirrel activity does not seem strongly influenced by recent disturbance. These data indicate stable population trends with highly erratic usage within a plot from year to year.

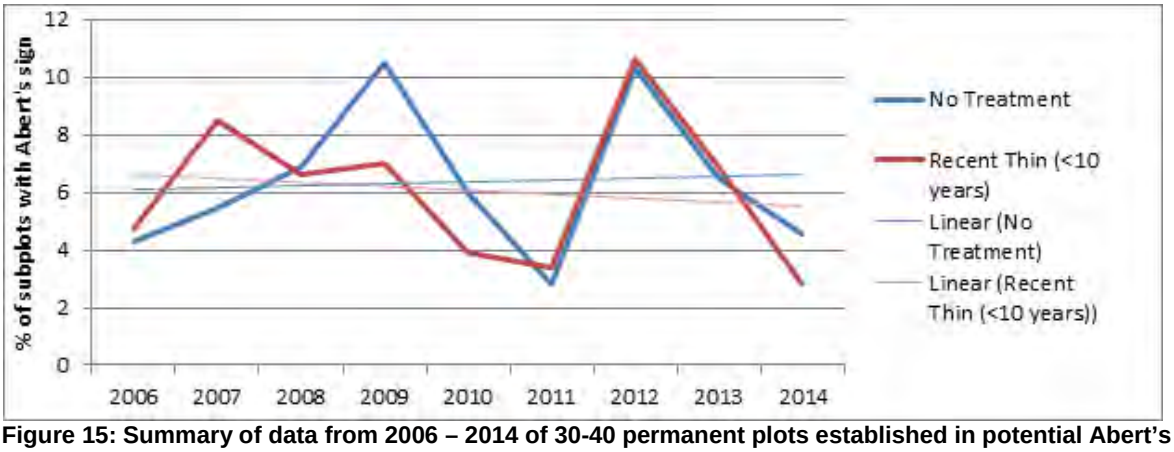


Figure 15: Summary of data from 2006 – 2014 of 30-40 permanent plots established in potential Abert's squirrel habitat.

Rocky Mountain Elk

Current population levels within the E-23 herd are stable, and CPW is in the process of revising the population objectives upward from 1200 individuals to current levels of 2700 to 3300 individuals (Grigg 2012). Threats to the sustainability of current population efforts include high road density, high levels of recreation, and the expansion of undesirable forest conditions. Elk are sensitive to high road densities and

the commensurate recreation pressure, and the Upper Monument Creek project area has a large number of existing system routes as well as non-system routes established by both motorized and non-motorized users.

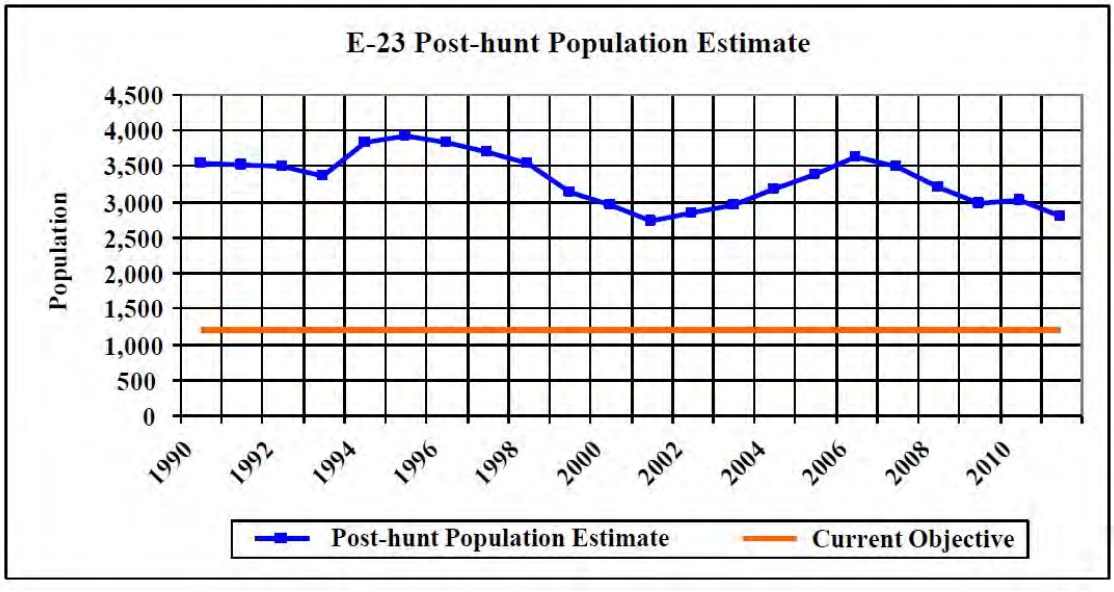


Figure 16: Elk population trend estimates for the E-23 Elevenmile herd, and 2012 objectives.

Alternative 1 (No Action): Wildlife

Direct and Indirect Effects

This alternative would not have any direct effects on wildlife and fisheries resources. However, in the absence of land management, indirect effects to species may occur in the form of habitat degradation or loss. The habitat conditions in the Upper Monument Creek landscape would remain unchanged or continue to develop undesirable characteristics. The density of forest vegetation would continue to be high in many areas, resulting in high levels of competition for nutrients, light, and water, which reduce stand vigor. High levels of shade tolerant conifers would remain on the landscape, with aspen declining from competitive stress and senescence. As tree vigor continues to decline, forest stands would become increasingly susceptible to drought stress, damage and mortality from insects and disease, and would continue to have structural characteristics that facilitate fire movement into the forest canopy.

The quality and extent of foraging habitat for various wildlife species would continue to be limited or in a degraded state as this alternative would perpetuate landscape conditions that are absent of small and large scale forest canopy openings. The low severity fires that once created and maintained small scale canopy openings are unlikely to occur in the UMC landscape due to the existence of high stand densities. Landscape level closed canopy conditions would also perpetuate the elevated risk of large-scale, high-intensity wildfire with sustained crown fire activity. Large openings in the UMC landscape may occur as a result of wildfire events. However, these openings would likely resemble those created by the Hayman (2002) and Waldo Canyon (2012) fires. These fires created openings that were uncharacteristically large, with negative long-term ecological impacts (e.g., loss of wildlife habitat, forest type conversion, etc.).

Cumulative Effects

In the absence of management actions that reduce fuel loads and canopy continuity, or promote a more balanced distribution of vegetation classes, the project area would remain at increased risk of widespread disturbance events, such as insect and disease outbreaks or wildfire. Insect outbreaks may initially increase the risk or severity of a wildfire at a stand level, but this risk would likely decline for several decades as canopy continuity and bulk density are reduced. Wildfire events may have negative effects on

forest vegetation, wildlife habitat, soils, infrastructure, personal property, and municipal watersheds. The effects of wildfire on the UMC landscape would depend on the location and extent of the burn, soil burn severity, and the occurrence of storm events in which rainfall intensity exceeds soil infiltration capacity. Wildfire may remove vegetation that functions to stabilize soils, and may result in extensive erosion and sedimentation. The existence of fine roots in areas with low and moderate soil burn severity would likely aid plant recovery. However, if fire consumes the duff and organic layers of the soil and the mineral soil is exposed, soil infiltration and water storage capacities would be reduced. Intense surface fires also lead to the formation of water-repellant layers in the soil (i.e., hydrophobicity). In areas with high soil burn severity, large areas would be devoid of vegetation and groundcover. The erosion of ash and surface soil during initial storm events would reduce slope roughness by filling depressions above rocks, logs, and remaining vegetation. In steep drainages, large runoff producing storms would likely create increased surface flow volumes and velocities that would transport available sediment from slopes and along channel bottoms.

Vegetation management projects are planned, or have been conducted, on land ownerships adjoining the UMC project area, including private parcels, the City of Colorado Springs, the City of Woodland Park, the United States Air Force Academy, and the Towns of Palmer Lake and Monument. Fire rehabilitation projects (e.g., stream channel and hillslope stabilization) have also occurred on National Forest System (NFS) lands and adjacent land ownerships within or near the Waldo Canyon Fire burned area. Under this alternative, the effectiveness of these fuels reduction and fire rehabilitation projects would be diminished, as these sites are located in proximity to NFS lands where forest conditions that are susceptible to large, high severity wildfire events would persist.

Ongoing and planned vegetation management projects would also continue to be implemented on NFS lands under the Trout West Hazardous Fuels Reduction and Catamount Forest Health and Hazardous Fuels Reduction projects. These projects entail the creation of openings, thinning, prescribed burning, and other fuel reduction treatments on up to about 40,000 acres. However, due to the location of these treatments relative to the project area, a reduction in the risk of disturbance events within the UMC landscape is not anticipated.

Alternative 1 (No Action): Management Indicator Species

Abert's Squirrel Direct and Indirect Effects

This alternative would not have any direct effects on the Abert's squirrel. However, indirect effects to this species may occur in the form of habitat loss and fragmentation as a result of fire suppression and the absence of vegetation management. Pre-treatment HABCAP analysis identifies 13,518 acres of potential cover habitat and 18,127 acres of existing cover habitat, with a HCI of 1.34, for the Abert's squirrel in the UMC project area (Table 34). The vegetation classes 'mid-closed' and 'late-closed' in the ponderosa pine woodland system, with typical canopy closure of 40 to 70%, provide the best cover habitat for Abert's squirrel. However, homogenous pine forests with relatively even age distributions, and an overrepresentation of dense mid-seral forests, cause unsustainable conditions. Before fire suppression became management policy, ponderosa pine forests in the region were characterized by frequent low-intensity surface fires resulting in heterogeneous stands and small openings (Veblen et al. 2000). Presently, mid-seral closed stands (class code 'B') make up about 47% of the ponderosa pine ecological system. Under the expected disturbance regime, the distribution of these stands should account for only 10% of the natural range of variability (Table 2). Although closed stand conditions provide cover for the Abert's squirrel, the disproportionately large percentage of closed stands are at an elevated risk of disturbance events, such as wildfire. The low severity fires that once created and maintained a more sustainable distribution of vegetation classes are unlikely to occur in the UMC project area. Under this alternative, existing stand conditions are predisposed to wildfire events that may result in the alteration in stand structure, or the loss or fragmentation of the forested stands utilized by this species.

Abert's Squirrel Cumulative Effects

At present, an overabundance of dense, closed canopy forest and corresponding lack of open forest conditions has created continuous, fairly uniform canopy conditions in the project area. These stands, being homogenous in structure, are not high quality habitat for the Abert's squirrel (Keith 2003, p.27). In addition, high stem density has reduced the vigor of trees, and structure and distribution predispose stands to insect and disease outbreaks. These stands are also at risk of large-scale, high-intensity wildfire events with sustained crown fire activity. In the event of a wildfire that results in high burn severity (i.e., stand replacement), large acreages of the forested habitat that may support this species may be altered or lost for several decades. In the absence of management actions that reduce fuel loads and canopy continuity, or promote a more balanced distribution of vegetation classes, the project area would remain at increased risk of these widespread disturbance events.

Rocky Mountain Elk Direct and Indirect Effects

This alternative would not have any direct effects on the Rocky Mountain elk. However, in the absence of land management, indirect effects may occur to the habitat of this species. As generalists, elk are supported by a variety of habitats in both their summer and winter ranges. Openings and early-seral forest are desirable for feeding habitat, while mature forests are preferred for cover. Pre-treatment HABCAP analysis demonstrates (Table 35) that elk summer and winter cover is abundant (i.e., HCI is 1.29) in the project area, while feeding habitat is not as widely available as desired (HCI is 0.66). This analysis supports the conclusion that the current predominant stand conditions, with widespread dense forest with little vertical and horizontal heterogeneity, are not sustainable for this species.

Under this alternative, the quality and extent of feeding habitat for this species would continue to be limited as this alternative would perpetuate landscape conditions that are absent of variable size openings. The density of forest vegetation would continue to be high in the project area. Although closed stand conditions provide cover for the elk, the disproportionately large percentage of closed stands are at an elevated risk of disturbance events, such as wildfire and insect and disease infestation. These stand conditions provide cover for the elk and may result in the recruitment of small openings utilized by this species. However, these conditions would also increase the risk of large-scale wildfire events that may increase elk feeding habitat, but may also eliminate cover for this species.

Rocky Mountain Elk Cumulative Effects

The low severity fires that once created and maintained a more sustainable distribution of vegetation classes are unlikely to occur in the UMC project area. Under this alternative, landscape level closed canopy conditions would perpetuate the elevated risk of large-scale, high-intensity wildfire with sustained crown fire activity. Large openings in the UMC landscape may occur as a result of wildfire events. However, these openings would likely resemble those created by the Hayman (2002) and Waldo Canyon (2012) fires. Wildland fire events such as this may substantially increase the amount, quality, and availability of feeding habitat for elk, but also reduce the sustainability of habitat by eliminating cover. In the absence of management actions that reduce fuel loads and canopy continuity, or promote a more balanced distribution of vegetation classes, the project area would remain at increased risk of these types of disturbance events.

Ongoing and planned vegetation management projects would continue to be implemented on NFS lands under the Trout West Hazardous Fuels Reduction and Catamount Forest Health and Hazardous Fuels Reduction projects. These projects entail the creation of openings, thinning, prescribed burning, and other fuel reduction treatments on up to about 40,000 acres. Due to the location of these treatments relative to the project area, a reduction in the risk of disturbance events within the UMC landscape is not anticipated. However, these treatments would improve habitat conditions for elk found within the UMC project area, as these treatment areas are within the range of the Eleven Mile herd.

Alternative 1 (No Action): Species Federally Listed as Threatened

Mexican Spotted Owl Direct and Indirect Effects

This alternative would not have any direct effects on the Mexican spotted owl. However, in the absence of land management, indirect effects to this species may occur in the form of habitat destruction, fragmentation, or degradation. In particular, the habitat conditions in the Riparian Recovery and Recovery Foraging/Non-breeding habitats would remain unchanged or continue to develop undesirable characteristics within the UMC project area.

Riparian forests are considered to be a key habitat for spotted owl recovery that could frequently be used by this species for foraging, roosting, daily movements, dispersal, and potentially for nesting (USDI FWS 2012, p.270). This alternative would result in continued degradation in the habitat quality of riparian forests consisting of quaking aspen due to increased levels of competition and reduced tree vigor. In the absence of management actions within decadent aspen clones or clones with high levels of conifer encroachment, these stands would continue to decline from competitive stress and senescence. As the distinction between riparian tree and shrub species and adjacent upland vegetation is lost, these stands would become of limited value to this species. In addition, riparian vegetation would also continue to be denuded along disturbed portions of creeks, impeding the recovery of herbaceous and deciduous woody vegetation and the development of desirable conditions for this species in the riparian forest habitat type.

Under this alternative, the density of forest vegetation would continue to be high in MSO habitat types, resulting in high levels of competition for nutrients, light, and water which would reduce the vigor of these stands. As tree vigor continues to decline in the project area, forest stands would become increasingly susceptible to drought stress, damage and mortality from insects and disease, and would continue to have structural characteristics that facilitate fire movement into the forest canopy.

Mexican Spotted Owl Cumulative Effects

At present, forested stands in the project area are at increased risk of disturbance events, such as wildfire and insect and disease infestation. An overabundance of dense, closed canopy forest and corresponding lack of open forest conditions has created continuous, fairly uniform canopy conditions. High stem density has reduced the vigor of trees, and structure and distribution predispose stands to insect and disease outbreaks. Stands are also at risk of sustained crown fire over large areas due to canopy continuity. The severity of wildfire events depend on a variety of factors, including fuel conditions (e.g., fuel moisture), location of the ignition, topography, and weather. However, wildfire events in the eastern portion of the project area are likely to burn with high intensity and at a high rate of spread due to the presence of steep slopes. Unfortunately, the stands that are at the most risk of a severe wildfire event are also the stands in which the highest quality spotted owl nest/roost habitat exists. In the absence of large scale vegetation management, the risk of wildfire events in the project area would remain unchanged. In the event of a wildfire that results in high burn severity (i.e., stand replacement), large acreages of the forested habitat that may support this species may be altered or lost for several decades.

Mexican Spotted Owl Determination of Effects

Under this alternative, stand structure and tree density would remain unchanged in the project area, perpetuating the risk of large-scale disturbance events. This species may be indirectly affected by disturbance events that result in the loss of MSO recovery habitat. Therefore, Alternative 1 *may affect,* but is *not likely to adversely affect* the Mexican spotted owl or the critical habitat of this species.

Preble's Meadow Jumping Mouse Direct and Indirect Effects

This alternative would not have any direct effects on the Preble's meadow jumping mouse. However, in the absence of land management, indirect effects to this species may occur in the form of habitat destruction, fragmentation, or degradation. Under this alternative, the density of forest vegetation would continue to be high in stands adjacent to potential and occupied Preble's habitat. High levels of competition for nutrients, light, and water would reduce the vigor of these stands. As tree vigor continues

to decline in the project area, forest stands would become increasingly susceptible to drought stress, damage and mortality from insects and disease, and would continue to have structural characteristics that facilitate fire movement into the forest canopy. These conditions increase the risk of wildfire events that may impact riparian and upland habitats within the project area that may support this species. In the event of a wildfire that results in high burn severity (i.e., stand replacement), Preble's habitat may be altered or lost, including critical habitat located along Beaver Creek and Trout Creek.

Preble's Meadow Jumping Mouse Cumulative Effects

At present, forested stands in the project area are at increased risk of disturbance events, such as wildfire and insect and disease infestation. An overabundance of dense, closed canopy forest and corresponding lack of open forest conditions has created continuous, fairly uniform canopy conditions. High stem density has reduced the vigor of trees, and structure and distribution predispose stands to insect and disease outbreaks. Stands are also at risk of sustained crown fire over large areas due to canopy continuity. The severity of wildfire events depend on a variety of factors, including fuel conditions (e.g., fuel moisture), location of the ignition, topography, and weather. However, wildfire events in the eastern portion of the project area are likely to burn with high intensity and at a high rate of spread due to the presence of steep slopes. These slopes are located in proximity to the potential and critical habitat of this species. Wildfire events originating within the UMC project area may spread onto the USAFA, which contains occupied habitat. Wildfire events that result in high burn severity may also cause excessive soil erosion and sediment disposition downstream that degrades or inhibits the recovery of Preble's habitat. In the absence of large scale vegetation management, the risk of wildfire events in the project area and potential effects on the habitat of this species would remain unchanged.

Preble's Meadow Jumping Mouse Determination of Effects

Under this alternative, stand structure and tree density would remain unchanged in the project area, perpetuating the risk of large-scale disturbance events. This species may be indirectly affected by disturbance events that result in the loss of Preble's habitat. Therefore, Alternative 1 *may affect,* but is *not likely to adversely affect* the Preble's meadow jumping mouse or the critical habitat of this species.

Alternative 1 (No Action): Sensitive Species

Rocky Mountain Bighorn Sheep Direct and Indirect Effects

This alternative would not have any direct effects on the Rocky Mountain bighorn sheep. However, indirect effects to this species may occur in the form of habitat loss, fragmentation, and degradation as a result of fire suppression and the absence of vegetation management. In Region 2, fire suppression policies have indirectly affected bighorn sheep by allowing changes in vegetation structure on bighorn ranges that have often resulted in decreased forage availability, loss of movement corridors, increased vulnerability to predators, and increased competition from other wild ungulates where forests encroach on open habitat types (Beecham et al. 2007, p.75). In 2012, the Waldo Canyon fire burned about 18,200 acres, of which 10,500 acres occur within the UMC project area. This wildfire event substantially increased the amount, quality, and availability of habitat to the Rampart bighorn sheep herd. However, portions of the project area north of Blodgett Peak that were used by this herd historically, remained unburned. Forest succession in this area has degraded the habitat conditions required for bighorn occupancy, as well as the habitat connectivity between existing lambing sites located at Queens Canyon and an area southwest of the USAFA. In the absence of vegetation management or a large-scale disturbance event, the suitability of habitat in this portion of the project area would remain unchanged or continue to decline, inhibiting the distribution of the Rampart herd within this historic range, and thereby reducing the resiliency of bighorn sheep to factors that threaten the viability of this population.

Rocky Mountain Bighorn Sheep Cumulative Effects

Under this alternative, the project area would retain landscape level closed canopy conditions that perpetuate the elevated risk of large-scale, high-intensity wildfire events with sustained crown fire activity. These disturbance events may resemble those created by the Hayman and Waldo Canyon fires. Although these fires created openings that were uncharacteristically large, these types of fire events may increase the availability of habitat for bighorn sheep foraging and dispersal. A high severity wildfire event in proximity to occupied bighorn sheep habitat may benefit this species by improving the production and palatability of forage for a few years. The Rampart herd may also respond to the removal of overstory trees and understory shrubs by an expansion in the range and improvement in the production of this population.

Rocky Mountain Bighorn Sheep Determination of Effects

Under this alternative, the bighorn sheep may be indirectly affected by the loss or degradation of habitat due to the absence of vegetation management, and the continued suppression of wildfires. However, stand structure and tree density would remain unchanged in the project area, perpetuating the risk of large-scale disturbance events that may result in improved habitat conditions for this species. Therefore, Alternative 1 *may adversely impact individuals, but is not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing* of the Rocky Mountain bighorn sheep.

Western Bumblebee Direct and Indirect Effects

This alternative would not have any direct effects on the western bumble bee. However, in the absence of land management, indirect effects to this species may occur in the form of habitat destruction, fragmentation, or degradation. In particular, the habitat conditions in the open meadow habitats would remain unchanged or continue to develop undesirable characteristics due to conifer encroachment within the UMC project area.

Open, flower-rich meadows are considered a vital habitat for western bumble bees to forage, nest and overwinter. This alternative would result in the continued degradation in the habitat quality of forest meadows due to increased levels of encroachment and reduced habitat availability. Studies have shown that meadows are highly sensitive to tree establishment and the resulting reductions in available light (Haugo and Halpern, 2007). The presence of trees will also biologically and chemically alter the meadow soils making it easier for other forest herbs and trees to assemble and more difficult to restore meadow vegetation (Griffiths et al., 2005). In the absence of management actions within areas that have high levels of conifer encroachment, these meadows would continue to decrease in size. As the floral vegetation is lost, these areas would no longer be able to support bumble bee colonies and would become of limited value to this species. Additionally, as meadow habitat becomes more fragmented, inbreeding will become more prevalent, resulting in decreased genetic diversity and an increased risk of decline for bumble bee populations.

Western Bumblebee Cumulative Effects

Current vegetation conditions within the UMC project area demonstrate that fire suppression and changes in land use have modified surrounding ecological systems. The lack of spatial heterogeneity has resulted in an overabundance of dense, closed canopy forest and a lack of open forest conditions, increasing the risk for wildfire and insect and disease infestation. While fire may benefit open meadow areas by reducing conifer encroachment and increasing connectivity, the high intensity and severity of these burns would likely kill any bees that may already be present in these areas. In the absence of large scale vegetation management, the risk of severe wildfire events in the project area would remain unchanged and the further encroachment of conifers into meadow areas would continue.

Western Bumblebee Determination of Effects

Under this alternative, conifer encroachment would continue to occur, resulting in the reduction of meadow habitat. This species may be indirectly affected by fragmentation and degradation that would

result in the loss of potential western bumble bee habitat. Therefore, Alternative 1 *may adversely impact individuals, but is not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing* the western bumble bee.

Bald Eagle Direct and Indirect Effects

This alternative would not have any direct effects on the bald eagle. However, in the absence of land management, indirect effects to this species may occur in the form of habitat loss. Under this alternative, the density of forest vegetation would continue to be high in the project area, resulting in high levels of competition for nutrients, light, and water would reduce stand vigor. As tree vigor continues to decline in the project area, forest stands would also become increasingly susceptible to drought stress, damage and mortality from insects and disease, and would continue to have structural characteristics that facilitate fire movement into the forest canopy. Disturbance events may result in the recruitment of snags utilized as roost sites by this species, but these conditions would also increase the risk of wildfire events. In the event of a wildfire that results in high burn severity (i.e., stand replacement), potential nest and roost habitat within the project area may be lost.

Bald Eagle Cumulative Effects

Disturbance events also pose a risk to the bald eagle nest site located west of the project area. Wildfire events originating within the UMC project area may spread to surrounding lands. Other ongoing and planned vegetation management projects are not expected to result in a reduction in the risk of disturbance events within the UMC landscape due to the limited scale and the location of these treatments relative to the project area. In the absence of large scale vegetation management, the risk of wildfire events in the project area and potential effects on the habitat of this species would remain unchanged.

Bald Eagle Determination of Effects

Under this alternative, stand structure and tree density would remain unchanged in the project area, perpetuating the risk of large-scale disturbance events. This species may be indirectly affected by disturbance events that result in the loss of habitat. Therefore, Alternative 1 *may adversely impact individuals, but is not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing* of the bald eagle.

Northern Leopard Frog Direct and Indirect Effects

This alternative would not have any direct effects on the northern leopard frog. However, in the absence of land management, indirect effects to this species may occur in the form of habitat degradation or loss. Under this alternative, the density of forest vegetation would continue to be high in many areas, resulting in high levels of competition for nutrients, light, and water, which reduce stand vigor. As tree vigor continues to decline, forest stands would become increasingly susceptible to drought stress, damage and mortality from insects and disease, and would continue to have structural characteristics that facilitate fire movement into the forest canopy. In the event of a wildfire that results in high burn severity, the riparian and associated upland habitats in which this species is associated may be altered or lost.

Northern Leopard Frog Cumulative Effects

In the absence of management actions that reduce fuel loads and canopy continuity, or promote a more balanced distribution of vegetation classes, the project area would remain at increased risk of widespread disturbance events, such as insect and disease outbreaks or wildfire. Wildfire may remove vegetation that functions to stabilize soils, and may result in extensive erosion and sedimentation. In areas with high soil burn severity, large areas would be devoid of vegetation and groundcover. The erosion of ash and surface soil during initial storm events would reduce slope roughness by filling depressions above rocks, logs, and remaining vegetation. In steep drainages, large runoff producing storms would likely create increased surface flow volumes and velocities that would transport available sediment from slopes and along channel bottoms. The habitat occupied by this species may be impacted, as the wetland and riparian areas

located in the vicinity of the project area may be degraded by both erosion and sediment deposition. Sediment deposited within breeding sites can also cover eggs, thus impeding respiration through membrane surfaces.

Northern Leopard Frog Determination of Effects

Under this alternative, stand structure and tree density would remain unchanged in the project area, perpetuating the risk of large-scale disturbance events. This species may be indirectly affected by disturbance events that result in degradation to habitat located along Trout Creek. Therefore, Alternative 1 *may adversely impact individuals, but is not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing* of the northern leopard frog.

Fringed Myotis, Hoary Bat, Townsend's Big-eared Bat, American Peregrine Falcon, Flammulated Owl, Northern Goshawk, and Olive-sided Flycatcher Direct and Indirect Effects

The following species have the potential to occur within the project area based on habitat requirements and known distribution, and have been grouped in order to simplify the analysis and disclosure of effects for the proposed project. Although the manner in which these species utilize habitats may vary, they are similarly impacted by habitat alteration and noise disturbance.

This alternative would not have any direct effects on this group of species. However, in the absence of land management, indirect effects to these species may occur in the form of habitat destruction, fragmentation, or degradation. Under this alternative, the density of forest vegetation would continue to be high in the project area, resulting in high levels of competition for nutrients, light, and water would reduce stand vigor. As tree vigor continues to decline in the project area, forest stands would also become increasingly susceptible to drought stress, damage and mortality from insects and disease, and would continue to have structural characteristics that facilitate fire movement into the forest canopy. These stand conditions may result in the recruitment of snags and small openings utilized by species such as the olive-sided flycatcher and fringed myotis, but these conditions would increase the risk of wildfire events. In the event of a wildfire that results in high burn severity (i.e., stand replacement), the montane forest vegetation utilized by this variety of species may be altered or lost.

The quality and extent of foraging habitat for these species would also continue to be limited as this alternative would perpetuate landscape conditions that are absent of small scale forest canopy openings and associated edge habitat. Open stand conditions are utilized as foraging habitat by the hoary bat and flammulated owl, while edge habitat is utilized by the Townsend's big-eared bat. Under this alternative, the low severity fires that once created and maintained these stand conditions are unlikely to occur in the UMC landscape due to the existing stand densities.

Fringed Myotis, Hoary Bat, Townsend's Big-eared Bat, American Peregrine Falcon, Flammulated Owl, Northern Goshawk, and Olive-sided Flycatcher Cumulative Effects

Under this alternative, landscape level closed canopy conditions would perpetuate the elevated risk of large-scale, high-intensity wildfire with sustained crown fire activity. Large openings in the UMC landscape may occur as a result of wildfire events. However, these openings would likely resemble those created by the Hayman (2002) and Waldo Canyon (2012) fires. These fires created openings that were uncharacteristically large, with negative long-term ecological impacts (e.g., loss of wildlife habitat, forest type conversion, etc.). In the absence of management actions that reduce fuel loads and canopy continuity, or promote a more balanced distribution of vegetation classes, the project area would remain at increased risk of these types of disturbance events.

Vegetation management projects are planned, or have been conducted, on land ownerships adjoining the UMC project area, including private parcels, the City of Colorado Springs, the City of Woodland Park, the United States Air Force Academy, and the Towns of Palmer Lake and Monument. Fire rehabilitation

projects (e.g., stream channel and hillslope stabilization) have also occurred on National Forest System (NFS) lands and adjacent land ownerships within or near the Waldo Canyon Fire burned area. Under this alternative, the effectiveness of these fuels reduction and fire rehabilitation projects would be diminished, as these sites are located in proximity to NFS lands where forest conditions that are susceptible to large, high severity wildfire events would persist.

Ongoing and planned vegetation management projects would also continue to be implemented on NFS lands under the Trout West Hazardous Fuels Reduction and Catamount Forest Health and Hazardous Fuels Reduction projects. These projects entail the creation of openings, thinning, prescribed burning, and other fuel reduction treatments on up to about 40,000 acres. However, due to the location of these treatments relative to the project area, a reduction in the risk of disturbance events within the UMC landscape is not anticipated.

Determination of Effects

Under this alternative, stand structure and tree density would remain unchanged in the project area, perpetuating the risk of large-scale disturbance events. These species may be indirectly affected by disturbance events that result in the loss of habitat. Therefore, Alternative 1 *may adversely impact individuals, but is not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing* of the fringed myotis, hoary bat, Townsend's big-eared bat, American peregrine falcon, flammulated owl, northern goshawk, and olive-sided flycatcher.

Alternative 2 (Modified Proposed Action): Wildlife

Direct and Indirect Effects

The management actions associated with this alternative have the potential to result in the direct harm to individual wildlife species. Species may also be affected through the modification of habitat, as well as the prompting of species behavioral and physiological responses. The significance and magnitude of effects on species or habitat are dependent on the type, location, extent, intensity, duration, frequency, and timing of the activity. Site-specific project design standards or conservation measures would also avoid or minimize the potential effects of the proposed management actions on fish and wildlife resources. Sustainable habitat conditions for these resources are expected to be maintained through application of these measures.

Under this alternative, the proposed management actions would move the project area toward developing a more desirable and historic open forest structure and fire regime. These management actions would promote greater diversity in tree composition and age classes, and improved vigor, productivity, and diversity of herbaceous understory vegetation. Forage production and quality would improve as tree density decreases, resulting in reduced competition for sunlight, moisture, and nutrients. This would result in improved habitat conditions for wildlife and a greater diversity of wildlife species.

Vegetation Management

The vegetation management treatments employed under this alternative would promote more sustainable forest stand conditions by altering the distribution and structure of forest vegetation within the UMC project area. Stand development would be improved as thinning treatments would increase the vigor of residual trees, enhance important grouping structure, reduce shade tolerant species, maintain and enhance the aspen component, increase the amount of understory vegetation, and shift age class distributions. Spatial heterogeneity would also increase at the stand level, as well as the landscape level, as small and large scale openings are created or enhanced. Forest resiliency would be enhanced as a more complex mosaic of vegetation classes would limit the incidence and potential impacts of disturbances events such as severe wildfire and epidemic insect and disease outbreaks (see Forest Vegetation Resource Report).

The combination of variable density thinning, opening creation or enhancement, and prescribed fire would also promote ecological conditions that are more characteristic of a natural fire regime. These

management actions would lessen crown fire hazard by disrupting horizontal and vertical canopy continuity, and increasing canopy base height, while reducing the amount of surface fuels that render forests more susceptible to high-intensity, stand-replacing fires. The decrease in tree density and ladder fuels would also result in more open canopy conditions that may promote the greater production of understory vegetation. An increase in herbaceous plant development would enhance the cover and forage for a variety of wildlife species, but may also facilitate more frequent surface fires with a higher rate of spread. However, frequent surface fire results would also aid in preventing severe wildfires, as surface fire intensity (e.g., flame length, rate of spread) and extent would be reduced in timber fuel types. In the event of a wildfire, these stand conditions would generally support more natural, low intensity fires that preserve watershed health and function, and have a diminished likelihood of causing the loss of habitat used by wildlife and fisheries resources.

Noise Disturbance

The behavioral responses of terrestrial species are influenced primarily by disturbance in the form of noise pollution and harassment. For instance, noise impedes or causes wildlife daily, seasonal, or dispersal movements. Adverse effects on wildlife include increases in energy expenditures, displacement in population distribution or habitat use, and a reduction in productivity. These avoidance behaviors may effectively reduce the amount of available habitat to wildlife species and exacerbates the problems posed by habitat fragmentation (Barber et al. 2009).

The presence of humans and equipment, and the high level of noise generated during the proposed mechanical treatments may cause both physiological and behavioral responses from species that can reduce reproduction and survival. This may occur in the form of a defense response that is active (i.e., fight or flight) or passive (i.e., inhibition of activity). For instance, nesting raptors may be incapable of becoming habituated to a new or existing level of human generated noise. Effects of raptors reacting to disturbance include increased energetic demands, nest abandonment, and avoidance flight and exposure to predators. Repeated displacement of species during feeding and resting periods may also cause increased energy expenditures through these avoidance behaviors. Wildlife species that are perceived as habituated to human caused disturbances may also endure subtle physiological responses, such as chronically elevated heart rates and changes in alertness and posture. Elevated heart rates, energy expended in response to disturbance, and reductions of energy input through disturbance may increase energy expenditures or decrease energy acquisition. These factors may result in increased sickness, disease, and the potential death of individual wildlife species.

Presently, motorized use of roads and trails is the primary source of human generated noise disturbance in the UMC project area. The response of wildlife species to noise may be more pronounced during mechanical treatments than to sources of disturbance in which human use is predictable and localized (e.g., motorized use confined to routes). Animal responses would also depend upon the intensity of perceived threats rather than on the intensity of noise (Barber et al. 2009). The noise associated with this alternative is expected to displace wildlife species. However, widespread impacts to wildlife species are not anticipated, as implementation of the proposed mechanical treatments would be inherently limited in both duration and extent.

Prescribed Fire

The prescribed fire treatments proposed under this alternative have the potential to result in the direct harm to wildlife species by causing the mortality, injury, and displacement of individuals. Wildlife species with limited mobility that live above ground are the most vulnerable to fire caused effects (Smith 2000). The magnitude of these effects depends on the season, intensity, and extent of the fire event. For example, migratory bird populations may not be affected by prescribed fire treatments that occur before their arrival in spring or after their departure in fall (Smith 2000).

Fires that burn during the nesting season appear to be most detrimental to bird and small mammal populations (Finch et al. 1997; Erwin and Stasiak 1979 in Smith 2000). If prescribed fire treatments are conducted during the spring, the destruction of nests and the mortality of young would likely occur to

ground-nesting species, such as the wild turkey and dusky grouse. The nestlings and fledglings of tree or shrub nesting birds would also be vulnerable to harm from prescribed fire due to their limited mobility during this period. In response to the loss of a nest, some species would attempt to renest, but this action would depend on the tendency of the species to attempt this behavior. For instance, wild turkey rarely renest if nests are destroyed after 2 to 3 weeks of incubation (Robbins and Myers 1992 in Smith 2000).

Prescribed fire treatments conducted during the spring may also impact mammal populations more than other periods due to the limited mobility of young. Most small mammals would avoid fire by seeking refuge underground or in sheltered places, such as tunnels, pathways under moist forest litter, stump and root holes, and spaces under rock, talus, and large dead wood (Ford and others 1999 *in* Smith 2000). However, small rodents that construct surface-level nests, such as rabbits, mice, and woodrats, are more vulnerable to fire-caused mortality than deeper-nesting species, especially because their nests are constructed of dry, flammable materials (multiple sources *in* Smith 2000). Despite possible losses, the high reproductive rates of small mammals would enable surface nesting species to recovery rapidly if post-fire habitat conditions provide adequate food and shelter.

Direct fire-caused mortality has also been reported for large mammals, including coyote, white-tailed deer, mule deer, elk, bison, black bear, and moose (multiple sources in Smith 2000). Large mammals avoid fire by moving to unburned patches or to areas outside of the fire perimeter. Mortality most likely occurs when fire fronts are wide and fast moving, fires are actively crowning, and when thick ground smoke inhibits visibility (Smith 2000). However, the effects of the prescribed fire treatments on large mammals are expected to be minimal as this management action is conducted in accordance with a prescribed fire burn plan. The burn plan prescription incorporates the various parameters necessary to achieve desired resource objectives (e.g., changed stand structure). The prescription is also an assessment of the complexity and risk of the action, which includes consideration of factors such as, ignition methods, potential fire behavior, weather conditions, vegetation type, topography, and estimated fuel loading, continuity, and arrangement. Prescribed fire treatments conducted under the constraints of a burn plan are not expected to result in the extent of fire effects that may occur during a wildfire event, and therefore would not expose large mammals to an elevated risk of mortality.

The proposed prescribed fire treatments would alter the vegetative structure and composition, and the spatial arrangement of habitats used by a variety of wildlife species for food, cover, or reproduction. This management action would create more open stand conditions, a greater diversity in tree composition and age classes, and improved composition and diversity of understory vegetation. An increase in vegetative diversity and structure may promote a greater assortment, and improved distribution and utilization, of wildlife species within the treatment areas.

Forage production and quality would also improve in response to reduced competition for sunlight, moisture, and nutrients. During a fire, if soil temperatures stay below 347°F, nutrient releases enhance plant growth and vigor (Agee 1993 in Kennedy and Fontaine 2009). This regrowth often leads to increased abundance of vegetative sprouts, flowers, seeds, and some insects. This increase attracts herbivores, aerial insectivores, nectarivores, and granivores to the fire site for new foraging opportunities (Saab et al. 2007a in Kennedy and Fontaine 2009). Small mammals, for example, may benefit from increasing food availability, but would be more exposed to predation by raptors initially due to reduced vegetative cover (Smith 2000). An increase in the palatability and nutrition of forage would also benefit large mammals, such as elk and mule deer (Smith 2000). The improved nutritional qualities of forage plants may persist for one to three growing seasons (multiple sources in Smith 2000). Some research also suggests that fire does not result in significant changes in nutrient levels. However, elk may prefer to forage in the burned areas because of the availability of preferred species and the efficiency of foraging (Smith 2000).

Snags, Partially Dead Trees, and Coarse Woody Debris

In order to achieve resource management objectives, dead standing trees and downed woody debris may be removed or reduced within select treatment units. This management action would reduce the

availability of these features as foraging substrate or refuge for a variety of wildlife species. However, these treatments would occur most frequently in stands in which prescriptions are designed for a reduction of fuels in proximity to infrastructure and human developments, and where the creation of openings are desired (e.g., groups of dead trees killed by insect and disease, bighorn sheep habitat improvement, etc.). Project design standards would require the retention of snags and downed woody debris in accordance with Forest Plan guidelines and directives. In addition, this alternative would enable management actions designed specifically for the creation of snags where these features are lacking or desired.

The proposed prescribed fire treatments would also result in the loss of snags and downed woody debris within treatment units. Conversely, prescribed fire may also result in the creation of snags as live trees are weakened or killed. However, in stands designated for fuel reduction, snag abundance would decline as these features would be reduced during subsequent treatments. Despite possible losses, this habitat component would continue to exist across the UMC landscape due to natural disturbance events. Project design standards employed during thinning operations would also promote the retention of live trees with characteristics that are desirable as replacement snags. For instance, living trees would be retained within treatment units that exhibit characteristics or indicators of decline, such as internal decay, sloughing bark, dead limbs, etc. These retention trees would serve as a replacement source for the snags and coarse woody debris that may be eliminated during operations.

Cavity Trees

The proposed mechanical thinning treatments may entail the deliberate removal of live or dead standing trees containing cavities when these features pose a hazard to personnel during operations. This action would not be conducted as a standard practice throughout the UMC project area, but would generally be employed where the creation of landings or skid trails are necessary to perform thinning operations. Dead standing trees with cavities that are considered a fire hazard may also be removed within the proposed fuel break treatment areas, which are located near the Town of Monument on the eastern portion of the project area. However, these treatment areas primarily contain ponderosa pine or the Gambel oak stands that are currently composed of dense, uniform trees with sparse structural diversity or standing dead trees. The effects of cavity tree removal on wildlife species would also depend on the timing of these treatments. For instance, if cavity trees are removed during the fall or winter periods, effects on avian species are expected to be negligible, while removal of these features during the spring or summer periods may harm or displace avian species and eliminate potential nest or roost sites. However, the application of project design standards would minimize the potential effects of cavity tree removal on wildlife species, as this action would prohibit the removal of these features that are active nest, roost, or den sites. The inadvertent removal of cavity trees may also occur as a direct or indirect result of mechanical equipment operations. Snags may be downed as equipment is operating or as live trees are felled. However, the snags impacted by this action are generally abundant, small in diameter, and are absent of cavities, and therefore have limited value to wildlife species for reproduction or refuge.

Wildlife Habitat Improvement

Snags, Partially Dead, and Coarse Woody Debris Recruitment

The objective of this management action is to ensure that features that have the potential to be utilized by wildlife for foraging, roosting, nesting, denning, cover, and hibernacula are available throughout the UMC landscape. In order to achieve this resource management objective, snags and live trees with characteristics that are desirable as replacement snags would be retained during vegetation management treatments. However, in areas deficient of these features, the recruitment of dead standing trees, partially dead trees, and downed woody debris may be accelerated through deliberate tree manipulation. Although the methods and results may vary, the negative effects of this management action on wildlife species would not differ from those effects described for the proposed vegetation management treatments. The application of project design standards would also minimize the potential effects of tree manipulation on wildlife species, as this action would require the protection of trees that are active nest, roost, or den sites.

The recruitment of snags and coarse woody debris would provide multiple benefits to a variety of wildlife species. This management action would serve as a method to provide habitat components for species that are selective as to the size, decomposition stage, and the abundance of these features. For example, treatment methods may be employed to enhance the abundance and distribution of large snags, which are deficient in the lower montane forests of the UMC landscape. However, the tree size, tree species, and method of snag creation are important factors in the form of decay and retention rates. Snags created by girdling, for instance, tend to decay externally and make poor cavity-nesting substrate, but would provide a source of coarse woody debris. Living trees with internal decay are more persistent and provide opportunities for cavity excavation, while the outside remains sound for protection. Live and dead standing quaking aspen, in particular, is an important source of cavities within the project area as this tree species has far more internal decay at a much earlier age than the coniferous species.

Aspen Restoration and Enhancement

Quaking aspen is utilized by wildlife species for food, cover, and nesting habitat disproportionately to the occurrence of the forest type on the UMC landscape. The management of aspen stands would provide multiple benefits to numerous wildlife species, providing habitat for primary and secondary cavity nesting birds, canopy nesting birds, and foraging habitat and cover for a variety of mammals, raptors, and ground-dwelling birds.

The objectives of this management action are to retain, restore, or enhance health and vigor, and expand the current extent of aspen clones. In order to achieve these resource management objectives, individual aspen and aspen clones would be retained during vegetation management treatments. However, decadent aspen clones or clones with conifer encroachment would be modified through vegetation management treatments. The method of treatment would depend on the stand conditions and risk factors. The success of treatments may also require the construction of fencing or barriers to exclude the browsing of aspen suckers by ungulates. Although the methods and results may vary, the negative effects of this management action on wildlife species would not differ from those effects described for the proposed vegetation management. The application of project design standards would also minimize the potential effects of this vegetation management on wildlife species, as treatments would require the protection of trees that are active nest, roost, or den sites.

Opening Creation and Enhancement

The objectives of this management action are to create and enhance openings of various size, shape, and arrangement to provide edge habitat and improve habitat quality and connectivity for a variety of wildlife species. The effects of this management action on wildlife species would not differ from those effects described for the proposed vegetation management treatments. Tree removal and prescribed fire treatment methods would be employed to create openings and expand existing openings to the extent possible. Thinning treatments would result in small interspatial openings between trees, while group selection methods would create or enhance larger openings. Openings and more open stand conditions would increase the use of these habitats by certain species. For example, the relative activity levels of clutter-intolerant bat species, such as the big brown bat, hoary bat, and silver-haired bat, may increase in treated areas as physical obstructions are reduced (Betts 2009). However, activity levels may decrease for clutter-tolerant species, such as the fringed myotis and long-eared myotis.

The creation and enhancement of openings would enable more sunlight to reach the forest floor, stimulating grass, forb, and shrub development. Improved understory conditions would attract small mammals, which serve as a prey base for numerous mammal and bird species. The quality, quantity, and availability of forage would also improve for large herbivores, such as elk and deer.

Riparian and Floodplain Enhancement and Restoration

Riparian Areas

The objectives of this management action are to retain, restore, or enhance riparian areas, which provide cover, large woody material for recruitment, and nutrients for aquatic and terrestrial organisms that are fed on by fish. These riparian areas are also generally important habitats for wildlife species as these sites contain an abundance and variety of food sources, free standing water, and protection in the form of vegetative cover for escape, hiding, and nesting. The treatments proposed under this alternative may temporarily impact the vegetation and soils along riparian areas. However, these treatments would maintain the ecological integrity and hydrological function these systems provide to watersheds by stabilizing stream channels and slopes, and restoring and increasing the vigor of vegetative cover.

Floodplain Improvement

The objectives of this management action are to enhance floodplain vegetation by thinning conifer encroachment within aspen clones, managing decadent aspen clones to encourage the development of a new vigorous cohort, reducing the density of understory and mid-story conifers to reduce ladder fuels, pruning dominant overstory trees to raise the crown base height, and releasing large conifers from competing vegetation to increase the vigor of these uncommon features. The effects of this management action on wildlife species would not differ from those effects described for the proposed vegetation management treatments.

Aquatic Habitat

The effects of the proposed management actions on fish and their habitats are primarily related to increased sedimentation from land disturbance and the alteration of riparian communities. The amount of fine sediment increases on and within stream substrates when sediment production exceeds a stream's transport capacity. Once in streams, fine sediments may be transported further downstream or deposited in slow water areas and behind obstructions, locally altering fish habitat conditions. In particular, fine sediment can fill the interstitial spaces among larger streambed particles, which can eliminate the living space for various microorganisms, aquatic macroinvertebrates, and juvenile fish. Spawning area quality is also affected as egg deposition and survival are reduced when sediment fills the interstitial spaces between gravels, preventing the flow of oxygen and the flushing of metabolic wastes. Emerging fry and aquatic insects can be trapped and smothered by sediment deposition in the gravels. Sedimentation of deep pools and coarse substrate used for rearing is also diminished and available space for over-wintering becomes limited. However, the effects of the proposed management actions on fish would be minimized with the application of project design standards. These standards would protect water quality by limiting soil displacement in the vicinity of streams or within riparian areas.

The introduction of invasive species is considered a primary threat to native ecosystems, second only to direct habitat loss. Aquatic nuisance species (ANS) are non-native plants, animals, and pathogens that can exist in lakes, streams, rivers, and wetlands. Colorado contains several aquatic nuisance species. These include animals such as the New Zealand mudsnails (*Potamopyrgus antipodarum*); pathogens such as those that cause whirling disease (*Myxobolus cerebralis)*; and plants such as Eurasian water milfoil (*Myriophyllum spicatum*). Whirling disease damages cartilage and compromises the nervous system of trout. Sites that are whirling disease positive within or adjacent to the project area include Trout Creek and West Monument Creek. There is a risk of spreading this pathogen to other water bodies in the project area where humans and equipment come in contact with these creeks. If introduced to other creeks, whirling disease would cause spinal deformities and decrease the ability of resident brook trout to feed and avoid predators. In addition, ANS would affect the ecological stability of infected waters, inhibiting any potential reintroduction efforts of native cutthroat trout species. Equipment and personnel would come in direct contact with water during the proposed riparian and floodplain improvements, but the risk of introducing or spreading aquatic nuisance species would be minimal. Project design standards employed during these treatments would prevent the introduction or spread of aquatic nuisance species by requiring the cleaning, disinfection, and rinsing of all equipment (e.g., personal protective equipment, heavy equipment, waders, hand tools, etc.) prior to contact with water.

Cumulative Effects

Most of the UMC project area is at risk from large-scale, high-intensity wildfire due to increases in tree density, encroachment of shade tolerant tree species, or the loss of shade intolerant tree species caused primarily by fire exclusion. Wildfire events that result in high burn severity (i.e., stand replacement) generally have negative effects on forest vegetation, wildlife habitat, and watershed function. However, wildfire events may also increase landscape heterogeneity by creating a spatially complex mosaic of unburned and burned patches (Kennedy and Fontaine 2009). A mosaic of successional stages in the landscape would maintain biodiversity by supporting specialists that require either early-seral or older forests, as well as species that require multiple seral stages throughout their life cycle (Kennedy and Fontaine 2009). In some cases, large, intense burns may function to maintain natural forest succession patterns of some forest types, and habitat diversity in others (Finch and others 1997 in Smith 2000).

Under this alternative, vegetation management would reduce fuel loading and canopy continuity, promote a more balanced distribution of vegetation classes, and increase spatial heterogeneity in the project area. Forested stands within the project area would be less susceptible to the risk of widespread disturbance events, such as insect and disease outbreaks or wildfire. For instance, western spruce budworm populations would likely decrease as Douglas-fir densities decrease; the dispersal potential of tussock moth would decrease as spatial heterogeneity and pine and aspen components increase; and the potential for epidemic outbreaks of bark beetle populations would be limited by the overall vigor of residual trees. The mosaic of forest structures and openings within the UMC project area would also allow fire to play a more natural role in the landscape. Prescribed fire may be utilized to maintain or increase heterogeneity at various scales, shifting vegetation classes and forest type distributions in a way that is more representative of historic conditions, and further perpetuating the role of fire on the landscape. As mechanical and prescribed fire treatments are completed under this alternative, opportunities to undertake additional projects may become more feasible within or near the UMC landscape.

Vegetation management projects are planned, or have been conducted, on land ownerships adjoining the UMC project area, including private parcels, the City of Colorado Springs, the City of Woodland Park, the United States Air Force Academy, and the Towns of Palmer Lake and Monument. Fire rehabilitation projects (e.g., stream channel and hillslope stabilization) have also occurred on National Forest System (NFS) lands and adjacent land ownerships within or near the Waldo Canyon Fire burned area. Under this alternative, the effectiveness of these fuels reduction and fire rehabilitation projects would be enhanced, as these sites are located in proximity to NFS lands where the susceptibly of stands to large, high severity wildfire events would be reduced. Vegetation management on NFS lands would complement these treatments by disrupting the continuity of hazardous fuels, improve forest health, vigor, and resistance to fire, insects, and disease, and reduce the risk of severe flooding and sedimentation to areas outside of the UMC project area.

Ongoing and planned vegetation management projects would also continue to be implemented on NFS lands under the Trout West Hazardous Fuels Reduction and Catamount Forest Health and Hazardous Fuels Reduction projects. These projects entail the creation of openings, thinning, prescribed burning, and other fuel reduction treatments on up to about 40,000 acres. Due to the location of these treatments relative to the project area, a direct reduction in the risk of disturbance events within the UMC landscape is not anticipated. However, these treatments would reduce the risk of disturbance events across the Pike and San Isabel National Forests.

Alternative 2 (Modified Proposed Action): Management Indicator Species

Abert's Squirrel Direct and Indirect Effects

The vegetation management proposed under Alternative 2 has the potential to result in the direct harm to individuals of this species. Potential harm to squirrels may occur as live trees are removed during

mechanical treatments that employ ground-based logging techniques. Individual squirrels may not be able to relocate, and active nests may be inadvertently removed, as tree felling with mechanical equipment limits visibility, and is performed at a rapid rate, when compared with manual methods.

Individual Abert's squirrels would also be displaced or otherwise disturbed during treatments, but the availability of ponderosa pine cover in the UMC project area provides individuals with the opportunity to move into nearby undisturbed habitats. This species would also be indirectly affected as habitat is manipulated under this alternative. The proposed treatments would result in reduced basal area, canopy closure, and tree density that may degrade the quality of Abert's squirrel habitat and reduce squirrel abundance (Keith 2003, p.15). According to Hoover and Wills (1984), in order to support a minimum viable population (i.e., 30 individuals), a minimum of 429 total acres is required, of which at least 219 and 210 acres are feeding and cover habitat, respectively. Contiguous stands of suitable habitat that surpass this threshold are available throughout the UMC project area. Preliminary monitoring data (Figure 15) also suggests that Abert's squirrel activity is not greatly inhibited by recent disturbances, but additional pre- and post-treatment monitoring would further inform Abert's squirrel response to the proposed management actions.

Despite the disturbance or removal of vegetation within Abert's squirrel habitat, the affected stands would retain suitable cover and foraging habitat for this species. Management objectives within the ponderosa pine/Douglas-fir forest ecological system emphasize the retention and enhancement of existing groups of trees. Project design standards would also preserve potential habitat for this species by requiring the retention of nest tree clumps during treatment within ponderosa pine stands. Post-treatment HABCAP analysis results in an estimated 12,293 acres of cover habitat and 13,764 acres of feeding habitat, with an HCI of 1.00 and 0.75, respectively (Table 34). The proposed treatments would improve squirrel cover HCI by reducing forest in vegetation class 'mid closed' to be more in line with the expected diversity of successional classes in the ponderosa pine type. The availability of ponderosa pine forest in the 'mid-closed' would remain ideal with an HCI of 1.00, but heterogeneity and commensurate resiliency would also increase, improving the sustainability of cover habitat for this species. Abert's squirrel feeding habitat is less dependent on closed canopy conditions. HABCAP analysis demonstrates that existing feeding habitat is nearly equal to potential habitat with an HCI of 1.04. Under this alternative, the feeding habitat HCI would be reduced to 0.75, as more habitat would be in a less desirable early-seral stage than existing conditions. However, the HCI for this habitat type would remain well above the Forest Plan standard of 0.53.

The vegetation management proposed under this alternative may also promote the development of desirable habitat conditions for these species at a stand level. The ponderosa pine/Douglas-fir ecological system represents marginal habitat for Abert's squirrel where Douglas-fir is the dominant species in the stand. This dominance by Douglas-fir is anticipated on north-facing slopes and in areas with higher moisture availability and productivity. However, the density of Douglas-fir has increased in this ecological system due to the exclusion of frequent, low- to mixed-severity fire. The proposed management in ponderosa pine/Douglas-fir woodlands would improve habitat conditions for the Abert's squirrel by promoting ponderosa pine as the dominant species. Treatments in ponderosa pine stands that open the understory while leaving groups of mature and near-mature trees with an interlocking canopy would also improve habitat for this species. In addition, tree removal within these stands would also release growing space, which may increase the vigor and promote the growth of residual trees. More importantly, vegetation management that strives for spatial heterogeneity would result in improved stand structure within ponderosa pine stands that is more resistant and resilient to the infestation and spread of pine beetle and disease, and less susceptible to high-intensity, stand-replacing fires.

Abert's Squirrel Cumulative Effects

Existing vegetation conditions are evidence that changes in land use patterns and effective fire suppression have modified ecological systems within the UMC landscape. The vegetative conditions within the UMC landscape differ, in both structure and distribution, from historic forest conditions. Forests are underrepresented in a number of the ecological attributes, such as spatial heterogeneity and

representation in older succession classes, which were once common and contributed to the resilience of pre-settlement forest landscapes. The mid-closed vegetation class dominates the UMC landscape and is significantly higher than NRV distributions in all three of the dominant ecological systems. The resiliency of the UMC landscape to the effects of largescale disturbances is also reduced. Under existing conditions, forested stands in the project area are at increased risk of disturbance events, such as wildfire and insect and disease infestation.

The restoration of ponderosa pine forests based on reconstruction of pre-settlement forest density and structure could reduce the density of large trees as much as 98 percent, leaving only 150 large trees or less per hectare (Mast et al. 1999 in Keith 2003). Such restoration could also exacerbate the effects of past even-aged management of ponderosa pine and further reduce stand, patch, and landscape diversity (Dodd et al. 2003). Squirrel productivity and densities would be expected to decrease when vegetation management prescriptions greatly reduce the diversity in forest structure, basal area of trees, canopy cover, and the frequency of interlocking canopies (Keith 2003). However, the objective of this alternative is not to recreate pre-settlement conditions, but to provide for more forest diversity, heterogeneity, and complexity that closely approximates the natural range of variability. The vegetation management treatments proposed under this alternative would occur in a variety of forest types in order to promote the composition, structure, and function that is more characteristic of desired ecological conditions. The proposed treatments are intended to result in the development of large trees, small and large forest openings, heterogeneous structural characteristics, understory plant diversity and forage productivity, and resiliency to disturbance events. Such forest structure and canopy cover would provide for the habitat needs of the Abert's squirrel by creating open, uneven-aged stands, with clusters of even-aged groups connected by canopy corridors. These conditions would also reduce the risk of insect and disease outbreaks, and diminish the potential spread and severity of wildfire events throughout the landscape.

Table 34. Abert's squirrel HABCAP values for existing conditions and possible post-work conditions.

Habitat Usage Type	Potential Habitat	Existing Habitat Capability	Existing HCI	Post-work Habitat Capability	Post-work HCI	HCI Change
Cover	13,518	18,127	1.34	12,293	1.00	+0.34
Feeding	18,423	19,192	1.04	13,764	0.75	-0.21

Rocky Mountain Elk Direct and Indirect Effects

The vegetation management proposed under Alternative 2 is not expected to degrade habitat conditions or result in the direct injury, mortality, or permanent displacement of individual Rocky Mountain elk. However, the presence of humans and equipment, and the noise generated from these sources during implementation may cause behavioral responses from this species. The potential effects of human caused disturbances on elk include increased energy expenditures and decreased energy acquisition, and displacement in distribution or habitat use. The effects of noise disturbance would be most detrimental to this species when treatments are conducted near potential calving areas. However, the potential for effects to elk calving would be minimized with the incorporation of site-specific project design standards. These design standards would establish timing restrictions that prohibit habitat modification and disturbance within elk calving concentration areas, as well as general disturbance or harassment of mammals with offspring throughout the project area.

The vegetation management proposed under this alternative would also improve habitat conditions for this species by promoting the development of a more desirable and historic open forest structure and fire regime. Thinning treatments would create small interspatial openings between trees, while group selection methods would create or enhance larger openings. A reduction in stand basal area, canopy closure, and tree density would increase understory grasses, forbs, and shrubs. Prescribed fire treatments would also promote improved composition and diversity of understory vegetation and stimulate vegetative growth of plant species that are grazed and browsed by elk. Vegetation management

treatments would also retain, restore, or enhance the health and vigor, and expand the current extent of aspen clones. However, some treatment areas may not be available to elk as fencing may be employed to prevent the intensive browsing of aspen suckers by this species.

Improvements to elk habitat are supported by the post-treatment HABCAP analysis of feeding habitat, and summer and winter cover (Table 35). The proposed treatments would improve all elk habitat types by creating more openings and early successional stage forests, and by reducing the extent of denser cover habitat. The availability of feeding habitat would increase from 0.66 to 0.87, while heterogeneity and commensurate resiliency would also increase, improving the sustainability of cover habitat for this species.

Table 35. Elk HABCAP values for existing conditions and possible post-work conditions.

Habitat Usage Type	Potential Habitat	Existing Habitat Capability	Existing HCI	Post-work Habitat Capability	Post-work HCI	HCI Change
Feeding	27,207	18,038	0.66	23,748	0.87	+0.21
Summer Cover	41,469	53,430	1.29	41,884	1.07	+0.22
Winter Cover	24,394	31,473	1.29	25,088	1.07	+0.22

The HABCAP analysis is intended to provide sufficient cover and feeding habitat across the landscape, but does not address the proximity of these habitat types. Hiding cover requirements partially address the need for cover and feeding habitat to be adjacent to each other. Hiding cover is best evaluated in the field on a site-by-site basis, as hiding cover requirements could be met by a host of features that reduce animal visibility, such as tree cover, dense understory, topography, and rocky terrain. Habitat Effectiveness uses the HABCAP calculations but incorporates road density. For this analysis, habitat effectiveness was not measured, as no new system roads are planned under this alternative.

Big game thermal cover provides both hiding cover and a degree of protection from extreme temperature fluctuations. Thermal cover is calculated by adding the acreage of all forested cover types with at least 75% canopy closure, and half the acreage of forests with at least 40% canopy cover (Table 4). Most of the treatments proposed under this alternative reduce thermal cover to some degree, as stand density is not consistent with the historic range of variability or other management goals. The proposed fuels reduction treatments, the introduction of more age classes through thinning, and the creation or reestablishment of openings, are often in opposition to thermal cover requirements. The post-treatment thermal cover values are estimated based on the greatest extent of vegetation management under this alternative. Even under this scenario, thermal cover is not expected to be reduced below Forest Plan requirements. In addition, the post-treatment reduction of thermal cover would generally be limited, as treatments would likely increase thermal cover in pole and mature stands in the long-term (i.e., beyond 10 years) due to the creation of available growing space and the release of partially- or fully-suppressed trees.

Table 4. Existing big game thermal cover and estimated post-treatment thermal cover in the UMC project area.

Management Areas	Forest Plan Requirement	Forested Area (acres)	Existing Thermal Cover (acres)	Existing Thermal Cover %	Post-work Thermal Cover (acres)	Post-work Thermal Cover %
4B and 5B	30%	8,444	3,077	36.4	2,684	31.7
All others	20%	51,123	20,250	39.6	11,795	23.1

Rocky Mountain Elk Cumulative Effects

According to Hoover and Wills (1984), in order to support a minimum viable population elk (i.e., 75 individuals), a minimum of 3,000 total acres is required. However, the range and population dynamics of the Eleven Mile herd are well documented (Grigg 2012) and encompass roughly 1,940 square miles (i.e., 1,241,600 acres). The UMC project area encompasses 70,600 acres, roughly 6% of the entire range of the Eleven Mile herd. While the extent of quality habitat within the range of the Eleven Mile herd is not analyzed in this document, it can be assumed that proposed actions in the UMC project area have a relatively small impact on the total available habitat of this herd.

Existing vegetation conditions are evidence that changes in land use patterns and effective fire suppression have modified ecological systems within the UMC landscape. The vegetative conditions within the UMC landscape differ, in both structure and distribution, from historic forest conditions. An overabundance of dense, closed canopy forest and corresponding lack of open forest conditions had created continuous, fairly uniform canopy conditions. High stem density has reduced the vigor of trees, and structure and distribution predispose stands to insect and disease outbreaks. Stands are also at risk of sustained crown fire over large areas due to canopy continuity. In 2012, the Waldo Canyon fire burned about 18,200 acres, of which 10,500 acres occur within the UMC project area. Wildland fire events such as this may substantially increase the amount, quality, and availability of feeding habitat for elk, but also reduce the sustainability of habitat by eliminating cover.

The vegetation management treatments proposed under this alternative would occur in a variety of forest types in order to promote the composition, structure, and function that is more characteristic of desired ecological conditions. The proposed treatments are intended to result in the development of large trees, small and large forest openings, heterogeneous structural characteristics, understory plant diversity and forage productivity, and resiliency to disturbance events. Vegetation management that strives for these conditions would be more resistant and resilient to disturbance events, and provide for the habitat needs of elk by creating feeding habitat while also preserving cover for this species.

Forage quality and quantity greatly influence elk distribution and habitat utilization (Miller 2002, p.437). On-going livestock grazing by domestic cattle occurs within the project area within the Limbaugh allotment. The management of livestock grazing in this allotment is designed with the objective of providing for the habitat requirements of wild ungulates. However, competition between elk and cattle for forage and space can occur where elk range and suitable range for livestock grazing overlap. Due to similarity in diets, large body size, and thus high forage intake, the competition for forage between elk and cattle has the potential to impact forage availability (Miller 2002, p.436). Currently, the suitable range for livestock grazing in the Limbaugh allotment occurs primarily outside of the project area. Although the vegetation management proposed under this alternative would improve the suitability of range within the project area, potential changes to livestock grazing patterns are not expected to influence elk population levels. While the diets of both elk and cattle are similar, competitive interactions may not be significant. In general, cattle tend to use areas with gentle slopes in close proximity to water, without apparent regard for security cover, while elk use steeper slopes at greater distance from water and limited distance from security cover (Miller 2002, p.438). More importantly the project area occurs within the Eleven Mile Elk Data Analysis Unit, E-23. Based on estimated figures, the elk population size within this DAU exceeds the long-term population objective (Figure 16). In order to achieve herd objectives for E-23, the CPW primarily employs hunting seasons to reduce elk populations and manage sex ratios. This management tool is utilized by the CPW throughout E-23, regardless of the presence or absence of permitted livestock grazing. While elk are managed for population and sex ratio objectives, CPW harvest levels will be the principal influence on elk population levels within the project area.

Alternative 2 (Modified Proposed Action): Species Federally Listed as Threatened

Mexican Spotted Owl Direct and Indirect Effects

The vegetation management proposed under Alternative 2 would entail the modification and removal of trees on 7,644 of 22,483 acres (i.e., 34%) within the project area classified as spotted owl Recovery Habitat (USDI FWS 2012, p.265). Spotted owl recovery habitat is currently unoccupied habitat occurring in mixed-conifer, riparian forests, and/or rocky canyons, that has the potential to be used by owls for nesting, roosting, foraging, dispersal, and other life history needs (USDI FWS 2012b, p.274). Various management actions are proposed in stands classified as nest/roost (133 ac.), foraging/non-breeding (6,695 ac.), and riparian (816 ac.). These management actions are not expected to result in the direct injury or mortality of individual Mexican spotted owls. However, the proposed treatments may have indirect effects on this species through the manipulation of potential habitat and by the noise disturbance generated during implementation.

During implementation, the presence of humans and equipment, and the noise generated from these sources, may cause behavioral responses from spotted owls that can reduce vigor and expose this species to threats. For instance, the potential effects of spotted owls reacting to human caused disturbance include increased energetic demands of avoidance flight, displacement in distribution or habitat use, and exposure to diurnal predators. However, the sources of disturbance that can alter the behavior of this species are expected to be limited in duration and extent. The proposed management actions would be performed during daylight hours, avoiding the period in which spotted owls actively forage and are most sensitive to human presence and noise.

Under this alternative, about 6,695 acres (i.e., 88%) of the vegetation management proposed within spotted owl habitat would occur in stands classified as Forested Recovery Habitats that are managed for foraging/non-breeding. These stands have the potential to provide foraging, dispersal, or wintering habitat for this species. However, these stands are generally single-storied and lack the habitat complexity or forest structure to support breeding spotted owls. Despite the disturbance or removal of vegetation within this recovery habitat type, the affected stands would remain suitable for the foraging, dispersal, or the other habitat needs of this species. The key habitat elements of this recovery habitat type would be retained during treatments, as design standards emphasize the retention of large trees, downed woody debris, and snags at the stand level. Tree removal within these stands would also release growing space for understory vegetation (i.e., grass, forbs, and shrubs), which may be used as forage and cover by the prey of this species, while increasing the vigor and promoting the growth of residual trees.

Vegetation management is proposed in stands classified as Forested Recovery Habitats managed for spotted owl nesting or roosting. However, the proposed treatments would affect only 133 of the 2,920 acres (i.e., 4%) of this habitat type within the project area. Within this recovery habitat type, about 44 acres would be removed for powerline clearing and bighorn sheep habitat enhancement. However, the affected stands do not contain the habitat characteristics in which the spotted owl is generally associated with for roosting or nesting, but are a part of larger modeled habitat. The stands proposed for bighorn sheep habitat enhancement are located on slopes with drier aspects and more open conditions, while the stands located within the powerline right-of-way have undergone existing maintenance that has inhibited trees from obtaining the structural features that are characteristic of desired spotted owl habitat, such as multistoried conditions. Within the other 89 acres of nest/roost recovery habitat, the proposed treatments would move stands toward developing more desirable conditions by promoting the growth of residual large trees. Adherence to project design standards during implementation would also ensure the retention of key habitat elements for spotted owl and prey species, including a diversity of tree species, spatial heterogeneity, high basal area, high tree densities, large trees (i.e., >16 or 18 in. dbh), snags, and coarse woody debris.

Riparian and floodplain enhancement and restoration treatments would occur on about 3,940 acres of the project area. About 709 acres of these treatments would occur in stands classified as spotted owl Riparian

Recovery Habitat. Riparian forests are considered to be a key habitat for spotted owl recovery that could frequently be used by this species for foraging, roosting, daily movements, dispersal, wintering, and potentially for nesting (USDI FWS 2012, p.270). The treatments proposed under this alternative would benefit the spotted owl (e.g., regeneration of riparian tree cover) and the prey of this species (e.g., providing dense ground cover for small mammals) by restoring, enhancing, or maintaining riparian conditions at properly functioning condition (USDI USFWS 2012, p. 271).

Under this alternative, non-system road and trail rehabilitation, hillslope stabilization, and stream habitat improvements may be conducted to mitigate existing watershed degradation. In particular, treatments would emphasize limiting soil erosion and the delivery of sediment to stream systems. These management actions may occur independently or in conjunction with vegetation management treatments and would require the use of natural materials found onsite, such as rock and whole trees. These materials may be used for slope and stream bank stabilization, in-stream habitat structures, or other watershed rehabilitation. The trees utilized for these treatments would average between 10 to 14 inches in diameter, and are not expected to have the characteristics (i.e., size or structure) to support spotted owl nesting or roosting, but may be used by this species for foraging or dispersal movements. However, these management actions are not expected to result in stand-level changes to spotted owl habitat. Rather, the stabilization of disturbed soils would promote the development of desirable conditions for this species, especially in the riparian forest habitat type, by facilitating the recovery of herbaceous and deciduous woody vegetation.

Mexican Spotted Owl Cumulative Effects

At present, forested stands in the project area are at increased risk of disturbance events, such as wildfire and insect and disease infestation. An overabundance of dense, closed canopy forest and corresponding lack of open forest conditions has created continuous, fairly uniform canopy conditions. High stem density has reduced the vigor of trees, and structure and distribution predispose stands to insect and disease outbreaks. Stands are also at risk of sustained crown fire over large areas due to canopy continuity. The severity of wildfire events depends on a variety of factors, including fuel conditions (e.g., fuel moisture), location of the ignition, topography, and weather. Wildfire events in the eastern portion of the project area are likely to burn with high intensity and at a high rate of spread due to the presence of steep slopes. These steep slopes are also sites in which spotted owl nest/roost recovery habitat primarily exists.

Under this alternative, the vegetation management proposed within spotted owl recovery habitat would not exceed 7,644 acres (i.e., 34%). However, these treatments would improve the resiliency of up to 22,483 acres of spotted recovery habitat, as well as other forest and riparian types for this species across the project area. The proposed treatments would disrupt the continuity of fuels in the project area by altering stand structure and reducing tree density. Surface and ladder fuels would also be reduced, including in stands located within and in proximity to spotted owl recovery habitat. By performing these treatments across large areas of the UMC project area, the potential spread and severity of wildfire events would be diminished throughout the landscape. Therefore, the resulting conditions would reduce the potential severity of disturbance events that may modify spotted owl habitat.

Vegetation management proposed under this alternative would also accelerate the development of desired conditions in spotted owl recovery habitat by reducing stand density. Reduced competition for nutrients and sunlight would facilitate the accelerated growth of residual trees, as well as promote the growth of understory vegetation that supports a variety of prey species. Stands classified as Forested Recovery Habitats managed for spotted owl foraging and non-breeding habitat would be enhanced on about 6,600 acres, while forested riparian and nest/roost habitat would be improved on about 816 and 89 acres, respectively.

Mexican Spotted Owl Determination of Effects

Under this alternative, the spotted owl may be indirectly affected through the manipulation of potential habitat and by the noise disturbance generated during implementation. However, despite the disturbance or removal of vegetation within spotted owl recovery habitat, the affected stands would retain the essential habitat elements necessary to be utilized by this species. In addition, the proposed treatments would move stands toward developing more desirable conditions by promoting the growth of residual trees and understory vegetation. Therefore, Alternative 2 *may affect,* but is *not likely to adversely affect* the Mexican spotted owl or the critical habitat of this species.

Preble's Meadow Jumping Mouse Direct and Indirect Effects

The vegetation management proposed under Alternative 2 is not expected to degrade habitat conditions or result in the direct injury, mortality, or permanent displacement of individual Preble's meadow jumping mice. Design standards were developed for this project with the purpose of minimizing the potential effects of the proposed management actions on individuals and the habitat of this species. Adherence to these standards would reduce the likelihood of individuals being affected during implementation, as well as minimize the potential modification of the upland and riparian vegetation in which the Preble's meadow jumping mouse is associated. For instance, the proposed management actions would not impact known Preble's sites, as the design standards prohibit management actions within the critical habitat of this species. In addition, a timing restriction would minimize the potential for management actions to disturb Preble's breeding, feeding, or sheltering, if present within modeled habitat.

When implementing the proposed fuel breaks and Gambel oak mitigation treatments within stands modeled as potential habitat, the use of machinery or ground-disturbing equipment would be confined to the hibernation period of November 1st through May 1st. However, the use of manual methods to conduct these treatments would be permitted within this habitat type during the active period of this species, and may result in temporary effects to individual Preble's. Human presence, equipment, and the noise generated from these sources may cause individuals to respond to the disturbance through avoidance of the specific activity. This may occur in the form of a defense response that is active (i.e. fight or flight) or passive (i.e. inhibition of activity). These behavioral responses affect species through increase energy expenditures or decreased energy acquisition. Human caused changes to species behavior also have the potential to expose species to an increased risk of predation. However, the effects of the proposed treatments on individuals are expected to be minimal within the potential habitat of this species.

The intent of these proposed treatments is to reduce non-riparian vegetation types, avoiding riparian sites with dense, herbaceous vegetation and a mature shrub component. Since these actions would not impact riparian vegetation, the proposed management actions are not expected to impact the day nests utilized by this species during the active period. In addition, the treatments proposed in upland habitats would be conducted during daylight hours, thus avoiding the period in which this species utilizes these areas for foraging. Since personnel are unlikely to encounter individual Preble's while conducting vegetation management treatments, the impacts to this species are expected to be negligible.

Preble's Meadow Jumping Mouse Cumulative Effects

The vegetation management proposed under this alternative is not expected to contribute to the decline in the extent or quality of Preble's habitat. Rather, these treatments would reduce the potential severity of disturbance events within the project area that may modify the habitat of this species. The proposed treatments would disrupt the continuity of fuels in the project area by altering stand structure and reducing tree density. Surface and ladder fuels would also be reduced, including in stands located in proximity to Preble's habitat. By performing these treatments across large areas of the UMC project area, the potential spread and severity of wildfire events would be diminished throughout the landscape. Therefore, the resulting landscape conditions would reduce the potential effects of disturbance events on 59 and over 2,000 acres of the critical and potential habitat of this species, respectively. The potential effects of disturbance events on the habitat of this species would also be reduced outside of the project

area, including the critical habitat located along Trout Creek, as well as occupied habitat in Monument Creek and the associated tributaries located throughout the United States Air Force Academy.

Preble's Meadow Jumping Mouse Determination of Effects

Under this alternative, individual Preble's may be indirectly affected through the manipulation of potential upland habitat and by the noise disturbance generated during implementation. However, the proposed vegetation management is not expected to degrade habitat conditions or result in the direct injury, mortality, or permanent displacement of individual Preble's meadow jumping mice. With the incorporation of project design standards that require timing restrictions and prohibit the removal of riparian vegetation within modeled habitat, as well as the exclusion of management actions within critical habitat, the potential impacts of the proposed action on this species are expected to be negligible. Therefore, Alternative 2 may affect, but is not likely to adversely affect the Preble's meadow jumping mouse, and would have no effect on the critical habitat of this species.

Alternative 2 (Modified Proposed Action): Sensitive Species

Rocky Mountain Bighorn Sheep Direct and Indirect Effects

The vegetation management proposed under Alternative 2 is not expected to degrade habitat conditions or result in the direct injury, mortality, or permanent displacement of individual Rocky Mountain bighorn sheep. However, the presence of humans and equipment, and the noise generated from these sources during implementation may cause behavioral responses from this species. The potential effects of human caused disturbances on bighorn sheep include increased energy expenditures and decreased energy acquisition, and displacement in distribution or habitat use. However, management actions that may modify the behavior of this species are expected to be limited, as the stands in which treatments are proposed are in a closed condition and are not conducive for bighorn sheep occupancy. Similarly, the proposed treatments are located outside of areas in which the Rampart herd is concentrated, such as the Waldo Canyon burned area. Disturbances to bighorn sheep reproduction efforts are also not anticipated, as the proposed treatments do not occur within the known lambing sites of the Rampart herd.

Forest succession has degraded the habitat conditions in the project area required for bighorn occupancy, as well as for movement between suitable habitat (e.g., lambing sites). Densely forested stands are rarely used by bighorn sheep as conditions inhibit forage and visibility for this species. Visibility is an important habitat variable for bighorn sheep, to the extent that the structure and height of vegetation that facilitates the detection of predators may be more important than composition of plant species (Beecham et al. 2007, p.21). The suppression of wildfire has permitted the structure and density of vegetation within the historic range of the Rampart herd to develop conditions in which forage availability is limited and the vulnerability of bighorn sheep to predation has increased. Under this alternative, the proposed thinning treatments, and openings created or enhanced, may improve the suitability of habitat conditions for this species. In particular, the treatments proposed in the ponderosa pine – Douglas-fir forest ecological system may create openings up to 40 acres in size, which may provide improved forage and horizontal visibility in the affected stands. However, the potential benefits of vegetation management to this species would be most pronounced where these treatments are conducted in proximity to occupied bighorn sheep habitat. In contrast, the bighorn sheep habitat improvements proposed under this alternative are designed specifically to expand the habitat base for the Rampart herd. These treatments target about 320 acres of stands located on steeper slopes (i.e., >45%) within moderate-density ponderosa pine/Douglas-fir and dry-mesic mixed conifer forest. The stands proposed for treatment are also located in proximity to escape terrain and are within the suspected movement corridors between the lambing areas of the Rampart herd. The application of mechanical and manual methods, and prescribed burning to reduce tree and shrub cover or encroachment, may displace individual bighorn sheep. However, with the incorporation of timing restrictions, the potential impacts of these treatments on this species would be minimized. Rather, reducing forest encroachment and creating more open habitat conditions would benefit the Rampart herd by providing increased forage and reduced competition with other wild ungulates, improved visibility to

avoid predation, and enhanced connectivity between existing lambing sites. When feasible, periodic prescribed burning in the treatment units would also benefit bighorn sheep by maintaining open conditions, and improve forage quality and production, particularly when located adjacent to escape terrain and currently utilized areas.

Rocky Mountain Bighorn Sheep Cumulative Effects

In 2012, the Waldo Canyon fire burned about 18,200 acres, of which 10,500 acres occur within the UMC project area. Wildland fire events such as this may substantially increase the amount, quality, and availability of habitat for bighorn sheep, particularly when located in proximity to areas occupied by this species. Under this alternative, vegetation management treatments would disrupt the continuity of fuels in the project area by altering stand structure and reducing tree density. By performing these treatments across large areas of the UMC project area, the likelihood of wildfire events that may benefit this species would be diminished throughout the landscape. However, the treatments proposed under this alternative may also facilitate an expansion in the range of the Rampart herd that wildland fire may provide. For instance, an area north of Blodgett Peak that was used by this herd historically, remained unburned by the Waldo Canyon fire. The proposed bighorn sheep habitat improvements are designed to encourage sheep dispersal by improving habitat connectivity between occupied sites, the Waldo Canyon burned area, and unburned areas north of the burn perimeter. Improving habitat quality for this species provides for resiliency that would not exist if habitat were marginal (Beecham et al. 2007, p.74). The reestablishment of historic use patterns of the Rampart herd would also be expected to result in a larger, more dispersed bighorn sheep herd, and thus a more resilient population that would be less susceptible to disease, human disturbance, and interactions with domestic animals.

According to Beecham et al. (2007), one of the more important activities that directly affect bighorns is domestic livestock grazing in bighorn sheep habitat. Bighorns are negatively impacted by disease transmission from domestic livestock, especially domestic sheep and goats. On-going livestock grazing occurs within the project area within the Limbaugh allotment, but consists solely of grazing by domestic cattle. Cattle grazing has the potential to result in a reduction of forage and space available to bighorn sheep by reducing the abundance and availability of preferred forage species and forcing them to compete with other wild ungulates for forage on summer and winter ranges (Beecham et al. 2007, p.74). However, the bighorn sheep habitat improvements proposed under this alternative do not occur within the Limbaugh allotment. Existing livestock grazing is also not expected to have any influence on potential bighorn sheep dispersal or habitat use patterns, as the suitable range for livestock grazing in the Limbaugh allotment occurs primarily outside of the project area. This alternative would also not influence the potential for domestic animals located in the City of Colorado Springs to interact with bighorn sheep within the project area.

Human recreational activities, especially hikers with dogs, and urban development are other factors that may influence the Rampart herd (Beecham et al. 2007, p.44). Human disturbance and human presence near lambing sites may be detrimental to bighorns in some locales (Beecham et al. 2007, p.37). A recent housing development located north of the Air Force Academy, and immediately east of the project area, is being established that will consist of about 475 homes on a 900 acre area. This housing development is a potential source of increased human activity within the eastern portion of the project area, but is not expected to impact bighorn sheep lambing opportunities in the near future.

Rocky Mountain Bighorn Sheep Determination of Effects

Under this alternative, bighorn sheep may be indirectly affected by the presence of humans and equipment, and the noise generated from these sources during implementation. However, the stands in which treatments are proposed are in a closed condition and are not conducive for bighorn sheep occupancy. In addition, with the incorporation of timing restrictions, the potential impacts of these treatments on this species would be minimized. The thinning treatments, and openings created or enhanced under this alternative may improve the suitability of habitat conditions for this species. These treatments may expand the habitat base for the Rampart herd by increasing forage, improving visibility, and enhancing connectivity between existing lambing sites. Therefore, Alternative 2 *may adversely*

impact individuals, but is not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing of the Rocky Mountain bighorn sheep.

Western Bumblebee Direct and Indirect Effects

The vegetation management proposed under Alternative 2 would entail the modification and removal of trees on approximately 21,606 acres of the 70,600 acre project area. An additional 2,285 acres will be managed using prescribed burning. The combination of tree removal and prescribed burning will help create new and expand existing openings. This activity would stimulate grass, forb, and shrub development while also improving habitat connectivity for the western bumble bee. While these management actions will ultimately create a more suitable habitat, using prescribed fire may result in killing bees that are in the area at the time of the burn. However, prescribed burns, especially in wetter meadow areas, would result in a mosaic pattern of the ground fuels burned and would burn at a much lower intensity than wildfire, resulting in a reduction of the potential negative impacts associated with burning. The grasses and forbs in these areas would also regenerate quickly and ultimately improve resiliency, connectivity, and diversity thereby creating a more suitable habitat for the bumble bee.

It is currently unknown if the western bumble bee occurs within the UMC project area. Additionally, it is very difficult to survey for the species, or to even find their nests. As a result, implementation may be carried out in areas that are unknowingly occupied by the western bumble bee. During the mechanical removal of trees, it is possible that the heavy machinery may run over and crush nest sites. The human caused disturbance may also cause any present bumble bees to leave the area which would result in increased energy expenditures and displacement in distribution or habitat use. The sources of disturbance that can alter the behavior of this species are expected to be limited in duration and extent. However, the subsequent disturbance to the ground may promote the establishment of invasive plant species that would outcompete the native flora species that the western bumble bee relies upon. In the event that invasive species establishment is evident, measures would be taken to eradicate and prevent their spread, including spraying herbicide and the potential seeding with native flora species.

Western Bumblebee Cumulative Effects

Under this alternative, the vegetation management proposed would improve a significant amount of potential western bumble bee habitat through thinning and prescribed burning. These proposed treatments would reduce the potential spread and severity of wildfire events across the UMC project area while also expanding potential bumble bee habitat and increasing connectivity. Ultimately, the resulting conditions would reduce the potential for and severity of disturbance events that may undesirably alter western bumble bee habitat. This proposed action would also accelerate the development of desired western bumble bee habitat conditions by increasing meadow size and prevalence while decreasing conifer encroachment and habitat fragmentation.

Western Bumblebee Determination of Effects

Under this alternative, the western bumble bee may be indirectly affected through the manipulation of potential habitat. However, despite the disturbance or removal of vegetation, the affected meadows would retain the essential habitat elements necessary to be utilized by this species. In addition, the proposed treatments would move openings towards developing more desirable conditions by promoting the growth of meadow flora while reducing conifer encroachment and habitat fragmentation. Therefore, Alternative 2 *may adversely impact individuals, but is not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing* the western bumble bee.

Bald Eagle Direct and Indirect Effects

The vegetation management proposed under Alternative 2 is not expected to degrade habitat conditions or result in the direct injury, mortality, or permanent displacement of individual bald eagles. However, the presence of humans and equipment, and the noise generated from these sources during implementation, may cause behavioral responses from bald eagles. These behavioral responses can affect species through

increase energy expenditures, decreased energy acquisition, and reduced productivity. For instance, the potential effects of bald eagles reacting to human caused disturbance include increased energetic demands of avoidance flight and displacement in distribution or habitat use. The effects of noise disturbance would be most detrimental to this species when treatments are conducted near potential nesting habitat and foraging sources, such as Rampart Reservoir. However, the potential for the proposed treatments to effect this species are expected to be minimal with the incorporation of site-specific project design standards. These design standards would establish protection zones and timing restrictions at active bald eagle nest or roost sites if present within the project area.

Bald Eagle Cumulative Effects

At present, forested stands in the project area are at increased risk of disturbance events, such as wildfire and insect and disease infestation. An overabundance of dense, closed canopy forest and corresponding lack of open forest conditions has created continuous, fairly uniform canopy conditions. High stem density has reduced the vigor of trees, and structure and distribution predispose stands to insect and disease outbreaks. Stands are also at risk of sustained crown fire over large areas due to canopy continuity.

The proposed treatments would disrupt the continuity of fuels in the project area by altering stand structure and reducing tree density. By performing these treatments across large areas of the UMC project area, the potential spread and severity of wildfire events would be diminished throughout the landscape. The resulting conditions would reduce the potential severity of disturbance events that may modify potential bald eagle habitat. The potential effects of disturbance events on the habitat of this species would also be reduced for features located near the project area, including the nest site located west of the project area.

While the proposed action is intended to improve the resiliency of stands in the project area to disturbance events, these treatments would also enhance habitat conditions for this species. The array of vegetation management treatments proposed under this alternative would promote the development of large trees, small and large forest openings, and heterogeneous structural characteristics. As stand density is decreased, a reduction in competition for nutrients and sunlight would facilitate the accelerated growth of residual trees. The created or enhanced openings may also improve the suitability of potential nesting habitat in proximity to large bodies of water, such as Rampart Range Reservoir.

Although potential nesting habitat exists in the project area, especially along the forested edges of reservoirs, high disturbance levels may preclude bald eagle use of the area for nesting. Existing sources of disturbance at reservoirs includes routine maintenance, construction projects, and recreational activities. Military training operations involving low-flying aircraft are regularly conducted in the vicinity, adding an additional dimension of disturbance. The vegetation management proposed under this alternative would result in an additional source of disturbance. However, the disturbance caused by these treatments would be limited in duration and would not create a lasting deterrent to bald eagle occupancy.

Bald Eagle Determination of Effects

Under this alternative, the bald eagle may be indirectly affected by the presence of humans and equipment, and the noise generated from these sources during implementation. However, with the incorporation of project design standards that require protection zones and timing restrictions, the potential impacts of the proposed treatments on this species are expected to be minimal. The vegetation management proposed under this alternative would also reduce the risk of large-scale disturbance events, while promoting the development of desirable habitat conditions for this species. Therefore, Alternative 2 *may adversely impact individuals, but is not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing* of the bald eagle.

Northern Leopard Frog Direct and Indirect Effects

The vegetation management proposed under Alternative 2 is not expected to degrade habitat conditions or result in the direct injury, mortality, or permanent displacement of individual northern leopard frogs.

Wetland and riparian habitats are essential to the life cycle of this species. The northern leopard frog is particularly susceptible to disturbance within breeding sites due to high species concentration and limited mobility. Under this alternative, direct effects to egg masses, tadpoles, or individual frogs are not anticipated as the proposed mechanical treatments would not occur in suitable breeding habitats. However, this species may be indirectly affected if the proposed treatments result in the alteration of wetland and riparian communities.

The vegetation utilized by this species for cover may be reduced during prescribed fire treatments. However, the effects of the prescribed fire treatments on the potential habitat of this species are expected to be minimal due to ignition methods and site conditions. Ignition in proximity to the riparian grass and shrubs in which this species is associated is generally performed outside this vegetation type, but allowed to back in to these areas. Although the northern leopard frog has limited mobility, these riparian grass and shrubs generally have higher fuel moisture and do not carry fire as well, and do not burn as completely or as intensely as dryer sites. In addition, prescribed fire treatments conducted during the fall season would coincide with a time in which this species is unlikely to occupy these habitats. Prescribed burning may also enhance riparian grass and shrubs by improving vegetation structure, as well as inhibiting the encroachment of coniferous species into these riparian areas.

The riparian and floodplain enhancement and restoration proposed under this alternative may entail ground disturbance within the potential habitat of this species. However, some of the proposed treatments target ephemeral and intermittent drainages, which do not contain the riparian vegetation and standing water required by this species for breeding. The treatments that occur within riparian areas would generally occur within sites in which riparian conditions are degraded, such as where roads are contributing sediment to the system due to inadequate drainage. The habitat conditions for this species would also be improved in locations where these treatments result in the development or expansion of wetland and riparian areas. This would benefit the northern leopard frog by providing improved water quality and foraging opportunities. The removal of conifer encroachment from riparian corridors and willow planting would also improve watershed functionality. These treatments are not expected to result in the removal of vegetation that functions to impede the movement of sediment into potential leopard frog habitat. Rather, the proposed treatments would reduce accelerated sediment yields by developing an effective riparian vegetation buffer with adequate floodplain access that would function to slow runoff and prevent erosion. The management actions proposed under this alternative would ultimately enhance habitat conditions in the project area if occupied by this species.

Northern Leopard Frog Cumulative Effects

The vegetation management proposed under this alternative would disrupt the continuity of fuels in the project area by altering stand structure and reducing tree density. The resulting stand conditions would reduce the risk of widespread disturbance events, such as insect and disease outbreaks or wildfire. Vegetation that is maintained or enhanced within or near drainages and riparian areas would continue to function to impede sediment movement into potential leopard frog habitat. By performing these treatments across large areas of the UMC project area, the potential spread and severity of wildfire events would be diminished throughout the landscape. The potential effects of disturbance events on the potential habitat of this species would thereby be reduced, including to occupied habitat located outside of the project area in Trout Creek.

Northern Leopard Frog Determination of Effects

Under this alternative, the northern leopard frog may be indirectly affected as proposed treatments would occur within wetland and riparian communities. However, the proposed vegetation management is not expected to degrade habitat conditions or result in the direct injury, mortality, or permanent displacement of individual northern leopard frogs. The array of vegetation management treatments proposed under this alternative would result in the development or expansion of wetland and riparian areas, while also reducing the risk of large-scale disturbance events. Therefore, Alternative 2 *may adversely impact*

individuals, but is not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing of the northern leopard frog.

Fringed Myotis, Hoary Bat, Townsend's Big-eared Bat, American Peregrine Falcon, Flammulated Owl, Northern Goshawk, and Olive-sided Flycatcher Direct and Indirect Effects

The vegetation management proposed under Alternative 2 has the potential to result in the direct harm to individuals of this group of species. These species may also be indirectly affected through the manipulation of habitat and by the noise disturbance generated during implementation of this alternative. The significance and magnitude of effects on species or habitat are dependent on the type, location, extent, intensity, duration, frequency, and timing of the activity. Site-specific project design standards or conservation measures would avoid or minimize the potential effects of the proposed management actions on these species. Sustainable habitat conditions for these species are expected to be maintained through application of these measures.

The vegetation management treatments employed under this alternative would promote more sustainable forest stand conditions by altering the distribution and structure of forest vegetation within the UMC project area. However, these treatments would entail the modification and removal of live, as well as dead-standing trees. Live tree removal would be performed through mechanical treatments employing ground-based logging techniques, or a combination of mechanical and manual methods, while dead-standing trees would primarily be removed inadvertently during prescribed fire treatments. Although the prescribed fire treatments may remove snags, these treatments may also result in the creation of snags as live trees are weakened or killed. The inadvertent removal of cavity trees may also occur as a direct or indirect result of mechanical equipment operations. Snags may be downed as equipment is operating or as live trees are felled. However, the snags impacted by this action are generally abundant, small in diameter, and are absent of cavities, and therefore have limited value to these species for foraging, reproduction, or refuge.

Tree removal may have negative effects on the species that utilize snags for roosting or nesting, such as the fringed myotis or flammulated owl, and species that use tree crowns for nesting, foraging, or roosting, such as the olive-sided flycatcher, hoary bat, or northern goshawk. The extent of these effects would depend on the timing of these treatments. If the proposed treatments are conducted during the fall or winter periods, effects on these species are expected to be negligible. The flammulated owl and olive-sided flycatcher are migratory, while the hoary bat is not known to hibernate in the state and the fringed myotis typically uses caves and mines as hibernacula. If treatments occur during the spring or summer periods, these species may be harmed or displaced, and potential nest or roost sites may be eliminated. However, the application of project design standards during implementation would minimize the potential effects of the proposed vegetation management on these species.

Project design standards would require the protection of live or dead trees containing cavities, active nest sites, and roost sites during implementation. Deferring treatments during the peak nesting period for breeding birds of April 1st through July 15th would also minimize potential negative impacts to these species, but this alternative does not preclude treatments during this period when necessary. Rather, project design standards would emphasize the retention of large trees and snags within treatment areas. The recruitment of dead standing trees, partially dead trees, and downed woody debris may also be accelerated through deliberate tree manipulation in areas deficient of these features. This proposed habitat enhancement, in conjunction with the application of design standards into the proposed vegetation management, would ensure the availability of the following habitat components within the treatment areas: potential nest cavities in snags or dead portions of live trees for the flammulated owl; foraging perches in the form of snags or dead tops of live trees for the olive-sided flycatcher; large snags with features that may be used a roost sites by the fringed myotis; and trees with large crowns that may be used as roost sites by the hoary bat and nest sites by the northern goshawk. The potential impacts of the proposed vegetation management on these species would also be limited at both spatial and temporal scales. Despite the removal of live and dead standing trees, these habitat components would continue to

exist in the project area and in the vicinity, and would remain unaffected by the proposed treatments. For example, stands located on steep slopes and drainages would be less accessible for tree removal.

Human presence, equipment, and the noise generated during implementation may have indirect effects on these sensitive species. These sources of disturbance may cause behavioral responses from these species that result in reduced vigor and increased exposure to threats. Potential effects to these species include increases in energy expenditures, displacement of individuals while foraging or during nesting (i.e., flushing adults off a nest while incubating eggs or tending to nestlings), and exposure to diurnal predators. For instance, the proposed vegetation management would not alter the vertical rocky features utilized by the peregrine falcon as nest sites, but smoke and noise disturbance may displace individuals. However, the application of design standards that establish protection zones and timing restrictions at active nest sites would minimize the potential for negative effects to breeding raptors.

The vegetation management proposed under this alternative would also promote the development of desirable habitat conditions for these species through reduced stand density. Thinning treatments would create small interspatial openings between trees, while group selection methods would create or enhance larger openings. Reduced competition for nutrients, moisture, and sunlight would improve the vigor and growth of residual trees, as well as promote the productivity and diversity of understory vegetation. Prescribed fire treatments would also promote a greater diversity in tree composition and age classes, and an improved composition and diversity of understory vegetation. The combination of these treatments would move stands in the project area toward the development of a more desirable and historic open forest structure and fire regime. These open stand conditions would improve the foraging ability of the hoary bat, and expand the availability of potential breeding and foraging habitat of the flammulated owl. The more heterogeneous stand conditions would also provide improved foraging opportunities for the northern goshawk. The opening of dense understory vegetation would improve the habitat conditions for the prey of this species. The Townsend's big-eared bat and the olive-sided flycatcher would also benefit from the potential increases in insect biomass, abundance, and richness due to created forest edge. The anticipated changes in vegetation composition or structure can also alter the abundance and diversity of insect prey base. However, the project area is large and contains a mosaic of stand conditions situated in a variety of arrangements, allowing for species to adjust to shifts in local prey abundance.

Cumulative Effects

At present, forested stands in the project area are at increased risk of disturbance events, such as wildfire and insect and disease infestation. An overabundance of dense, closed canopy forest and corresponding lack of open forest conditions had created continuous, fairly uniform canopy conditions. High stem density has reduced the vigor of trees, and structure and distribution predispose stands to insect and disease outbreaks. Stands are also at risk of sustained crown fire over large areas due to canopy continuity. Large-scale wildfire events have the potential to result in the widespread loss of habitat for most of these sensitive species.

Under this alternative, the proposed treatments would disrupt the continuity of fuels in the project area by altering stand structure and reducing tree density. By performing these treatments across large areas of the UMC project area, the risk of insect and disease outbreaks would be reduced, and the potential spread and severity of wildfire events would be diminished throughout the landscape. The potential effects of disturbance events on the habitat of these species would also be reduced outside of the project area.

The lower montane forests of the UMC project area contain fewer openings and large snags than desired, with the exception of areas impacted by insect and disease outbreaks and wildfire. The olive-sided flycatcher frequently nests in early successional post-fire forests, but usually does not occur in closed canopy forests, and is uncommon in forests in the sapling-pole or mature forest stages that lack gaps or edges (Kotlier 2007). This species responded favorably to the Waldo Canyon fire of 2012, which created large acreages of primarily early-seral forest. However, these early-seral stands are concentrated in the southern portion of the UMC project area. Historically, early-successional forests were smaller in scale and spatially distributed throughout the landscape. The juxtaposition of mature trees and forest openings

is an important habitat attribute for this species (Kotlier 2007). Under this alternative, the proposed prescribed fire treatments would be conducted under the parameters of a burn plan, which generally limits fire severity. Low-severity fires have less potential to create forest gaps (i.e., post-fire tree mortality is low) than high-severity fires, and consequently, would be less beneficial to this species (Kotlier 2007). However, the array of vegetation management treatments proposed under this alternative would promote the development of large trees, small and large forest openings, and heterogeneous structural characteristics. While the proposed action is intended to improve the resiliency of stands in the project area to disturbance events, these treatments would also ensure that habitat for the olive-sided flycatcher, as well as other sensitive species, is retained or enhanced, and well distributed throughout the UMC project area.

Determination of Effects

Under this alternative, sensitive species may be indirectly affected through the manipulation of potential habitat and by the noise disturbance generated during implementation. These species may be displaced, and nesting or roosting habitat may be impacted. However, with the application of project design standards, these effects would be minimized. The vegetation management proposed under this alternative would also promote the development of desirable habitat conditions for these species. Therefore, Alternative 2 *may adversely impact individuals, but is not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing* of the fringed myotis, hoary bat, Townsend's big-eared bat, American peregrine falcon, flammulated owl, northern goshawk, and olive-sided flycatcher.

Heritage Resources

Current Conditions

Cultural resources include prehistoric and historic archaeological and architectural structures, features, and objects, as well as Native American traditional cultural and religious properties and properties important to other cultural groups. Prehistoric properties include lithic scatters, quarries, temporary camps, extended camps, wickiups, hunting/kill/butchering sites, processing areas, rock shelters, formative era stone structures, caves, rock art panels, trails, and isolated finds. Historic properties include homesteads, trails and roads, irrigation ditches, reservoirs, mining sites, corrals, line camps, cabins, trash scatters, and isolated finds. Together these properties represent human use of the area by Native American and Euroamerican cultures, covering a timeframe from the Paleoindian period (13, 4000 B.P) through the present.

Resource Conditions

The condition of a cultural resource is assessed through field observation, inventory, and project review. The primary indicator is whether the characteristics that would qualify a resource for listing on the NRHP, or the cultural values of an area important to Native American or other traditional communities, have been lost or diminished. These characteristics can be affected by physical destruction, damage, neglect, alteration, isolation, transfer, sale, or lease of a resource, or modification of the resource setting. Specific indicators include the extent or intensity of natural weathering, erosion, wildfire, ground disturbance, grazing, recreation use, and unauthorized collection, intrusion, and vandalism. This kind of loss affects the completeness and accuracy of the scientific information that can be derived from a resource, the aesthetic, historic, or interpretive value of a resource, and the importance of a resource in maintaining social and cultural traditions.

The prehistoric site types expected to be present in the project planning area include open lithic scatters and architectural sites, sheltered camps and habitations, quarries, and rock art panels. To date, only two types of prehistoric site types have been recorded: open and sheltered lithic scatters. Both site types are very similar in that they contain a scattering of artifacts, and no architectural features. However, other features, such as hearths, may be present. Hearths often contain material that can be used to date a site.

Thus, sites containing hearths are often recommended as eligible for listing on the NRHP because they have the potential to provide additional scientific information beyond what can be seen on the surface.

Historic site types expected to be found in the project area include those associated with mining, transportation, homesteading, ranching, recreation, logging, water conveyance, and civilian conservation corps activities (CCC).

Since the 1970's, various large and small cultural projects have been conducted in the planning area. A total of forty studies have been completed, which resulted in 8,410 acres being surveyed for cultural resources. The projects included those for timber sales, ecosystem management, seismograph studies, power lines, fuels reduction, post-fire restoration, and wildlife habitation improvement, among others. In addition, the proposed project area includes The Monument Nursery, which is a part of a larger historical district that is listed on the State Register of Historic Places, and is Officially Eligible for listing on the NRHP. Various projects have been conducted specifically on the Monument Nursery, and its associated historic buildings.

The cultural resource surveys conducted to date have resulted in the identification and recordation of sixty-two archaeological sites. The sites are predominately historic resources (n = 52), with a small representation of prehistoric sites (n = 10). In addition, twenty-eight isolated finds were recorded. Again, the majority of which are historic (n = 22), compared with prehistoric resources (n = 6). Of the total sites recorded, eight are considered officially eligible for listing on the NRHP, while seven are recommended as "needs data officially". Sites that are recommended, or officially determined, as needing more data must be treated as eligible until a professional archaeologist who meets the Secretary of the Interior Standards can re-evaluate the eligibility determination and consult with the Colorado State Historic Preservation Office (CO SHPO). In addition, ten sites do not have a recommended eligibility determination so they must be re-evaluated prior to any project undertaking.

Two open lithic sites previously recorded in the project area are officially eligible for listing on the NRHP, while, one needs more data and four are not eligible. Three sheltered sites documented did not have an evaluation given when they were recorded in 1975. Given that these sites were recorded nearly forty years ago, they will need to be re-recorded and evaluated for an NRHP determination prior to implementation of the project.

Alternative 1 (No Action): Cultural

Direct and Indirect Effects

All of the prehistoric and historic sites, known and unknown, are vulnerable to large scale disturbance events such as wildland fire. The historic sites that contain wooden elements are particularly vulnerable to fire events. The no action alternative would not provide any oppurtunities to futher locate or protect sites vulnerable to fire given that fire risk would remain high throughout the project.

Alternative 2 (Modified Proposed Action): Cultural

Direct and Indirect Effects

All of the prehistoric and historic sites types already recorded, or expected to be found in the project area are vulnerable to the direct effects from forest restoration treatments that may include mechanical thinning with product removal, mastication, hand thinning, and prescribed fire to create the desired conditions for ecosystem diversity. The historic sites that contain wooden elements are particularly vulnerable to fire, albeit wildland fire events pose a larger risk when compared to managed fire events. All project associated activities that include ground disturbance, such as road construction and/or improvements, construction and decommissioning of trails, and mechanical fuels treatments, have the potential to damage archaeological features, uncover buried sites, and displace and/or damage artifacts. As proposed project activities are determined, heritage resource processes would be followed prior to

implementation. Project design criteria and mitigation measures can be implemented to avoid or mitigate adverse effects to these sites. However, if an eligible site cannot be avoided, mitigation would be developed with the OAHP / State Historic Preservation Officer (SHPO)

Indirect effects that may result from implementation of this project include a potential for access to sites that were previously remote. This may result in increased vandalism to archaeological resources from new and increased recreational opportunities, the unauthorized collection of artifacts, increased erosion, and trampling and disbursement of artifacts as a result of increased foot and vehicular traffic.

Recreation

Access to Project Area

Access to the project area by road from the south is on Rampart Range Road (Forest Road 300) from Garden of the Gods City Park in Colorado Springs and from the north from Sedalia, or on State Highway 67 to the Rainbow Falls area. From the east, the project area is accessible from Monument on Mt. Herman Road (Forest Road 320). From the west the project area is accessible from Woodland Park on Rampart Range Road (Forest Road 300). State Highway 24 provides access from Colorado Springs to Woodland Park.

Unless there is heavy snow in the winter, many of the roads and trails near Colorado Springs, including in the project area, are accessible year-round. The roads and trails higher in elevation in the project area often hold snow into the spring so are less accessible.

Beginning in 2015, a seasonal winter closure was implemented on Rampart Range Road from Garden of the Gods Park to the intersection of Rampart Range Road and Rampart Reservoir Recreation Area Road. Additionally, the north end of Rampart Range Road is closed each winter and spring at the Pikes Peak and South Platte Ranger District boundary.

Developed Recreation

Developed recreation is defined as recreation that takes place in constructed recreation sites, such as campgrounds and picnic areas.

Rampart Reservoir Recreation Area is located in the project area. The recreation area contains two small overnight campgrounds, a picnic area, a boat ramp and parking areas for fishing access. The recreation area is generally open from early May to mid-October. Springdale Campground is a small overnight campground on Rampart Range Road surrounded by private land and is usually open from Memorial Day through Labor Day weekend.

Monument Open Space is located on the east side of the project area west of Monument. A developed trailhead off Mt. Herman Road near the Monument Fire Center provides parking for a network of system and non-system trails around the Fire Center and for the Monument Trail, (#715).

Dispersed Recreation

Dispersed recreation is considered to be all recreation on or off roads and trails that takes place outside of developed recreation sites, such as fee campgrounds and picnic areas where amenities are provided. Dispersed recreation includes hiking, mountain biking, back packing, rock climbing, equestrian use, back country camping, fishing, hunting, off-highway vehicle use, target shooting, sightseeing, and other activities. Dispersed camping is considered camping along roads or trails with no amenities, such as picnic tables or toilets. Dispersed camping is popular along roads off Rampart Range Road and in the Rainbow Falls area.

Dispersed recreation use near urban areas is generally higher, and as areas experience more crowding, more conflicts between users may occur. More regulations may be in place in high use areas to protect resources or for public safety.

In the past few years, there has been an increase in illegal residential campers who live on National Forest lands. This is causing resource damage due to lack of sanitation facilities and large volumes of trash have been left in campsites, which may create bear problems and has become a drain on district personnel to remove the trash.

Trails

Existing non-motorized trails in the project area include:

- Lovell Gulch Trail (#706) is a 4.5 mile loop trail northeast of Woodland Park. The trail is popular for hiking, mountain biking and equestrian use.
- Rainbow Gulch (#714) and Rampart Reservoir (#700) Trails are a 13 mile loop trail that begins on Rampart Range Road east of Woodland Park and travels around Rampart Reservoir. The trail is very popular with mountain bikers. The trail is also used by hikers and equestrians, although horses are not allowed in the Rampart Reservoir Recreation Area. The Rainbow Gulch Trail is used by anglers to access the inlet to Rampart Reservoir for fishing.
- The Monument (#715), Mt. Herman (#716) and Limbaugh (#756) Trails are in the Mt. Herman Road area and are popular for mountain biking, hiking and some equestrian use.
- Schubarth Trail (#721), Stanley Canyon Trail (#707) and West Monument Creek Trail (#713) are trails east and north of Rampart Reservoir. Public access to these trails on the east end of the trails is limited depending on the security level at the Air Force Academy.

Multi-use/Motorized Trails

The Pikes Peak Ranger District Motor Vehicle Use Map (MVUM) designates roads and trails open to highway legal vehicles, roads open to all vehicles, trails open to vehicles 50” or less in width, and trails open to motorcycles only. In the Rainbow Falls area there are 4 motorized trails open to vehicles 50” or less. These include #631 (3.23 miles), #633 (2 miles), #634 (1.5 miles) and #650 (2.3 miles). Trail 650 continues on to the South Platte Ranger District.

Roads

There are approximately 142.9 miles of roads in the project area. 43.2 miles are open to licensed vehicles only and 99.7 miles are open to all vehicles, including unlicensed OHV’s.

Rainbow Falls is a popular off-highway vehicle (OHV) area in the northwest side of the project area. The Rainbow Falls Trailhead and area are accessed from State Highway 67 north of Woodland Park or from Rampart Range Road. The roads in the Rainbow Falls area are open to unlicensed OHV’s. Rainbow Falls is a popular dispersed camping area and many people camp along the roads and ride their OHV’s from their campsites.

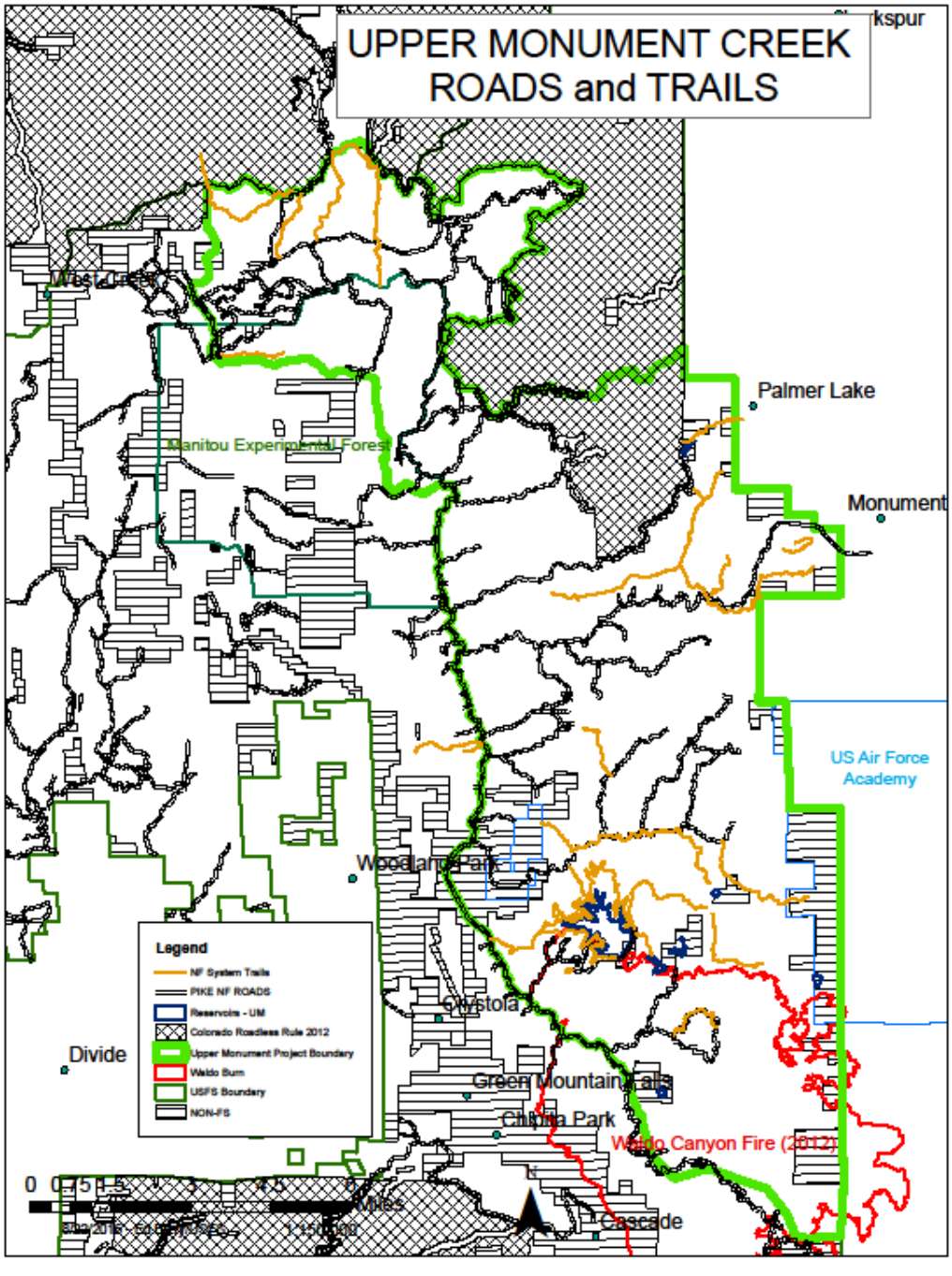


Figure 17. Map of National Forest roads and system trails within UMC.

Many miles of non-system roads and trails (also called unauthorized, undesignated or social roads and trails) exist in the project area. Some of these non-system roads and trails lead from private land onto National Forest lands. These roads and trails were historic routes or were user created and were not designed or built to Forest Service trail standards. By policy, the Forest Service may not spend appropriated funds to maintain or improve non-system roads or trails, however the Forest Service may spend appropriated funds to close non-system roads and trails.

The nature of the trail surface on most roads and trails in the project area, primarily Pikes Peak granite, lends to continual erosion of the road and trail surface and maintenance is needed regularly. Local volunteer groups contribute annually toward maintaining the trails in the project area.

Target Shooting

The National Forest System (NFS) lands on the southern end of the project area from Garden of the Gods Park to Forest Road 322 and the NFS lands in the Rainbow Falls area are closed to target shooting under a Forest Supervisor's Order. Target shooting is a popular activity in the northern end of the project area. Because target shooting is concentrated in the northern end of the project area, the area has experienced degradation from shooting, including damage to trees, increased trash, increased non-system roads, and increased unsafe shooting incidents.

Christmas Tree Cutting Program

The northern end of the project area has been the designated Pikes Peak Ranger District Christmas tree cutting area since 2003. Approximately 4,500 Christmas trees under 6" in diameter have been cut and removed from the cutting area each year. The majority of the Christmas trees have been cut adjacent to roads.

Recreation Special Uses

The project area is used annually by several permitted outfitters and guides and for occasional recreation events. Outfitter and guide special use permits are issued for hiking, mountain biking, backpacking, rock climbing, hunting, and ATV and jeep tours.

The project area is located in a portion of Big Game Management Unit 511 and Sheep Unit 34. Currently, one priority outfitter and guide permit is issued for guided day sheep hunting in Sheep Unit 34. Additionally, one priority special use permit is issued for guided day mountain lion hunting district-wide.

The Beaver Lakes Summer Home Group is located in the project area and consists of 6 privately owned recreation residence cabins that are authorized under special use permits.

Recreation Experience

The sense of creativeness, refreshment and pleasure which the recreationist has while recreating or having a good time can be viewed as the recreationist "realizing satisfactory experiences." The recreationist attains these satisfactory experiences by participating in preferred recreation activities in preferred surroundings or settings. (ROS Users Guide) Expectations of recreationists are influenced by many factors. The quality of a recreation opportunity is judged by how well it leads to the kind of experiences particular types of recreationists' desire. Generally, roads and trails along creeks, rivers or riparian areas, roads or trails that lead to a destination, such as a lake or summit of a mountain, viewing wildlife and scenery, changes in road or trail grade, challenging roads and trails, diversity in forest type, and loop roads and trails all add to a more desirable recreation experience.

The Waldo Canyon Fire on the south end of the project area changed the recreation experience. In the areas where the fire burned with high intensity, the forest canopy is nearly gone. Although the fire improved the views, there is no longer screening or shade around potential dispersed campsites. However, the Waldo Canyon Fire resulted in substantial aspen regeneration and will likely provide a popular scenic drive along the southern end of Rampart Range Road in the fall while the aspen leaves are changing color.

Recreation Opportunity Spectrum

The Recreation Opportunity Spectrum (ROS) is a combination of activities, settings, and probable experiences and provides a framework for recreation managers to define classes of outdoor recreation opportunity environments. The land and water areas of the Forest are inventoried and mapped by ROS

class to identify which areas are currently providing which kinds of recreation opportunities. (ROS Users Guide) The established ROS classes in the project area are Semi-Primitive Motorized, Rural, and Roaded Natural (Figure 18) .

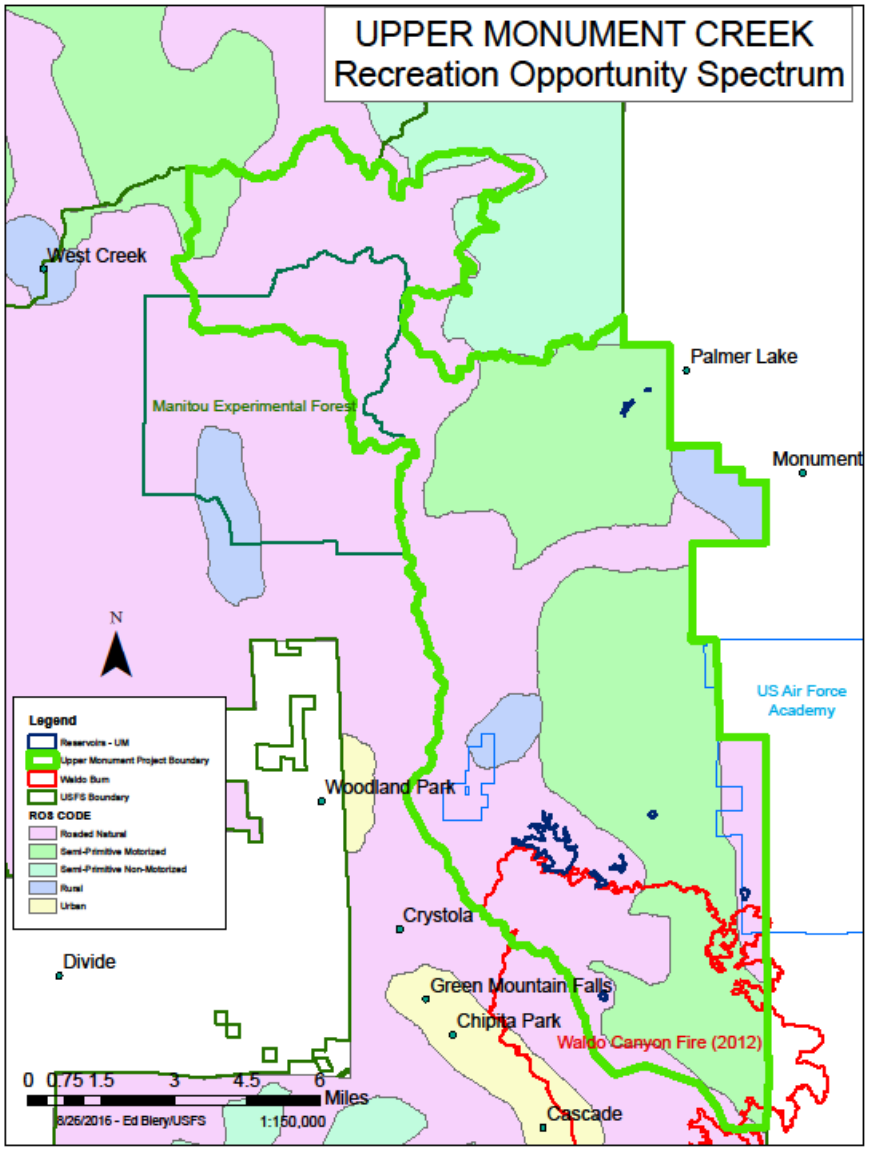


Figure 18. Recreation Opportunity Spectrum Map.

As seen in Table 37 below, Recreation opportunities can be expressed in terms of three principal components: the activities, the setting, and the experience.

Table 37. ROS classes and activities in the project area.

	Semi-primitive Motorized	Roaded Natural	Rural
Activity	Hiking, horseback riding, motorcycling, mountain biking, viewing scenery,	Hiking, horseback riding, motorcycling, automobiles, train and	Hiking, horseback riding, motorcycling, automobiles, train and bus touring,

	camping, hunting, cross country skiing, snow shoeing	bus touring, bicycling, viewing scenery, camping, hunting, resort and commercial services, cross country skiing, snow shoeing. Access and travel is conventional motorized, including sedan, trailers, RV'S and some motor homes.	bicycling, viewing scenery, camping, hunting, resort and commercial services, recreational cabins, team sports, downhill skiing, cross country skiing, snow shoeing. Access and travel is conventional motorized, including sedan, trailers, RV'S and some motor homes.
Setting	Predominantly natural appearing environment. Low concentration of users, but often evidence of others on trails. Minimum on site controls and restrictions present but subtle.	Mostly natural appearing environment with moderate evidences of the sights and sounds of man. Interactions between users may be low to moderate, but with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is provided for in construction standards and design of facilities.	Can be a substantially modified natural environment. Sights and sounds of humans are readily evident and interaction with other users is often moderate to high. Facilities are designed for use by a large number of people. Moderate densities are provided far away from developed sites. Facilities for intensified motorized use and parking are available.
Experience	Moderate probability of experiencing isolation from the sights and sounds of humans, independence, closeness to nature, and tranquility. High degree of self-reliance, challenge and risk in using motorized equipment. Opportunity to use motorized equipment while in the area.	Probability for experiencing affiliation with individuals and groups is prevalent, as is the convenience of sites and opportunities. Opportunity to affiliate with other users in developed sites but with some chance for privacy. Self-reliance on outdoor skill of only moderate importance. Little challenge and risk.	Probability for experiencing affiliation with individuals and groups is prevalent, as is the convenience of sites and opportunities. Opportunities for wildland challenges, risk taking, and testing of outdoor skills are generally unimportant.

Alternative 1 (No Action): Recreation

Direct and Indirect Effects

Under Alternative A, recreation opportunities and experiences would not change, unless a catastrophic fire changes the landscape.

Unhealthy forest conditions contribute to management issues for recreation. Insect and disease outbreaks and wildland fires cause tree mortality which creates hazard trees in and around developed and dispersed recreation sites and along roads and trails. Erosion issues from widespread tree mortality can occur for many years until stable groundcover is established.

A high intensity fire in the project area would result in a change to the recreation experience, as was seen after the Hayman Fire and Waldo Canyon Fire. These fires caused damage to recreation facilities and trails and has affected the forest scenery for many years. Recreation use in the fires areas was prohibited for several years following the fires. The potential for falling trees on roads and trails exists in fire areas for well over 10 years. Camping and recreating in a recently burned area is not a desirable experience. If a large fire occurred in the project area, it would take several years for the forest to regenerate to provide a desirable recreation area again.

Non-system routes in the project area would continue to exist until funding is obtained to close and decommission the routes. Non-system routes lead to increased erosion and soil disturbance and may become unsightly scars on the landscape.

Indirect effects from the no action alternative would result in roads, trails and watersheds in the project area continuing to degrade over time, which would negatively affect the recreation experience.

Alternative 2 (Modified Proposed Action): Recreation

Direct and Indirect Effects

No changes to developed or dispersed recreation are proposed in this project, although many non-system routes would be closed following treatment. Short-term negative impacts to recreation would occur during treatment activities, including noise from machinery, dust from machinery operating and hauling timber, smoke and ash from burning, and immediate changes to the landscape from treatment disturbance, such as logging slash, until ground cover is reestablished.

Short term impacts to recreation would occur if roads and trails in the treatment areas are closed during treatments and recreationists are displaced.

Improvements to roads would enhance off-highway vehicle driving and driving for pleasure. Improved roads would also increase access to forest areas that are currently inaccessible due to poor road conditions.

Recreation would be enhanced by a heathier forest. Reducing the risk of wildland fires would preserve recreation opportunities over time. In areas where thinning or burning will take place, views and scenery may be improved. There may be more opportunities for viewing wildlife as wildlife habitat is improved.

As wildlife habitat improves, hunting opportunities would likely be improved.

As the forest is thinned and opened up, more non-system routes may be developed from vehicles being driven off-road. Non-system routes may also be developed if temporary roads for project implementation are not completely closed. Minimizing user created recreation routes was identified as a key issue for this project. As project activities are planned and developed on the ground, it will be important to lay out units to minimize future access routes into the forest by visitors. Following project activities, skid roads and access routes into the units should be completely rehabilitated and blocked to prevent the routes from becoming new non-system roads. Monitoring should be completed for many years following project activities, and if new non-system roads or trails have developed, the routes should be closed as soon as possible to prevent them from becoming established.

Displacement of recreationists during treatment activities and immediately following treatment may result in more use in other dispersed camping areas, OHV areas and target shooting areas.

Comparison of Alternatives

Table 38. Comparison of effects for recreation resources.

Alternative A	Alternative B
No direct changes to recreation opportunities. Potential for large wildland fires increased, which would adversely affect recreation.	Short term negative effects to recreation during treatment activities. Reduced large wildland fire potential. Enhanced scenery due to healthier forest. Improved views from more open forest. Potential for non-system routes being developed from a more open forest.

Cumulative Effects

The Pike and San Isabel National Forests has recently begun a motorized travel management analysis to evaluate roads and trails on the forest. The analysis is expected to take up to five years. The analysis may result in some changes to roads or motorized trails.

The closure of the southern portion of the project area and the Rainbow Falls area to target shooting has concentrated shooting in the northeastern portion of the project area. This has resulted in increased damage to trees from shooters placing targets on trees, large volumes of trash, non-system roads developing, and instances of unsafe shooting.

Displacement of recreationists due to the Hayman Fire and Waldo Canyon Fire has increased use in other areas of the forest, including in the project area. Increases in dispersed camping and off-road vehicle use contributes to resource damage, illegal roads and trails, and more trash.

Western spruce budworm and tussock moth infestations have caused damage and mortality to trees in the project area, which has affected the scenery of the forest. Dead trees along roads and trails and in dispersed campsites also contribute to hazards for recreation activities.

Visual Resources

The Visual Resources Project Area is defined to include landscapes directly affected by the proposed activities and surrounding lands which may be visually sensitive to changes in the seen environment. Several major roadways travel through and along the edge of the UMC Project Area including Rampart Range Road (Forest Road 300) from Colorado Springs, Sedalia, or Woodland Park; State Highway 67 from Woodland Park to the Rainbow Falls area; Mt. Herman Road (Forest Road 320) from Monument and State Highway 24 providing access from Colorado Springs and Woodland Park.

The UMC Project Area is characterized as mountainous terrain with an aspect dependent dry continental forest with elevations generally range from 6800 feet to 9740 feet. The higher elevations are found in the western and central portion of the Project Area, while less dominant ridge and mountain features are found to the east, at elevations around 6800 feet. The mountainous terrain creates undulating lines on the landscape. Slopes are predominantly moderate to steep, with steeper terrain, jagged textures and patterns occurring on rocky outcroppings and ridgelines.

Forest vegetation within the UMC project area is a diverse mosaic of forest structures and cover types driven by topographic, moisture, and elevational gradients. Vegetation primarily consists of mixed conifers, including Ponderosa Pine, Douglas fir and lodgepole pine with understories of aspens, gambel oak, and other native shrubs and grasses. Overall, the conifers create homogeneous, medium textures throughout much of this landscape. Increased vegetation diversity and patterns are created where deciduous aspen trees and grasslands occur in dispersed meadows. Textures range from coarse textured escarpments on rocky outcroppings and ridgelines to medium textures where conifers dominate.

Throughout the project area, several intermittent streams and incised drainages create localized vegetation patterns, which contrast with adjacent lands.

In 2012, the Waldo Canyon Fire burned 18,200 acres of which approximately 10,500 acres fall within the UMC analysis area. Portions of the Waldo Canyon burn scar have experienced significant erosion with the removal of vegetation within these watersheds. The view shed has changed dramatically after the fire in terms of color, textures and patterns and can be seen from most nearby major highways.

State Highway 24, State Highway 67, Rampart Range Road (Forest Road 300) and the Mt. Herman Road (Forest Road 320) provide access and views of the project area. Many of the roads are travelled frequently by those wishing to for a scenic drive. Dung fall months, these travelways are busy with people taking in the fall colors and scenic beauty along the roadways. In recent years, the Western spruce budworm and tussock moth infestations have also caused damage and mortality to trees in the project area, which has affected the scenery of the forest. Cultural modifications primarily consist of rural residential subdivisions and second homes, historic structures, forest service facilities, and a network of roads and trails.

Overall, the scenic attractiveness of the project area would be considered average with some areas of scenery occurring in the landscape that exhibit a more unique level of scenic appeal. The predominant character of the Project Area, including most National Forest System lands, is a classic western landscape with ponderosa pine, Douglas fir, lodgepole pine, aspen, meadows and rock outcrops. The undeveloped landscapes generally are perceived to have high scenic integrity, while landscapes with utility corridors, other developments and dispersed residential uses contribute to low to moderate scenic integrity conditions.

Alternative 1 (No Action) Visual Resources

Direct and Indirect Effects

Alternative 1 (No Action) poses the greatest risk of a large scale, high intensity wildfire that could affect visual resources. Wildfire could impact the visual character of the area and potentially change the landscape character, scenic attractiveness and scenic integrity for several years. The significance of the impacts to the visual resource would depend on the size and severity of the wildfire. Should a fire occur, direct effects would include forest visitors viewing smoke as well as fire suppression actions such as cutting of trees and disturbing soil to create fuel breaks. These effects would be short term and, as a result, would be less than significant. Alternative 1 (No action) would have the greatest risk of a severe wildfire that could produce significant visual impacts, such as those seen in the Waldo fire burn scar.

Indirect effects would include changes in the visual landscape, such as charred soils which can also cause water repellency, burned understory vegetation, and scorched or completely burned trees. The duration of the visual effects would depend on the severity of the fire, which is related to fire intensity. Short term impacts may last from two to five years post fire, for many low severity fires. A low severity fire is characterized by minimal, short term ecosystem effects. Soils are not heated, and overstory vegetation is rarely affected. The result of a low severity fire is fuels reduction and top kill of understory vegetation. The existing scenic attractiveness and scenic integrity would not change dramatically due to the impacts of a low severity fire. These fires would have less than significant effects.

A large, high severity fire, however, could dramatically change the visual landscape and potentially have both positive and negative effects. The scenic character of the forest could change from a forested landscape to a more open landscape with varying stands of trees (aspen and multistoried stands) and meadows. These changes would affect the scenic attractiveness by potentially opening up viewing areas in a previously dense forest. These effects could be considered positive. However a high severity fire could also have long term potentially negative impacts as well. A high severity fire affects large acreages and is expressed by complete fuel consumption and extensive soil heating, and usually more than 70 percent top kill of vegetation. Many burned areas within the Waldo Canyon Fire would be considered a

high severity and high intensity fire. Stands of fire killed trees are still visible and the visual changes from the Waldo Canyon Fire are long term and significant. As seen after the Waldo Fire, a high severity fire in the Project Area would affect the scenic character, change the scenic attractiveness to low, and affect the scenic integrity of the Project area.

Cumulative Effects

There are no foreseeable projects affecting visual resources in the Project Area, including any other fuel reduction projects which could help to restore more natural forest conditions that are resilient to fire, insects and diseases. Past fire suppression policies and implementation have created hazardous fire conditions throughout much of the Project Area. It is likely that wildfire suppression would continue due to the history of large, destructive fires in the area combined with the proximity of residential areas. Therefore, cumulatively, this alternative would continue the trend of increasing forest fuels and therefore a corresponding increase in insect and disease outbreaks, potential high severity fires, and other consequences of deferred forest management. However, past large wildfires in the area have altered the character of the forest including a large portion of the Project Area. Should a large, intense fire occur in the unburned portions of the Project Area, the cumulative effect could be a cumulative change in the Scenic Attractiveness Class and Scenic Integrity of the area.

Alternative 2 (Modified Proposed Action) Visual Resources

Alternative 2 (Modified Proposed Action) entails the treatment of up to 31,700 acres within the 70,600 acre UMC project area. A combination of mechanical thinning with product removal, service work, manual thinning, pile burning, post treatment broadcast burning, and first entry prescribed fire would be utilized to achieve the desired ecological conditions. Implementation of these management actions is expected to extend over a period of 10 years or more.

Direct and Indirect Effects

Alternative 2 (Modified Proposed Action) has the potential to affect views from popular recreation areas and travelways. The direct visual effects would include the presence of heavy equipment on sites to be treated, presence of slash, soil disturbance, and fugitive dust and, when prescribed burning is being conducted, the presence of smoke. Effects such as fugitive dust and soil disturbance would only be visible within foreground distances. However, effects of thinning, piling and burning, broadcast burning, and temporary roads would be visible from middle ground and background distances. These effects would be short term; likely lasting for the period of time required to complete the treatments in a particular location as well as the time to complete revegetation of temporary roads. Overall, the scenic attractiveness would remain as average, with some unique scenery occurring where the landscape is viewed against more dominant peaks to the west. The scenic integrity would not change due to few changes in ongoing activities in the area and the type of treatments that would occur, which would maintain the integrity of the forest, but provide less dense canopies.

Indirect visual effects would include long term changes in views of the forested landscapes. A decreased density of trees would be apparent, however in terms of changes in lines, texture, form, and color the differences between treated and non-treated areas would not be apparent to most viewers.

Alternative 2 could also provide long term beneficial impacts on visual resources in treated areas by increasing age class diversity. The thinning would also provide better views for trail users through formerly dense forest trails. Tree species diversity would also be likely to increase including more aspen trees and greater variety of understory vegetation due to a more open canopy.

Alternative 2 (Modified Proposed Action) would result in the lower risk for a large, intense wildfire. The impacts from wildfire on visual resources as discussed for Alternative 1 would still be possible, however, the fuels reduction treatments would reduce the long term risk of a large, intense fire and increase the possibility that fires, should they start, would be limited in size and intensity and would be easier to manage. With the fuel treatments, there would be a reduced risk for a stand replacing fire. Residents and

other recreational users who are familiar with forest treatments are likely to prefer the visual impacts related to treatments compared to the visual consequences of a large scale, high severity and high intensity fire, where scenic character, attractiveness, and integrity could be altered (see description of effects of this type of wildfire in Alternative 1). These visual effects would include openings in the forest mosaic, thinning of dense canopies, and less evidence of insects and disease due to increased resiliency of the forest.

Alternative 2 (Modified Proposed Action) would have no significant adverse impacts on visuals, particularly if visual design criteria are met. Long term, Alternative 2 could provide benefits to the visual environment by increasing the diversity of vegetation, opening the forest canopy, and creating a more historical landscape character in treated areas. Additionally, this alternative lessens the risk of unacceptable resource damage from high severity wildfire, which could cause landscape scale visual impacts that lasts several decades.

Cumulative Effects

Under this alternative, the proposed treatments would disrupt the continuity of fuels in the project area by altering stand structure and the density of trees. By performing these treatments across large areas of the UMC project area, the risk of insect and disease outbreaks would be reduced, and the potential spread and severity of wildfire events would be diminished throughout the landscape. By reducing large-scale intense fires, the visual resources within the project area would be improved.

Climate Change

Carbon dioxide has been identified as a central driver of changing climatic characteristics and is in constant flux due to the global carbon cycle (Solomon et al. 2007). Carbon dioxide emissions from the global carbon cycle are now coupled with increasing rates of anthropogenic induced CO2 releases, and current trends indicate that these levels show no indication of slowing (Solomon et al. 2007). Forests on the Front Range not only provide valuable ecosystems services such as erosion control, wildlife habitat, and water recharge, but forests also drive terrestrial carbon budgets through storing carbon in live biomass, forest soils, and dead woody material (Malmsheimer et al. 2008).

Future projections indicate that northern latitudes are expected to warm due to changes in climate, and this warming will likely be accompanied by changes to abiotic conditions, disturbance patterns, and biotic cycles (Malmsheimer 2008). Current projections indicate that temperatures will increase over the next several decades and all seasons are expected to see an average increase of 3ºC (Liu et al. 2013). Temperature changes can expand the potential range of tree species, extend the growing season, modify the timing of budbreak and dormancy, and increase or decrease biomass accumulation depending on local conditions (Malmsheimer 2008). Many of the potential benefits from a changing climate for forested vegetation will be affected by limiting factors such as available soil moisture. Changes in moisture patterns have the potential to increase the potential for water deficit during the growing season lowering both live and dead fuel moisture contents as precipitation amounts decrease (Rocca et al. 2014). Rises in temperature will increase the transpiration demand for forest vegetation which combined with lower precipitation amounts has the further potential to stress live trees, predispose trees to forest insects and disease, reduce biomass accumulation, and reduce fuel moisture.

Fire activity and characteristics are also projected to be affected by changes in climate. Under a projected doubling of carbon dioxide levels Price and Rind (1994) have suggested that there will possiblly be a 44% increase in lightning caused fires which will also correlate to an increase of forested area burned by 78%. Fire intensity and severity, along with area burned, are all predicted to increase within the western United States under modeled climate change scenarios (Flannigan et al. 2000). Warmer spring temperatures will result in earlier snow melt and warmer summers and falls will also likely lead to drier forest fuels as they are exposed to warmer drier conditions for a greater portion of the year and will extend the fire season (Rocca et al. 2014, Lui et al. 2013). Climate driven changes in abiotic processes combined with dense existing forest conditions has the potential to increase fire occurrence, size, and

severity although site specific climate driven changes are difficult to predict (Rocca et al. 2014). Fire regimes within the UMC landscape are very dependent on climatological cycles and have been for centuries, therefore changes in climatic characteristics have to potential to significantly affect future fire characteristics within the project area.

Uncharacteristically dense forests that are found throughout the Rocky Mountains are highly susceptible to insect outbreaks from bark beetles, spruce budworms, and tussock moths especially under climate change scenarios (Covington et al. 1994, Savage et al. 1996, Skinner and Chang 1996, Breshears and Allen 2002, Oliver 2002, Schimel 2004, Peterson et al. 2005). Climate change induced droughts and changes in precipitation will likely create stands more susceptible to insects as these trees experience reduction in available soil moisture, reducing tree vigor, making them less capable of fending off infestations (Negron 1998). Increased stress in trees is only one factor to consider when looking at climate effects on forest insects. Multiple studies indicate that there is real potential for shifts and increases in habitat for pest species such as mountain pine beetle and the gypsy moth (Logan et al. 2003, Logan and Powell 2001). This expansion of potential habitat is fairly common as models indicate that the warmer northerly conditions will also likely increase the outbreaks of typical southern insect species into higher latitude and elevations and can expose once safe tree populations to additional sources of insect disturbance altering mortality events (Dale et al. 2001). There is also evidence that forests pests are capable of producing large and more brood per year with more favorable warming, thus increase the potential for larger more severe attacks annually (Mitton and Ferrenberg 2012). It is also likely that an increase in fuel loading and a change in fuel structure would be coincide with increases in insect induced morality which could affect fire potential and behavior. These shifts in forest pest habitat can impact forest development dynamics by altering species composition and tree distribution and has the potential to create forest vegetation patterns with no historical analogy. Current endemic and epidemic forest insect populations within the UMC project area have the potential to increase under future projected climate scenarios and could substantially alter future forest conditions.

Although it is difficult to address and manage for all potential changes driven by a modified climate active management of forest ecosystems can help alleviate and curtail some potential effects. The USDA 2010-2015 Strategic Plan, specifically Goal 2, states that plan goals are to “ensure our national forests and private working lands are conserved, restored, and made more resilient to climate change, while enhancing our water resources” (USDA 2010). Creating healthy, resistant, and resilient forest conditions through silvicultural practices can aid in helping forests adapt to changing climatic conditions (Malmsheimer 2008). Managing forests through harvesting and thinning operations can result in conditions that are both ecologically favorable and can increase carbon sequestration (Sedjo et al. 1995). Vigorously growing stands are good candidates for absorbing the deleterious and positive effects of a changing climate as they are less influenced by stresses of competition for growing space. Rocca et al. (2014) propose that mechanical treatments and the use of prescribed fire to restore or maintain historical forest structure could be effective strategies in trying to mitigate the impacts of climate change. Other authors stress that increasing forest resistance (i.e. the capacity of an ecosystem to avoid or withstand a disturbance) and resilience (i.e. the capacity of an ecosystem to regain function and development after a disturbance) may be more important that mimicking historic conditions that developed under entirely different climatic conditions (Malmsheimer 2008). Regardless of treatment goals designing more fire-resistant stands and landscapes will create forests that are more resistant and resilient to the changes imposed on them by climate change (Stephens et al. 2012).

The Colorado Climate Change Vulnerability Study found that temperatures have increased by 2.0 degrees F. over the last 30 years and 2.5 degrees over the last 50 years. The report also found minimum daily temperatures in Colorado rose more than daily maximums and temperatures increased in all seasons with the largest increases in summer. Increased average daily air temperatures are known to increase stream water temperatures. According to the report between 1971-2000 Colorado snowmelt and peak runoff shifted 1-4 weeks earlier. The Climate models referenced by the report predict an additional temperature increase of 2.5 degrees F. 5.0 degrees F by 2050. These predicted temperature increases were above the 1971-2000 baseline under a medium low emissions scenario. In most cases mid-21st century hydrology

projections show decreased annual streamflow for Colorado's major rivers. In support of this finding, the Joint Front Range Climate Change Vulnerability Study found a streamflow decrease of 5-20% at 18 gauge stations between 2040 and 2070.

Greenhouse gas emissions have been found to increase overall global temperatures. Anthropogenic sources of greenhouse gas emissions result from burning fossil fuels for electricity, heat and transportation. In 2013 electricity produced 31%, transportation 27%, commercial and residential 12% and agriculture 9%off the total annual greenhouse gas emissions. In 2013 greenhouse gas emissions increased over 2012 levels (http://www.epa.gov/climatechange/ghgemissions/sources.html)

Alternative 1 (No Action): Climate Change

Direct and Indirect Effects

Under Alternative 1 the no action alternative, the Upper Monument Creek project area would remain more vulnerable to climate change. Under Alternative 1, there would be no vegetation treatments, no reduction in fire severity risk, and no improvements to the transportation system to mitigate road and trail derived sediment. Given future climate change , as described in the Colorado Climate Change Vulnerability Study, Alternative 1 would not contribute to enhancing resiliency from expected climate change.

A very slight increase in greenhouse gas emissions could occur under Alternative 1, resulting from increased motorized use in the area over time. Impacts due to this very slight increase are unmeasurable.

Cumulative Effects

Current project impacts combined with historic an ongoing project impacts from historic uses will most likely result in a general downward trend in ecological resiliency. Resiliency and restoration are encouraged to mitigate climatic change impacts described above.

A very slight increase in greenhouse gas emissions could occur under Alternative 1, resulting from increased motorized use in the area over time. Although these increases are additive to the global concentration of atmospheric greenhouse gases, contribution from this alternative is insignificant.

Alternative 2 (Modified Proposed Action): Climate Change

Direct and Indirect Effects

Under Alternative 2 the proposed action, vegetation treatments, floodplain treatments, and broadcast burn will move the project area towards the natural range of variability (NRV. Moving the project landscape towards NRV,will help the landscape absorb disturbances, and increased riparian vegetation in floodplain areas will help shade streams and creeks from direct sunlight, which may keep water temperatures cooler. Based on the findings outlined in the Colorado Climate Change Vulnerability Study indicating higher future air temperatures, the re-establishment of historic conditions across the landscape , through the application of vegetation treatments that move the project are closer to NRV, reintroduction of fire on the landscape, and restoration of riparian vegetation should help the project area be more resilient to future impacts of climate change.

A similar increase in greenhouse gas emission as identified under Alternative 1 could also occur under Alternative 2. A slight increase could result from increased motorized use in the area over time. Heavy equipment such as masticators, chippers, excavators front-end loaders and various trucks would be used to haul material to and from the project site and move onsite material or place new material. The greenhouse gas emission would only be during project implementation and would be slight. Impacts due to these very slight emissions are unmeasurable.

Cumulative Effects

Greenhouse gas emissions can be expected to increase slightly during project implementation from heavy equipment use in the area. However, healthier riparian vegetation resulting from project implementation could provide a new carbon sink, which may offset emissions from project implementation.

Social and Economic

Summery statistics for Douglas, El Paso and Teller counties are highlighted. Unless otherwise noted, sources include Colorado Demographer Office and EPS-HDT (2015). Reference the Social and Economic Report for tables and more detailed information.

Age and Population:

The study area's population is rising while the median age is also increasing.

From 2000 to 2014, Colorado's population increased by 21%, from 4.3 to 5.2 million. Douglas County saw a 71% increase during this period, while El Paso and Teller increased 25% and 14%, respectively. El Paso, with 645,707 people in 2014, is the most populous county in the state (Douglas at 299,794 and Teller at 23,363). The Colorado Demography Office projects that by year 2050, statewide population will past the 8.5 million mark. By then, El Paso County's population is projected to reach 1 million, with Douglas and Teller Counties at 494,000 and 32,000 respectively.

In 2014, Colorado's median age was 36.2, up 5.5% from 2000's median age of 34.3. During this period, the median ages of all counties within the study area have increased also, though at different rate (Teller up 23.9%, Douglas up 10.4%, and El Paso up 1.8%).

Population is an important variable to consider because outside of the natural birth/death rates, the ability to attract and retain individuals to live and work within an area is critical to the survival of a community and its economy. If an area has a large retired population, or soon-to-be-retired population, for example, the needs and interests of the public may place different demands on public land managers than an area with a large number of minors or young adults. As the "Baby Boomer" generation (those born between 1946 and 1964) enters retirement age, their mobility, spending patterns, and consumer demands (for health care and housing[4], for example) can affect how communities develop economically. An aging population can also affect changing demands on land use (e.g., recreation).

Environmental Justice (Race, Ethnicity and Poverty)

Overall, the study area is less racially diverse and has lower poverty rates than the state of Colorado as a whole. El Paso County, however, has a slightly larger population reporting as 'two or more races' and 'Black or African American Alone'.

For this analysis, poverty data for the state of Colorado and three counties has been used to reflect the presence of low-income populations within the study area. Overall, the study area has either less or similar amount of individual and family living below the poverty line compared with the state of Colorado as a whole. Nonetheless, families in El Paso County, especially those with female householder, have slightly higher poverty rates.

Existing Economic Conditions

Per Capita Income, Non-Labor income, Average Earnings per Job and Unemployment Rate are described below in order to depict measures of individual prosperity in the study area.

PerCapita Income is total personal income (from labor and non-labor sources) divided by total population. In 2014, Colorado‘s per capita income ($48,869) was relatively similar to the three-county study area (labeled ‘County Region’). County-level data reveal that Douglas County has the highest per capita income while El Paso and Teller Counties’ per capital income are lower than the state‘s average. Per capita income is considered one of the most important measures of economic well-being. However, it can be misleading. Per capita income is total personal income divided by population. Because total personal income includes non-labor income sources (dividends, interest, rent, and transfer payments), it is possible for per capita income to be relatively high due to the presence of retirees and people with investment income. And because per capita income is calculated using total population and not the labor force as in average earnings per job, it is possible for per capita income to be relatively low when there are a disproportionate number of children and/or elderly people in the population. For these reasons, Non-Labor Income as a percentage of Total Personal Income are reported below. It reveals that compared with El Paso, Teller and Colorado as a whole, Douglas County’s non-labor income is a relatively smaller share of its total personal income.

Non-Labor income consists of dividends, interest and rent (money earned from investments), and transfer payments (includes government retirement and disability insurance benefits, medical payments such as mainly Medicare and Medicaid, income maintenance benefits, unemployment insurance benefits, etc.). In many counties non-labor income (e.g., retirement and investment income, government transfer payments) can be more than a third of all personal income. As the baby boomer generation retires, this source of income will continue to grow. A high dependence on non-labor income can be an indication of an aging population and/or the attraction of people with investment income. Public lands activities may affect these constituents.

Average Earnings per Job are the total earnings divided by total employment. Full-time and part-time jobs are counted at equal weight. Employees, sole proprietors, and active partners are included. Average earnings per job is an indicator of the quality of local employment. A higher average earning per job indicates that there are relatively more high-wage occupations. Average earnings per job figures reveal that Douglas County’s average earnings are higher compared with El Paso, Teller and Colorado as a whole.

Unemployment Rate is an important statistics of economic well-being. The annual unemployment rate is the number of people actively seeking but not finding work as a percent of the labor force. This figure can go up during national recessions and/or when more localized economies are affected by area downturns. The unemployment rates for the state of Colorado and Douglas County are around the natural rate of 4% – 5%. Economists generally consider the natural rate as the level of unemployment that predominantly comprises of voluntarily unemployed workers (i.e. transitional unemployment in a healthy economy).

Land Ownership and Use

Understanding the makeup of the land base in an area is important because some actions on federal lands may affect the local economy, particularly if federal lands are a large portion of the land base. Some federal public lands prohibit most forms of commercial use and development. These include National Parks, Wilderness, and National Monuments, for example. Since these lands are managed primarily for their non-commercial values (i.e., scenery, wildlife, recreation) they potentially play a different economic role than public lands more commonly associated with commodity sectors.

Forest Service lands are the largest component of federal land ownership in Douglas and Teller Counties, and minimal ownership in El Paso County. Teller County has the largest percent of total land area in federal ownership (43.6%).Alternative 1 (No Action): Social and Economic

Direct and Indirect Effects

Under the No Action alternative, no treatment activities would occur. There will be no Bighorn Sheep Habitat Improvement, broadcast burn, restoring of riparian vegetation, road improvements, hillslope stabilization, closing user created routes, stabilizing channels, creating fuel break, the use of mechanical

ground based logging equipment for removal, Oakbrush Mitigation, or other activities (including those along transmission lines). Except for the in-house planning costs (sunk cost), Alternative A would incur no costs or revenues.

Alternative 2 (Modified Proposed Action): Social and Economic

Direct and Indirect Effects

The project would likely produce short-term economic contributions to the local community in the form of employment and income. These may be new or existing full, part time or temporary employments. Since most treatment activities will be carried out by private firms, the project would also benefit companies and businesses that support those operations including local fuel businesses, mechanics, and other businesses that provide support services. Activities with commercial product removal associated with this project could further support / sustain employment and income in the timber sector. CFLRP funding is available (approximately $2 million) to carry out the proposed action. Treatments and restoration activities that reduce fire risks will ultimately benefit local communities, including life and properties in the WUI.

Cumulative Effects

There are many factors that influence and affect the local social and economic environment. National, State, and county policies affect population growth, demographics, and land uses. The West has been the fastest growing region in the country and this trend is expected to continue for the next 20 years (U.S. Census data and projections). Increased population could put increased pressure on resources in the forest.

Environmental Justice and Civil Rights

Based on the composition of the affected communities, along with cultural and economic factors, the activities that are proposed would have no disproportionately adverse effects to human health and safety, or environmental effects to minorities, those of low income, or any other segments of the population. There are no significant negative direct, indirect, or cumulative effects relative to issues of environmental justice through the implementation of the action alternative. None of the alternatives would restrict nor alter opportunities for subsistence hunting or fishing by Native American tribes. It is unlikely, that implementation of any of the action alternatives would adversely affect minority or low-income populations.

Unavoidable Adverse Effects

There would not be any unavoidable adverse effects related to forest vegetation and timber resources as adverse effects are mitigated by design features and mitigation.

There would not be any unavoidable adverse effects to hydrology and soil resources. Potential adverse effects would be minimized or mitigated through appropriate use of resource protection measures outlined and project design criteria.

For Northern goshawk, there is likely to be a short-term decrease in habitat quantity and quality; however, these values would increase in the long-term.

In the short-term (1 to 5 years), visual disturbances from restoration activities would be within the referenced conditions of the area. Disturbances would be visible and would lower the scenic quality. Potential short-term effects include exposure of bare soil, tree stumps, and contrasting color and texture of surfacing materials. The effects would be mitigated and become less noticeable as natural vegetation is reestablished and the surface material begins to be incorporated into the soil horizon.

The alternatives would cause short-term and temporary decreases in provision of recreation opportunities on parts of the District. There may be short-term displacement of recreationists during implementation and a temporary decrease in the quality of recreation settings due to the presence of slash, skid trails, log landings, temporary road construction, and creation of dust and noise from logging operations and log hauling. Logging operations including loss of herbaceous cover, disorderly management activities, and noise and dust, as well as lack of, have been found to decrease the quality of recreation settings and user satisfaction.

Irreversible/Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road.

An irretrievable commitment of resources is associated with alternative 1, the no action alternative. In alternative 1, there is the likelihood that there would be additional larger fires with larger areas with higher severity fires than occurred historically. Post-fire effects that require decades of recovery would be irretrievable in the short-term and potentially the long-term. For example, topsoil that is critical to healthy surface vegetation would take centuries to recover. The loss of old growth and old trees would be irretrievable, as it would require decades and centuries to recover.

There would be no irreversible or irretrievable commitment of habitat associated with selection and implementation of the proposed action that affects threatened, endangered, or candidate aquatic biota.

Cumulative Effects Common to All

The cumulative effects analysis covers a period of time starting with settlement of the area by Euro-Americans in the late 19th century and ending 10 years into the future. The cumulative effects analysis area includes the Upper Monument Creek Project Area as well as adjacent private and National Forest System lands where past, present and reasonably foreseeable future management actions could affect the Project Area.

Past Impacts

The Euro-American settlement of the Pikes Peak area began in the mid-1800s and brought with it mining, logging, road construction, grazing, non-native plant and animal species, human caused fires, suppression of natural fires, and many other activities that have altered the natural disturbance regimes of the forest. Following the period of intensive logging and wildfires in the late 1800s, there was increased erosion and a reduction in water quality as sediment from the recently logged and burned areas reached the streams and rivers. In an attempt to ameliorate some of the previous deleterious land uses an aggressive reforestation program was started on the Pike National Forest in the early 1900s (Bates 1923). Seedlings used for this effort were typically from offsite genetics that were poorly adapted to growing conditions on the Front Range and many of these plantations are still visible on the landscape because of their short statured “tree farm” appearance.

The period of extraction of minerals and timber was followed by the establishment of the Pike National Forest in 1908 with an emphasis on watershed protection and reestablishing the forested landscape. With the establishment of the municipal watersheds for the towns of Colorado Springs, Woodland Park, Cascade, and the Tri-Lakes area, the management emphasis for the lands within and surrounding the Upper Monument Creek Project Area was one of maintaining forest vegetation and minimize disturbance. Because of this emphasis on maintaining water quality very few vegetation treatments or logging was conducted on the National Forest. However in more recent years some vegetation treatments have been initiated to reduce the wildfire hazard.

In the last half twentieth century, active fire suppression became another emphasis of the USDA Forest Service. The policy of suppressing wildfires over the last 100 years has resulted in many forests developing denser vegetation that would have historically been reduced by more frequent, low intensity and mixed severity fires.

Several large fires burned in the area between 1850 and 1890. Some of these were human caused. In recent times, several wildfires are reported in the area ever year. Most are less than half an acre. This cycle of relatively little fire activity was interrupted in 1989 when the Berry Fire burned 850 acres near the outskirts of the USFS Monument Fire Center. More recently the Waldo Canyon Fire burned just northwest of Colorado Springs which destroyed 346 homes and forced 32,000 residents to evacuate. Approximately 10,500 of the total 18,200 acres burned in the Waldo Fire fall within the UMC analysis area. Portions of the Waldo Canyon burn scar have experienced significant erosion and mass wasting due to the loss of slope stability with the removal of vegetation within these watersheds. Millions of dollars are being spent annually by communities to protect and restore their watershed infrastructure damaged by the Waldo Canyon fire (CSU 2014, Elpasaco 2014).

Present Impacts

There has been essentially no significant management within the UMC landscape. Select areas within the Waldo have been treated with erosion prevention barriers to stabilize hillsides and hazard trees have been treated along the main arterial route (Nation Forest System Road 300). Currently efforts are underway to treat approximately 130 acres of hazard trees from the Waldo Canyon Fire within the Rampart Reservoir area. A small portion (approximately 180 acres) of the Waldo burn were planted in 2014 with a mix of ponderosa pine and Douglas-fir seedlings to facilitate stand development in areas of high burn severity. Approximately 970 acres of vegetation management has occurred along the western boundary of the project area. Treatments in these areas range from variable density thinnings, to opening creation, to understory removal and occur mainly in the ponderosa pine-Douglas-fir forest type.

Tourism in the area has increased as visitors come to visit Colorado Springs and Pikes Peak and are attracted to the diverse recreation opportunities available near Colorado Springs. Due to its close proximity to Colorado Springs, the project area has historically and continues to have high usage by both motorized and non-motorized recreationists. Trail motorcycles and mountain bikes have evolved and have become more popular in recent decades and the trail system in the project area has seen increased usage.

The temporary closures of many recreation areas within the Hayman (22 miles northwest of the project area) and Waldo Canyon (5 miles north) fire areas, have caused increased use of the trail system within and surrounding the project area. However, additional trail opportunities have become available as the City of Colorado Springs, El Paso County and Colorado State Parks have acquired open space lands and have planned and constructed new trail systems.

Reasonably Foreseeable Future Impacts

Prescribed fire and thinning are activities that have occurred surrounding the project area and will continue to occur in the foreseeable future. Wildfire is possible and has occurred in the past 30 years. Implementation of Upper Monument Creek will tie into these previous and ongoing treatments along the western edge of the UMC project area and will help decrease the potential for active crown wildfire to carry across the landscape. A substantial barrier to crown fire spread will be established along the western boundary of the Roadless area in the norther portion of the project area. Prescribed fire will cause short-term localized impacts to air quality. Spring and fall burning will occur when conditions allow and local residents will be notified of burning.

The 2005 Travel Management Rule requires every National Forest to complete a Motorized Vehicle Use Map (MVUM). In August 2016, the Pike and San Isabel began scoping to complete the analysis for the MVUM. The Pike and San Isabel MVUM effort will continue to include public involvement and official comment periods, in order to help the Forest identify a designated system of roads, trails, and areas for

public motorized vehicle use. Once the travel management planning effort is complete, the network of designated roads, trails, and areas will be displayed on a MVUM. This planning will cover the Upper Monument Creek Project area, and may result in travel management actions in addition to, and/or different from those proposed this project.

The PSICC is scheduled to begin revision of the Forest Plan during implementation of Upper Monument Creek. The revision of the Forest Plan will be benefial for this project as it will update desired conditions, goals, standards, and objectives using the most current best available science.

Invasive plants are a threat to all habitats due to their negative effects to native ecosystems. Treatment of invasive plants infestations along roads and in project implementation polygons will be treated as part of the prevention strategy for the Upper Monument Creek Project. Mitigation measures that include type of chemical treatments, application rates, area treated, timing, and buffers on streams significantly reduce the risk of effects from this activity. However, the overall risk of adverse aggregate effects due to noxious weed treatment is rated moderate because they are not completely controllable, and need to be administered.

Due to the proximity to the City of Colorado Springs the project area is a popular area for organized recreational events. Recreation event and outfitter and guide special use permits may be issued in the future for various commercial recreation activities. Use on permitted trails may temporarily increase while participants are training for events, on the day of events or during permitted activities. This increased use may displace other trail users and use on nearby trails may temporarily increase. Proposed special use permits would be analyzed under a separate analysis.

On-going routine roads and trails maintenance will continue on all roads and trails within and surrounding the project area. The roads and trails maintenance projects and bridge replacements may temporarily displace trail users and use may temporarily increase on other nearby trails. After trail projects are completed, use may increase on the improved trails.

Human populations are expected to increase along the front range and/or shift towards the wildland urban interface. This population increase could increase visitation to the forest and cause visitor use impacts to resource. Increased use could cause more user created roads and trails; however, active treatments in the area will help the forest identify, mitigate, and close user created roads and trails.

Vegetation treatments are expected to occur on private land adjacent to the forest boundary in Palmer Lake, the Air Force Academy, Colorado Springs Utilities. Completion of those vegetation treatments along with any other treatments related to the Waldo Recovery or the Manitou Experimental Forest will help to restore the ecosystem, making it more resistant to severe wildfire or insect and disease outbreak.

Effects of Not Amending the Forest Plan

Three Forest Plan Amendments were evaluated and dismissed.

1. Wildlife amendment for Elk hiding cover. It was determined this project would meet the intent of the wildlife hiding cover described in the Forest Plan.

2. Allowing fire to burn on the landscape. Letting fire burn on the landscape is a function of time or year, location, and whether treatments have occurred to provide safe anchor points.

3. Timber openings: Currenlty a maximum of 40 acre openings can be created and maintained in all management areas other than 7A and 7D, with the exeption of aspen enhancement in those management areas. NFMA standards require certification or replanting within five years in suitable timber management areas 7A and 7D. The amendment would require changing the management area and the suitability of timber.

There will be no effects on the project from not amending the forest plan because it was determined that implementation can move the forest towards the desired conditions. Also, the forest will begin revising the Forest Plan in the next couple years and issues brought up in projects such as this can be resolved at that planning level.

Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with …other environmental review laws and executive orders."

- All potentially affected tribes were contacted during the Notice-of-Intent phase of project development. A copy of this draft document will be sent to all tribes for their comment as per consultation requirements of the National Historic Preservation Act.
- The Colorado State Historic Preservation Office (SHPO) has been contacted regarding this project and the consultation package for this draft document is being prepared. Section 106 concurrence and clearance for the project will be completed in the final EIS.
- The U.S. Fish and Wildlife Service (USFWS) were contacted during the Notice-of-Intent phase of project development. Ongoing consultation with USFWS will be completed in the final EIS.
- 404 permits would be required from the U.S. Army Corps of Engineers if the Forest Service or partners including municipal water providers identifies a need to conductstream channel alterations for water quality improvements and watershed restoration.

Chapter 4. Consultation and Coordination

Prepareres and Contributors

The following personnel were directly involved with preparation of this draft environmental impact statement.

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The Forest Service consulted the following individuals, Federal, state, and local agencies, tribes, and non-Forest Service persons during the development of this draft environmental impact statement.

United States Fish and Wildlife Service

Colorado Parks and Wildlife

El Paso County Government

Teller County Government

City of Palmer Lake

City of Colorado Springs

City of Monument

City of Woodland Park

State Historic Preservation Officer

Native American Tribes

Cheyenne and Arapaho Tribes of Oklahoma

Comanche Nation of Oklahoma

Jicarilla Apache Nation

Kiowa Tribe of Oklahoma

Northern Cheyenne Tribe

Southern Ute Tribe

Ute Indian Tribe (Uintah and Ouray Reservation)

Ute Mountain Ute Tribe

Others

As described in Chapter 1, the Upper Monument Creek project was submitted to the Front Range Roundtable as part of the forest landscape restoration program. The Rountable created a collaborative group to provide recommendations and feedback to the District throughout the lifespan of the project. The collaborative meetings were open to the public to attend.

The project was posted on the Forest's schedule of proposed actions website on April 1, 2014 and the notice of intent (NOI) to prepare an environmental impact statement was published in the Federal Register on May 22, 2014 (FR Doc. 2012-24317). The NOI asked for public comment on the proposal from May 22 until July 7, 2014. The District received comments from 24 entities including individuals, local government, state government, federal and state agencies, and organizations. Three public meetings were conducted on May 28, 29, and June 3, 2014. The meetings were held in an open house style with a

brief PowerPoint and the opportunity for the public to view documents and maps of the proposal, ask questions, and submit comments. Additionally, the District has met with the collaborative group consistently throughout the process. These meetings are always open to the public to provide information, ask and answer questions, and discuss the proposal.

References

Abella SR, Springer JD. 2015. Effects of tree cutting and fire on understory vegetation in mixed conifer forests. Forest Ecology and Management. 335: 281-299.

Agee JK. 1993. Fire ecology of Pacific Northwest forests. Washington, D.C.: Island Press. 505 p.

Agee JK, Skinner CN. 2005. Basic principles of forest fuel reduction treatments. Forest Ecology and Management. 211: 83-96.

Ager, A.A., Day, M.A., Finney, M.A., Vance-Borland, K., Vaillant, N.M. 2014. Analyzing the transmission of wildfire exposure on a fire-prone landscape in Oregon, USA. Forest Ecology and Management 334: 377-390.

Alexander ME, Hawksworth FG. 1975. Wildland Fires and Dwarf Mistletoes: A Literature Review of Ecology and Prescribed Burning. USDA Forest Service General Technical Report RM-14. 1-12.

Allen KK, Blodgett JT, Burns KS, Cain RJ, Costello SL, Eager TJ, Harris JL, Howell BE, Mask RA, Schaupp, Jr. WC, Witcosky JJ, Worrall JJ. 2010. The field guide to diseases & insects of the Rocky Mountain Region. USDA Forest Service General Technical Report RMRS-GTR-241. Fort Collins, CO. 336 p.

Barber, J. R., K. R. Crooks, and K. M. Fristrup. 2009. The costs of chronic noise exposure for terrestrial organisms. Trends in Ecology and Evolution, 25(3): 180-189.

Baron, J.S. 2002. Rocky Mountain Futures: An Ecological Perspective. Washington, DC : Island Press.

Bartos, D.L., 2000. Landscape dynamics of aspen and conifer forests. Aspen Bibliography. Paper 782.

Colorado State Forest Service. 2011. 2011 Report on the Health of Colorado's Forests. Annual Report. Available at: https://csfs.colostate.edu/media/sites/22/2015/03/126850_2011Health- ColoForest-www.pdf Accessed 10/26/2016.

Bates, CG. 1923. Planting in the National Forests. The Scientific Monthly. 609-616.

Beecham, J. J. Jr., C. P. Collins, and T.D. Reynolds. 2007. Rocky Mountain Bighorn Sheep (*Ovis canadensis*): A Technical Conservation Assessment. USDA, Forest Service, Rocky Mountain Region.

Betts, B.J. 2009. The Effect of a Fuels-Reduction Silviculture Treatment on Bat Activity in Northeastern Oregon. Northwestern Naturalist. 90:107-116.

Bisson, P.A.; Bilby, R.E.; Bryant, M.D.; [and others]. 1987. Large woody debris in forested streams in the Pacific Northwest: past, present, and future. Streamside Management: Forestry and Fisheries Interactions. Institute of Forest Resources Contribution No. 57. E.O. Salo and T.W. Cundy. Seattle, University of Washington: 143-190.

Breshears DD, Allen CD. 2002. The importance of rapid, disturbance-induced losses in carbon management and sequestration. Global Ecology and Biogeography. 11:1-5.

Brown, PM, Kaufmann MR, Sheppard WD. 1999. Long-term, landscape patterns of past fire events in a montane ponderosa pine forest of central Colorado. Landscape Ecology. 14: 513-532.

Bucker, C.A. and D.J. Shure. 1985. The response of *Peromyscus* to forest opening seize in the southern Appalachian Mountains. Journal of Mammalogy 66: 299-307.

Butler DR, Malanson GP, Walsh SJ. 1992. Snow-avalanche paths: conduits for the periglacial-alpine to the subalpine-deposition zone. In A. Abrahams and J Dixon, editors, Periglacial geomorphology. John Wiley Publishers, London.

http://csfs.colostate.edu/pdfs/SFRA09_csfs-forestassess-web-bkmrks.pdf Accessed 10/15/2014

https://www.csu.org/pages/stormwater-r.aspx Accessed 10/14/2014

Cain, RJ. 2014. LCS-14-18 Forest health protection visit to Pikes Peak Ranger District. Unpublished. Rocky Mountain Region, Forest Health and Protection. Golden, CO. Available at the Pikes Peak District office.

Chojnacky, David C.; Bentz, Barbara J.; Logan, Jesse A. 2000. Mountain pine beetle attack in ponderosa pine: Comparing methods for rating susceptibility. Res. Pap. RMRS-RP-26. Ogden, UT.

Churchill DJ, Larson AJ, Dahlgreen MC, Franklin JF, Hessburg PF, Lutz JA. 2013. Restoring forest resilience: from reference spatial patterns to silvicultural prescriptions and monitoring. Forest Ecology and Management. 291: 442-457.

Colorado Department of Local Affairs (CODOLA). 2015. Population Data. State Demography Office, Department of Local Affairs, State of Colorado.

Colorado Department of Public Health and Environment. 2013. Regulation No.31 - The Basic Standards and Methodologies for Surface Water (5 CCR 1002-31).

Colorado State Forest Service. (2010). Forestry Best Management Practices to Protect Water Quality in Colorado.

Colorado State Forest Service. 2011. 2011 Report on the Health of Colorado's Forests. Colorado State University. Fort Collins, Colorado.

Covington WW, Moore MM. 1994. Southwestern ponderosa pine forest structure: changes since Euro-American settlement. Journal of Forestry. 92(1): 39-47.

Cram DS, Baker TT, Fernald AG, Cibilis AF, VanLeeuwen DM. 2015. Fuel and vegetation trends after wildfire in treated versus untreated forests. Forest Science. 61(4): 753-762.

Dale VH, Joyce LA, McNulty, Neilson RP, Ayres MP, Flannigan MD, Hanson PJ, Irlands LC, Lugo AE, Peterson CJ, Simberloff D, Swanson FJ, Stocks BJ, Wotton BM. 2001. Climate change and forest disturbances. BioScience. 51(9): 723-734.

Denslow, J.S. 1980. Patterns of plant species diversity during succession under different disturbance regimes. Oecologia 46: 18-21.

Department of Agriculture, Forest Service, Rocky Mountain Research Station. 10 p.

DeBano LF, Neary DG, Folliott PF. 1998. Fire's effects on ecosystems. John Wiley and Sons, Inc. New York, NY. 333 p.

DeByle, N.V. 1985. Wildlife. In: DeByle, N.V., R.P. Winokur. Aspen: Ecology and management in the western United States. Gen. Tech. Rep. RM-119. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 135-152.

Dickinson Y. 2014. Landscape restoration of a forest with a historically mixed-severity fire regime: What was the historical landscape pattern of a forest and openings? Forest Ecology and Management. 331: 264-271.

Doesken N, Pielke RA, Bliss OAP. 2003. Climate of Colorado: Climatography of the Unites States No. 60. Access 10/17/14 http://climate.atmos.colostate.edu/climateofcolorado.php

Dodd, N. L., S. S. Rosenstock, C. R. Miller, and R. E. Schweinsburg. 1998. Tassel-eared

squirrel population dynamics in Arizona: Index techniques and relationships to habitat condition. Arizona Game and Fish Department Technical Report 27, Phoenix, AZ.

Economic Profile System – Human Dimensions Toolkit (EPS-HDT). 2015. Headwaters Economics. www.headwaterseconomics.org/eps-hdt.

Elliot, William J.; Miller, Ina Sue; Audin, Lisa. Eds. 2010. Cumulative watershed effects of fuel management in the western United States. Gen. Tech. Rep. RMRS.GTR.231. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 299 p.

Fiedler CE, Friederici P, Petruncio M, Denton C, Hacker WD. 2007. Managing for old growth in frequent fire landscape. Ecology and Society. 12(2): 20.

Finney, M.A. 2006. An overview of FlamMap fire modeling capabilities. In: Andrews, P.L., Butler, B.W. Fuels management – How to measure success: Conference Proceedings. Fort Collins, CO; U.S. Department of Agriculture, Forest Service Rocky Mountain Research Station, RMRS-P-41. p. 213-220.

Flannigan MD, Stocks BJ, Wotton BM. 2000. Climate change and forest fires. The Science of the Total Environment. 262: 221-229.

Food and Agriculture Organization of the United Nations [FAO].Global forest resource assessment. 2005. www.fao.org/forestry/fra. [10 Aug. 2014]

Front Range Rountable. 2014. Upper Monument Creek Landsscape Restoration Initiative, summary Report and Collaborative Recommendations.

Frye RH, Landis TD. 1975. Mountain pine beetle and dwarf mistletoe, Lake Creek Area, San Carlos Ranger District, Pike-San Isabel National Forest. USDA Forest Service, Biological Evaluation Region 2, R2-75-4.

Furniss RL , Carolin VM. 1977. Western Forest Insects. Miscellaneous Publication No. 1339, U.S. Department of Agriculture Forest Service. 224-226, 346-347, 353-359.

Griffiths, R., M. Madritch, and A. Swanson. 2005. Conifer invasion of forest meadows transforms soil characteristics in the Pacific Northwest. Forest Ecology and Management 208: 347-358.

Grigal, D.F. 2000. Effect of Extensive Forest Management on Soil Productivity. Forest Ecology and Management, 138, 167-185.

Grigg, J. 2012. *E-23 Elk Management Plan.* Salida, CO: Colorado Parks & Wildlife: Southeast Region.

Hadley KS, Veblen TT. 1993. Stand response to western spruce budworm and Douglas-fir bark beetle outbreaks, Colorado Front Range. Canadian Journal of Forest Research. 23:479-491.

Haugo, R.D. and C.B. Halpern. 2007. Vegetation responses to conifer encroachment in a western Cascade meadow: a chronosequence approach. Canadian Journal of Botany 85: 285-298.

Hoffman, R. W., H.G. Shaw, M.A. Rumble, B.F. Wakeling, C.M. Mollohan, S.D. Schemnitz, R. Engel-

Wilson and D.A. Hendel. 1993. Management Guidelines for Merriam's Wild Turkeys. Colorado Division of Wildlife, Division Report. 18. 24pp.

Hoover, R. L., and D. L. Wills. 1984. *Managing forested lands for wildlife.* U.S. Forest Service, Rocky Mountain Region.

HRPCC http://www.hprcc.unl.edu/cgi-bin/cli_perl_lib/cliMAIN.pl?co1528 accessed 10/17/14

Huckaby LS, Kaufmann MR, Stoker JM, Fornwalt PJ. 2001. Landscape patterns of montane forest age structure relative to fire history as Cheesman Lake in the Colorado Front Range. *in* Ponderosa Pine Ecosystems Restoration and Conservation: Steps Toward Stewardship, Conference Proceedings. Flagstaff AZ, April 25-27, 2000. USDA Forest Service, Rocky Mountain Research Station, Proceedings RMRS-P-22

http://www.elpasoco.com/Documents/Waldo%20Canyon%20Fire/RRG%20-%20Grants%20Matrix%20(Sept%202014).pdf accessed 10/14/2014

Imeson AC, Verstraten JM, van Mulligen EJ, Sevink J. 1992. The effects of fire and water repellency on infiltration and runoff under Mediterranean type forest. Catena 19: 345-361.

Jack, JG. 1900. Twentieth annual report of the Unites States Geological Survey to the Secretary of the Interior 1898-99: Part V – Forest reserves. Government Printing Office. Washington. On file at the Pikes Peak Ranger District.

Kaufmann MR, Regan CM, Brown PM. 2000. Heterogeneity in ponderosa pine/Douglas-fir forests: age size structure in unlogged and logged landscapes of central Colorado. Canadian Journal of Forest Resources. 30: 698-711.

Kaufmann MR, Fornwalt PJ, Huckaby LS, Stoker JM. 2001. Cheesman Lake – A Historical Ponderosa Pine Landscape Guiding Restoration in the South Platte Watershed of the Colorado Front Range. *in* Ponderosa Pine Ecosystems Restoration and Conservation: Steps Toward Stewardship, Conference Proceedings. Flagstaff AZ, April 25-27, 2000. USDA Forest Service, Rocky Mountain Research Station, Proceedings RMRS-P-22

Kaufmann MR, Binkley D, Fule PZ, Johnson M, Stephens SL, Swetnam TW. 2007. Defining old growth for fire-adapted forests of the western United States. Ecology and Society. 12(2): 15.

Keith, J O. 2003. The Aberts Squirrel (Sciurus aberti): A Technical Conservation Assessment. USDA Forest Service: Rocky Mountain Region.

Kennedy, P.L., and J.B. Fontaine. 2009. Synthesis of Knowledge on the Effects of Fire and Fire Surrogates on Wildlife in U.S. Dry Forests. Special Report 1096, Extension and Experiment Station Communications, Oregon State University. Corvallis, Oregon.

Kilham, L. 1971. Reproductive behavior of Yellow-Bellied Sapsuckers: Preference for nesting in fomes-infected aspen and nest hole interrelations with flying squirrels, raccoons, and other animals. The Wilson Bulletin 83: 159-171.

Knight DH. 1994. Mountains and plains: the ecology of the Wyoming landscapes. Yale University Press. New Haven, Connecticut.

Kotliar, N. B. 2007. Olive-sided Flycatcher (*Contopus cooperi*): A Technical Conservation Assessment.

USDA, Forest Service, Rocky Mountain Region.

Libohova, Z. 2004. Effects of Thinning and a Wildfire on Sediment Production Rates, Channel Morphology, and Water Quality in the Upper South Platte River Watershed. Master of Science Thesis, Department of Forest, Rangeland, and Watershed Stewardship, Colorado State University, Fort Collins, Colorado, Spring 2004.

Liu YQ, Goodrick SL, Stanturf, JA. 2013. Future U.S. wildfire potential trendsprojected using a dynamically downscaled climate change scenario. Forest. Ecology and Management. 294, 120–135.

Logan JA, Powell JA. 2001. Ghost forests, global warming, and the mountain pine beetle. American Entemologist. 47(3): 160-173.

Logan JA, Regniere J, Powell JA. 2003. Assessing the impacts of global warming on forest pest dynamics. Frontiers in Ecology and Environment. 1: 130-137.

Low G. 2013. Landscape conservation forecasting for Upper Monument Creek: Report to Upper Monument Creek collaborative landscape restoration initiative. Unpublished. Available at Pikes Peak Ranger District.

Lyon, L. J., and A. G. Christensen. 2002. Elk and land management. In North American elk: ecology and management, eds. D. E. Toweill and J. W. Thomas, 557-581. Washington, DC: Smithsonian Institution Press.

MacDonald, L.H. and J.D. Stednick. 2003. Forests and Water: A State-of-the-Art Review for Colorado. CWRRI Completion Report No. 196.

Malmsheimer RW, Heffernan P, Brink S, Crandall D, Denke F, Galik E, Helms JA, McClure N, Mortimer M, Ruddell S, Smith M, Stewart J. 2008. Forest management solutions for mitigating climate change in the United States. Journal of Forestry. 106(3): 115-172.

Mannan, R.W., R. N. Conner, B. Marcot, and J. M. Peek. Managing Forestlands for Wildlife. Pages 689-721 *in* T.A. Bookhout, (ed). Research and Management Techniques for Wildlife and Habitats. Fifth ed. The Wildlife Society. Bethesda, MD.

Maser, C., and J. M. Trappe, tech. eds. 1984. The seen and unseen world of the fallen tree. Gen. Tech. Rep. PNW-164. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station.

Mast JN, Veblen TT. 1999. Tree spatial patterns and stand development along the pine-grass ecoctone in the Colorado Front Range. Canadian Journal of Forest Research. 29: 575-584.

McCabe GJ, Wolock DM. 2010. Long-term variability in Northern Hemisphere snow cover and associations with warmer winters. Climate Change. 99: 141–153.

McCambridge WF, Amman GD, Trostle GC. 1979. Forest Insect and Disease Leaflet 2, USDA Forest Service, Mountain Pine Beetle. 1-7.

Megahan, W.F. and J. Hornbeck. 2000. Lessons learned in watershed management: a retrospective view. USDA Forest Service Proceedings RMRS-P-13.

Meinzer, O.E. 1923. Outline of Ground-Water Hydrology. Geological Survey Water-Supply Paper 494. U.S. Geological Survey, Washington, DC.

Millar CI, Stephenson NL, Stephens SL. 2007. Climate change and forests of the future: managing in the face of uncertainty. Ecological Applications. 17(8): 2145-2151.

Miller, D. E., and J. B. Ritter 1996. An examination of the Rosgen classification of natural rivers, Catena, 27, 295–299.

Miller, M. W., D. P. Knowles, and M. S. Bulgin. 2008. Pasteurellosis Transmission Risks between Domestic and Wild Sheep. Council for Agricultural Science and Technology (CAST). Commentary QTA2008-1. Ames, Iowa. 8 p.

Mitton JB, Ferrenberg SM. 2012. Mountain pine beetle develops an unprecendented summer generation in response to climate warming. The American Naturalist. 179(5): 163-171.

Moore R. 1992. Soil survey of Pike National Forest, eastern part, Colorado, parts of Doulas, El Paso, Jefferson, and Teller counties. National Cooperative Soil Survey. 106 p.

Natural Resources Conservation Services. 1992. Soil Survey of Pike National Forest, Eastern Part, Colorado, Parts of Douglas, El Paso, Jefferson, and Teller Counties.

Neitro, W. A., R. W. Mannan, D. Taylor, V. W. Binkley, B. G. Marcot, F. F. Wagner, nd S. P. Cline. 1985. Sangs (Wildlife Trees), pages 130-169 *in* Brown, E. R. (ed). Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington. USDA, Forest Service, Pacific Northwest Region.

Negron JF. 1998. Probability of infestation and extent of mortality associated with the Douglas-fir beetle in the Colorado Front Range. Forest Ecology and Management. 107: 71-85.

Newton, I. 1994. The role of nest sites in limiting the numbers of hole-nesting birds: A review. Biological Conservation 70: 265-276.

NOAA. 2014 http://www.crh.noaa.gov/pub/?n=/ltg/cg_county_co.php accessed 10/17/14

O'Connell, M.A., J.G. Hallett, and S.D. West. 1993. Wildlife Use of Riparian Habitats: A Literature Review.

Oliver CD. 2002. Forests with crowded trees of small diameters- a global issue affecting forest sustainability. In Small diameter timber: resource management, manufacturing, and markets. Proceedings from conference held February 25-27, 2002 in Spokane, Washington. Compiled and edited by DM Baumgartner, LR Johnson, EJ DePuit. Washington State University Cooperative Extension.

Pacala SW, Hurtt GC, Baker D, Peylin P, Houghton RA, Birdsey RA, Heath L, Sundquist ET, Stallard RF, Ciais P, Moorcroft P, Caspersen JP, Shevliakova E, Moore B, Kohlmaier G, Holland E, GLoor M, Harmon ME, Fan SM, Sarmiento JL, Goodale CL, Pandey DN. 2002. Global climate change and carbon management in multifunctional forests. Current Science. 83(5) 593-602.

Packard, F.M. 1942. Wildlife and Aspen in Rocky Mountain National Park, Colorado. Ecology 23:478-482.

Patriquin, K.J. and R.M.R. Barclay. 2003. Foraging by bats in cleared, thinned and unharvested boreal forest. Journal of Applied Ecology 40:646-657.

Peet RK. 1981. Forests on the Rocky Mountains. In M.G. Barbour and W.D. Billings, eds. Terrestrial vegetation of North America. Cambridge: Cambridge University Press. 64-102.

Peterson DL, Johnson MC, Agee JK, Jain TB, McKenzie D, Reinhardt ED. 2005. Forest structure and fire hazard in dry forests of the western United States. USDA Forest Service. PNW-GTR-628.

Potyondy, J.P. and Geier, T.W. 2010. Watershed Condition Classification Technical Guide. USDA Forest Service. *Note: PSICC Updated Database 2010.*

Powell, D.C. 2008. Aspen community types of the Pike and San Isabel National Forests in south-central Colorado. Rd-ECOL-88-01. Second Edition. Lakewood, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Region. 278 p.

Price C, Rind D. 1994. The impact of a 2 x CO2 climate on lightning-caused fires. Journal of Climate. 7**:** 1484-1494.

Pyne SJ. 2001. Year of the fire: the story of the great fires of 1910. Mountain Press Publishing Company. 325 p.

Reynolds, R.T., E.C. Meslow and H.M. Wight. 1982. Nesting habitat of coexisting Accipiter in Oregon. Journal of Wildlife Management 46: 124-138.

Rice, R. M. and Sherbin, S. A. 1977. Estimating sedimentation from an erosion-hazard rating. USDA Forest Service Research Note PSW-323.

Robichaud PR, Beyers JL, Neary DG. 2000. Evaluating the effectiveness of postfire rehabilitation treatments. USDA Forest Service General Technical Report RM-GTR-63. Fort Collins, CO.

Rocca ME, Brown PM, MacDonald LH, Carrico CM. 2014. Climate chang impacts on fire regimes and key ecosystem services in Rocky Mountain forests. Forest Ecology and Management. 327: 290-305.

Rocky Mountain Field Institute. 2014. Upper South Platte/Hayman Conservation Campaign Final Effectiveness Monitoring Report.

Rocky Mountain Field Institute and USDA Forest Service. 2015. Waldo Canyon Fire 2014 BAER Effectiveness Monitoring.

Rollins, M.G. 2009. LANDFIRE: a nationally consistent vegetation, wildland fire, and fuel assessment. International Journal of Wildland Fire 18: 235-249.

Romme WH, Knight DH. 1981. Fire frequency and subalpine forests succession along a topographic gradient in Wyoming. Ecology. 62: 319-326.

Romme, W.H., M.L. Floyd, D. Hanna, and E.J. Bartlett. 2009. Chapter IV: Aspen Forests. Historical Range of Variability and Current Landscape Condition Analysis: South Central Highlands Section, Southwestern Colorado and Northwestern New Mexico. Fort Collins, Colorado: Colorado Forest Restoration Institute.

Rosgen, D. L. 1994. A Classification of Natural Rivers, Catena, 22, 169–199.

Rosgen, D. L. 2011. Wildland Hydrology. Trail Creek Watershed Assessment & Conceptual Restoration Plan: The WARSSS Results of the Hayman Fire.

Savage M, Brown PM, Feddema J. 1996. The role of climate in a pine forest regeneration pulse in the southwestern United States. Ecoscience. 3: 310-318.

Seager, A.T., C. Eisenberg, and S.B. St. Clair. 2013. Patterns and consequences of ungulate herbivory on aspen in western North America. Forest Ecology and Management 299: 81-90.

Schimel D. 2004. Mountains, fire, fire suppression, and the carbon cycle in the western United States. USDA Forest Service. PSW-GTR-193. 57-62.

Schmid, JM, Amman GD. 1992. Dendroctonus beetles and old-growth forests in the Rockies. P. 51-59 in M.R.Kaufmann, W.H. Moir, and R.L. Bassett, editors, Oldgrowth forests in the Southwest and Rocky Mountain regions. USDA Forest Service, General Technical Report RM-213.

Schmid, JM, Mata SA. 1996. Natural variability of specific forest insect populations and their associated 138 effects in Colorado. USDA Forest Service, General Technical Report RM-275.

Schoennagel T, Veblen TT, Romme WH, Sibold JS, Cook ER. 2005. Enso and pdo variability affect drought-induced fire occurrence in Rocky Mountain subalpine forests. Ecological Applications. 15: 2000–2014.

Scott, J.H., Burgan, R.E. 2005. Standard fire behavior fuel models: a comprehensive set for use with Rothermel's surface fire spread model. Gen. Tech. Rep. RMRS-GTR-153. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 72 p.

Sedjo RA, Wiseniewski J, Sample AV, Kinsman JD. 1995. The economics of managing carbon via forestry: assessment of existing studies. Environmental and Resource Economics. 6: 139-165.

Shepperd, W.D. 2001. Manipulations to Regenerate Aspen Ecosystems. Shepperd, W.D., D. Binkley, D.L. Bartos, T.J. Stohlgren, and L.G. Eskew, compilers. 2001. Sustaining aspen in western landscapes: symposium proceedings; 13-15 June 2000; Grand Junction, CO. Proceedings RMRS-P-18. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 460 p.

Shepperd, W.D. 2004. Techniques to restore aspen forests in the western U.S. Transactions of the Western Section of the Wildlife Society 40: 52-60.

Sherriff RL, Platt RV, Veblen TT, Schoennagel TL, Gartner MH. 2014. Historical, observed, and modeled wildfire severity in montane forests of the Colorado Front Range. Plus One. 9(9): 1-17.

Sherriff RL, Veblen TT. 2008. Variability in fire–climate relationships in ponderosa pine forests in the Colorado Front Range. International Journal of Wildland Fire. 17:50–9.

Shure, D.J. and D.L. Phillips. 1991. Patch size of forest openings and arthropod populations. Oecologia 86: 325-334.

Shuster, W.C. 1980. Northern goshawk nest site requirements in the Colorado Rockies. Western Birds 11: 89-96.

Sibold JS, Veblen TT, Gonzalez ME. 2006. Spatial and temporal variation in historic fire regimes in subalpine forests across the Colorado Front Range in Rocky Mountain National Park, Colorado, USA. Journal of Biogeography. 33: 631–647.

Skinner CN, Chang CR.1996. Sierra Nevada Ecosystem Project: Final report to Congress, vol. II, Assessments and scientific basis for management options. Davis: University of California, Centers for Water and Wildland Resources.

Smith DM, Larson BC, Kelty MJ, Ashton PMS. 1997. The practice of silviculture: applied forest ecology. John Wiley & Sons, Inc. New York. 537 p.

Smith, J.K., (ed.) 2000. Wildland fire in ecosystems: effects of fire on fauna. Gen. Tech. Rep.

RMRS-GTR-42-vol. 1. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Squires, J.R. and L.F. Ruggiero. 1996. Nest-site preference of Northern Goshawks in southcentral Wyoming. The Journal of Wildlife Management 60: 170-177.

Stam, B.R., J.C. Malechek, D.L. Bartos, J.E. Bowns, and E.B. Godfrey. 2008. Effect of Conifer Encroachment Into Aspen Stands on Understory Biomass. Rangeland Ecology Management 61: 93-97.

Stephens SL, Moghaddas JJ, Edminster C, Fiedler CE, Haase S, Harrington M, Keeley JE, Knapp EE, McIver JD, Metlen K, Skinner CN, Youngblood A. 2009. Fire treatment effects on vegetation structure, fuels, and potential fire severity in western U.S. forests. Ecological Applications. 19(2): 305-320.

Stephens SL, McIver JD, Boerner RJ, Fettig CJ, Fontaine JB, Hartsough BR, Kennedy PL, Schwilk DW. 2012. The effects of forest fuel-reduction treatments in the United States. Bioscience. 62(6): 549-560.

Stiver, J. 2015. Wildlife Biologist, Southeast Region, Colorado Parks and Wildlife. Colorado Springs, Colorado. Personal communication with Forest Service wildlife biologist.

Stiver, J. 2014. Bighorn Sheep Management Plan, Data Analysis Unit RBS-14, Rampart Herd, Game Management Unit S34. Colorado Parks and Wildlife, Southeast Region, Colorado Springs, Colorado.

Stoddard MT, Sanchez Meador AJ, Fule PZ, Korb JE. 2015. Five-year post-restoration conditions and simulated climate-change trajectories in a warm/dry mixed-conifer forest, southwestern Colorado, USA. Forest Ecology and Management. 356: 253-261.

Strahan RT, Stoddard MT, Springer JD, Huffman DW. 2015. Increasing weight of evidence that thinning and burning treatments help restore understory plant communities in ponderosa pine forests. Forest Ecology and Management. 353: 208-220.

Solomon S, Qin D, Manning M, Chen Z, Marquis M, Averyt KB, Tignor M, Miller HL (eds). 2007. Summary for policymakers. In: Climate change 2007: The physical science basis, Contribution of Working Group I to the Fourth Assessment Report of the Inergovernmental Panel on Climate Change [IPCC]. Cambridge University Press. Cambridge, United Kingdom and New York, NY, USA.

Tappeiner, II JC, Maguire DA, Harrington TB. 2007. Silviculture and ecology of western U.S. forests. Corvallis: Oregon State University Press. 440p.

Thomas, J.W., M.G. Raphael, R.G. Anthony. E.D. Forsman, A.G. Gunderson, R.S. Holthausen, B.G. Marcot, G.H. Reeves, J.R. Sedell and D.M. Solis. 1993. Viability assessments and management considerations for species associates with late successional and old growth forests of the Pacific Northwest. Pacific Salmon Workgroup.

Tietje, W.D., and R.L. Ruff. 1980. Denning Behavior of Black Bears in Boreal Forest of Alberta. The Journal of Wildlife Management 44: 858-870.

Town of Monument Source Water Protection Plan. townofmonument.org.

USDA Forest Service. 2001. Forest Roads: A Synthesis of Scientific Information.

USDA Forest Service. 2005. Management Indicator Species, Forest Plan Amendment 30, Land and Resource Management Plan for the Pike and San Isabel National Forests, Cimmaron and Comanche National Grasslands.

USDA Forest Service. 2006. FSH 2509.25 Watershed Conservation Handbook.

USDA Forest Service. 2012. National Best Management Practices for Water Quality Management on National Forest System Lands.

USDA Forest Service. 2015. Travel Analysis Process Report Addendum, Pikes Peak Ranger District.

USDA Forest Service. 2015. Bear Creek Watershed Improvement Environmental Assessment Hydrology Specialist Report.

USDA Forest Service. Rocky Mountain Region. Land and Resource Management Plan Pike and San Isabel National Forests Comanche and Cimarron National Grasslands.

U.S. Department of Agriculture [USDA]. 2010a. USDA Strategic Plan 2010-2015. http://www.ocfo.usda.gov/usdasp/sp2010/sp2010.pdf. [Date accessed unknown]

U.S. Department of Agriculture [USDA]. 2010b. Field guide to diseases and insects of the Rocky Mountain Region. Gen. Tech. Rep. RMRS-GTR-241. Ft. Collins, CO: Rocky Mountain Research Station. 336p.

U.S. Department of Agriculture [USDA], Forest Service. 2008. Forest Service strategic framework for responding to climate change, version 1.0. Washington D.C.: USDA Forest Service. 21p. Available online at http://www.fs.fed.us/climatechange/documents/strategic-framework-climate-change-1-0.pdf.

USDA, Pike and San Isabel National Forest Land and Resource Management Plan (Forest Plan), 1984

USDA, Forest Service ROS Users Guide

U.S. Department of the Interior, Fish and Wildlife Service. 2012. Final Recovery Plan for the

Mexican Spotted Owl (*Strix occidentalis lucida*), First Revision. Albuquerque, New Mexico, USA.

Vaillant, N.M., Ager, A.A., Anderson, J. 2013. ArcFuels10 system overview. Gen. Tech. Rep. PNW-GTR-875. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 65 p.

Vale TR, ed. 2002. Fire, native peoples, and the natural landscape. Island Press: Washington, D.C. 315 p.

Veblen TT, Donnegan JA. 2005. Historical range of variability for the forest vegetation of the National Forests of the Colorado Front Range. USDA Forest Service, Rocky Mountain Region.

Wagenbrenner JW, MacDonald LH, Rough D. 2006. Effectiveness of three post-fire rehabilitation treatments in the Colorado Front Range. Hydrological Process. 20: 2989-3006.

Waltz AEM, Stoddard MT, Kalies EL, Springer JD, Huffman DW, Sanchez Meador A. 2014. Effectiveness of fuel reduction treatments: assessing metrics of forest resiliency and wildfire severity after the Wallow Fire, AZ. Forest Ecology and Management. 334: 43-52.

White, C.A., C.E. Olmsted and C.E. Key. 1998. Aspen, Elk, and Fire in the Rocky Mountain National Parks of North America. Wildlife Society Bulletin 26: 449-462.

Wildland Hydrology and USDA Forest Service. 2013. Waldo Canyon Fire Watershed Assessment: The WARSSS Results.

Williams MA, Baker WL. 2012. Comparison of the *higher*-severity fire regime in historical (A.D. 1800s) and modern (A.D. 1984-2009) montane forests across 624,156ha of the Colorado Front Range. Ecosystems. 15: 832-847.

Wyoming Game and Fish Department. 2010. Riparian Areas, III-8-1. State Wildlife Action Plan. State Wildlife Action Plan.

Yocom Kent LL, Shive KL, Strom BA, Sieg CH, Hunter ME, Stevens-Rumann CS, Fule PZ. 2015. Interactions of fuel treatments, wildfire severity, and carbon dynamics in dry conifer forests. Forest Ecology and Management. 349: 66-72.

Younk, J.V. and M.J. Bechard. 1994. Breeding ecology of the northern goshawk in high-elevation aspen forests of northern Nevada. Studies of Avian Biology 16: 119-121.

Appendices

Appendix A Scoping Comments and Response

1. Focused fuel reduction near homes, transmission lines, developed recreation areas, and reservoirs

Response: The proposed action includes treatments under transmission lines and near private land inside the project boundary. Treatments around Palmer Reservoir were added in response to scoping comments. See page 21

2. Reduce dense oak concentration in the eastern UMC and Forest border

There are Oakbrush mitigation treatments along the eastern border of the Forest and project boundary. Additional treatments near Palmer Lake were also added and analyzed. See pages 33 and 21.

3. Reintroduce of fire where possible in lower elevation stands

4. Use Fire Cautiously

The purpose and need, desired conditions, and proposed action include using fire as a tool on the landscape. Burn plans are created for prescribed fires and fire will only be used when conditions set in the plans are met. See page 43 for a description of the prescribed fire under the proposed action.

5. Eliminate or minimize treatment in Roadless

6. An alternative that prohibits mechanized thinning or other logging in inventoried roadless areas; and an alternative that prohibits temporary or permanent roads within inventoried roadless areas.

Roadless treatments along the western border of the Rampart East Colorado Roadless area were removed. 383 acres of treatments on the eastern edge of the Rampart East Colorado Roadless area were added based on public comments and continued dialogue with the concerned citizens of Palmer Lake and the Coalition of the Upper South Platte. Tree cutting with chainsaw use would occur but there would not be any ground-based logging. An analysis of hand treatments in the roadless area was conducted to determine if those treatments improved or met the intent of the roadless area. See pages 51 and 91.

7. Retain/Protect Old Growth

A desired condition of this project is to protect and/or encourage the maintenance and development of large old trees. See pages 15 and 17.

8. Protect and Maintain Wildlife Habitat

The proposed action includes wildlife habitat improvements treatments, design criteria, and mitigation measures for creating and protecting habitat. See page 40

9. Fight Noxious Weeds and Protect Rare Plants

Design criteria and mitigation measures will help fight noxious weeds and protect rare plants. See page 52.

10. Alternative thinning ratios-the proposed treatment is too intense

11. Suggest openings less than 40 acres, we need to be clear that openings will start small and mostly be small with a few larger openings throughout the entire landscape

12. Believe BA in some ponderosa pine reduced from 115 to 25 is extreme.

13. Retain some Douglas fir

Openings of various sizes would occur across the landscape. Some Douglas-fir would be retained. See pages 34-35 and page 44.

14. Protect Watershed

15. Treatments of large opening could cause erosion

Floodplain Improvement treatments were added to the proposed action. Design criteria and mitigation measures will be used to limit soil loss. See pages 39 and 58.

16. Insert draft monitoring plan/ how will the project area be managed in the future. The ROD must require monitoring before any ground-disturbance.

A monitoring plan is included in Appendix C. This plan was developed through the collaborative group.

17. Don't amend the forest plan

An analysis was conducted on forest plan amendments and it was determined the project could meet the purpose and need without any amendments. All proposed amendments were eliminated. See pages 23 and 30.

18. Consider existing academic resources

Academic resources have been used throughout the planning phase, from the collaborative group to resource specialists citing work. These resources will continue to work with the Forest Service through implementation and monitoring. See page 27 and Appendix C.

Appendix B Watershed Condition Class Framework

HUC	Watershed	2010 Condition Class	Indicator	2010 Condition Class	Core Indicator	2010 Condition Class	Attributes	2010 Rating
110200030101	Beaver Creek	1.4	Aquatic Physical	1.3	Water Quality	1	Impaired Waters	1
							Water Quality Problems	1
					Water Quantity	1	Flow Characteristics	1
					Aquatic Habitat	2	Habitat Fragmentation	3
							Large Woody Debris	2
							Channel Shape and Function	1
			Aquatic Biological	1.7	Aquatic Biota	2.3	Life Form Presence	2
							Native Species	2
							Exotic and/or Invasive Species	3
					Riparian Vegetation	1	Vegetation Condition	1
			Terrestrial Physical	1.4	Road & Trail Network	1.5	Open Road Density	2
							Road Maintenance	1
							Proximity to Water	2
							Mass Wasting	1
					Soil	1.3	Soil Productivity	1
							Soil Erosion	2
							Soil Contamination	1
			Terrestrial Biological	1.2	Fire Effects & Regime	1	Fire Condition Class	1
							Wildfire Effects	N/A
					Forest Cover	1	Loss of Forest Cover	1
					Rangeland	1	Vegetation Condition	1
					Terrestrial Invasive Species	2	Extent & Rate of Spread	2
					Forest Health	1	Insects & Disease	1
							Ozone	1

HUC	Watershed	2010 Condition Class	Indicator	2010 Condition Class	Core Indicator	2010 Condition Class	Attributes	2010 Rating
101900020105	Horse Creek-Trout Creek	2.5	Aquatic Physical	2.6	Water Quality	3	Impaired Waters	3
							Water Quality Problems	3
					Water Quantity	2	Flow Characteristics	2
					Aquatic Habitat	2.7	Habitat Fragmentation	3
							Large Woody Debris	2
							Channel Shape and Function	3
			Aquatic Biological	3	Aquatic Biota	3	Life Form Presence	3
							Native Species	3
							Exotic and/or Invasive Species	3
					Riparian Vegetation	3	Vegetation Condition	3
			Terrestrial Physical	2.1	Road & Trail Network	1.8	Open Road Density	1
							Road Maintenance	2
							Proximity to Water	3
							Mass Wasting	1
					Soil	2.3	Soil Productivity	3
							Soil Erosion	3
							Soil Contamination	1
			Terrestrial Biological	2.2	Fire Effects & Regime	1	Fire Condition Class	1
							Wildfire Effects	N/A
					Forest Cover	2	Loss of Forest Cover	2
					Rangeland	3	Vegetation Condition	3
					Terrestrial Invasive Species	3	Extent & Rate of Spread	3
					Forest Health	2	Insects & Disease	1
							Ozone	3

HUC	Watershed	2010 Condition Class	Indicator	2010 Condition Class	Core Indicator	2010 Condition Class	Attributes	2010 Rating
110200030105	Middle Monument Creek	1.4	Aquatic Physical	1.3	Water Quality	1	Impaired Waters	1
							Water Quality Problems	1
					Water Quantity	1	Flow Characteristics	1
					Aquatic Habitat	2	Habitat Fragmentation	3
							Large Woody Debris	2
							Channel Shape and Function	1
			Aquatic Biological	1.7	Aquatic Biota	2.3	Life Form Presence	2
							Native Species	2
							Exotic and/or Invasive Species	3
					Riparian Vegetation	1	Vegetation Condition	1
			Terrestrial Physical	1.2	Road & Trail Network	1	Open Road Density	1
							Road Maintenance	1
							Proximity to Water	1
							Mass Wasting	1
					Soil	1.3	Soil Productivity	1
							Soil Erosion	2
							Soil Contamination	1
			Terrestrial Biological	1.8	Fire Effects & Regime	3	Fire Condition Class	3
							Wildfire Effects	N/A
					Forest Cover	1	Loss of Forest Cover	1
					Rangeland	2	Vegetation Condition	2
					Terrestrial Invasive Species	2	Extent & Rate of Spread	2
					Forest Health	1	Insects & Disease	1
							Ozone	1

HUC	Watershed	2010 Condition Class	Indicator	2010 Condition Class	Core Indicator	2010 Condition Class	Attributes	2010 Rating
101900020502	Upper East Plum Creek	1.5	Aquatic Physical	1.3	Water Quality	1	Impaired Waters	1
							Water Quality Problems	1
					Water Quantity	1	Flow Characteristics	1
					Aquatic Habitat	2	Habitat Fragmentation	3
							Large Woody Debris	2
							Channel Shape and Function	1
			Aquatic Biological	1.7	Aquatic Biota	2.3	Life Form Presence	2
							Native Species	2
							Exotic and/or Invasive Species	3
					Riparian Vegetation	1	Vegetation Condition	1
			Terrestrial Physical	1.3	Road & Trail Network	1.3	Open Road Density	1
							Road Maintenance	1
							Proximity to Water	2
							Mass Wasting	1
					Soil	1.3	Soil Productivity	1
							Soil Erosion	2
							Soil Contamination	1
			Terrestrial Biological	1.8	Fire Effects & Regime	2	Fire Condition Class	2
							Wildfire Effects	N/A
					Forest Cover	1	Loss of Forest Cover	1
					Rangeland	2	Vegetation Condition	2
					Terrestrial Invasive Species	2	Extent & Rate of Spread	2
					Forest Health	2	Insects & Disease	1
							Ozone	3

HUC	Watershed	2010 Condition Class	Indicator	2010 Condition Class	Core Indicator	2010 Condition Class	Attributes	2010 Rating
110200030102	Upper Monument Creek	1.6	Aquatic Physical	1.3	Water Quality	1	Impaired Waters	1
							Water Quality Problems	1
					Water Quantity	1	Flow Characteristics	1
					Aquatic Habitat	2	Habitat Fragmentation	3
							Large Woody Debris	2
							Channel Shape and Function	1
			Aquatic Biological	1.7	Aquatic Biota	2.3	Life Form Presence	2
							Native Species	2
							Exotic and/or Invasive Species	3
					Riparian Vegetation	1	Vegetation Condition	1
			Terrestrial Physical	1.6	Road & Trail Network	1.8	Open Road Density	2
							Road Maintenance	2
							Proximity to Water	2
							Mass Wasting	1
					Soil	1.3	Soil Productivity	1
							Soil Erosion	2
							Soil Contamination	1
			Terrestrial Biological	1.8	Fire Effects & Regime	3	Fire Condition Class	3
							Wildfire Effects	N/A
					Forest Cover	1	Loss of Forest Cover	1
					Rangeland	1	Vegetation Condition	2
					Terrestrial Invasive Species	3	Extent & Rate of Spread	3
					Forest Health	1	Insects & Disease	1
							Ozone	1

HUC	Watershed	2014 Condition Class	Indicator	2014 Condition Class	Core Indicator	2014 Condition Class	Attributes	2014 Rating
110200030103	West Monument Creek	2.4	Aquatic Physical	2.2	Water Quality	2	Impaired Waters	1
							Water Quality Problems	3
					Water Quantity	2	Flow Characteristics	1
					Aquatic Habitat	2.7	Habitat Fragmentation	3
							Large Woody Debris	2
							Channel Shape and Function	3
			Aquatic Biological	2.7	Aquatic Biota	2.3	Life Form Presence	2
							Native Species	2
							Exotic and/or Invasive Species	3
					Riparian Vegetation	3	Vegetation Condition	3
			Terrestrial Physical	2.3	Road & Trail Network	2.3	Open Road Density	2
							Road Maintenance	3
							Proximity to Water	3
							Mass Wasting	1
					Soil	2.3	Soil Productivity	3
							Soil Erosion	3
							Soil Contamination	1
			Terrestrial Biological	2.2	Fire Effects & Regime	3	Fire Condition Class	N/A
							Wildfire Effects	3
					Forest Cover	3	Loss of Forest Cover	3
					Rangeland	2	Vegetation Condition	2
					Terrestrial Invasive Species	2	Extent & Rate of Spread	2
					Forest Health	1	Insects & Disease	1
							Ozone	1

HUC	Watershed	2010 Condition Class	Indicator	2010 Condition Class	Core Indicator	2010 Condition Class	Attributes	2010 Rating
101900020602	Headwaters West Plum Creek	1.5	Aquatic Physical	1.5	Water Quality	1.5	Impaired Waters	1
							Water Quality Problems	2
					Water Quantity	1	Flow Characteristics	1
					Aquatic Habitat	2	Habitat Fragmentation	3
							Large Woody Debris	2
							Channel Shape and Function	1
			Aquatic Biological	1.7	Aquatic Biota	2.3	Life Form Presence	2
							Native Species	2
							Exotic and/or Invasive Species	3
					Riparian Vegetation	1	Vegetation Condition	1
			Terrestrial Physical	1.4	Road & Trail Network	1.5	Open Road Density	1
							Road Maintenance	1
							Proximity to Water	3
							Mass Wasting	1
					Soil	1.3	Soil Productivity	1
							Soil Erosion	2
							Soil Contamination	1
			Terrestrial Biological	1.4	Fire Effects & Regime	2	Fire Condition Class	2
							Wildfire Effects	N/A
					Forest Cover	1	Loss of Forest Cover	1
					Rangeland	1	Vegetation Condition	1
					Terrestrial Invasive Species	1	Extent & Rate of Spread	1
					Forest Health	2	Insects & Disease	1
							Ozone	3

HUC	Watershed	2010 Condition Class	Indicator	2010 Condition Class	Core Indicator	2010 Condition Class	Attributes	2010 Rating
101900020103	Long Gulch-Trout Creek	2.3	Aquatic Physical	2.6	Water Quality	3	Impaired Waters	3
							Water Quality Problems	3
					Water Quantity	2	Flow Characteristics	2
					Aquatic Habitat	2.7	Habitat Fragmentation	3
							Large Woody Debris	2
							Channel Shape and Function	3
			Aquatic Biological	2.7	Aquatic Biota	2.3	Life Form Presence	2
							Native Species	2
							Exotic and/or Invasive Species	3
					Riparian Vegetation	3	Vegetation Condition	3
			Terrestrial Physical	2	Road & Trail Network	2	Open Road Density	2
							Road Maintenance	3
							Proximity to Water	2
							Mass Wasting	1
					Soil	2	Soil Productivity	2
							Soil Erosion	3
							Soil Contamination	1
			Terrestrial Biological	1.4	Fire Effects & Regime	2	Fire Condition Class	2
							Wildfire Effects	N/A
					Forest Cover	1	Loss of Forest Cover	1
					Rangeland	1	Vegetation Condition	1
					Terrestrial Invasive Species	2	Extent & Rate of Spread	2
					Forest Health	1	Insects & Disease	1
							Ozone	1

Appendix C Monitoring Plan