United States
Department of
Agriculture

Forest Service

May 2013

Environmental Assessment

Escalante Forest Restoration and Stewardship Project

Ouray Ranger District; Grand Mesa, Uncompahgre, and Gunnison National Forests; Montrose County, Colorado

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SUMMARY

The Escalante Forest Restoration and Stewardship (EFRS) project is located on the Uncompahgre Plateau about 20-40 miles southwest of Delta, Colorado. The project area encompasses 136,079 gross National Forest acres. Approximately 5,771 acres of private land contained in 13 blocks are located within the project area. Please refer to the attached Project Area Overview map.

This proposal is a product of the Uncompahgre Plateau Collaborative Forest Landscape Restoration Project grant obtained by the GMUG National Forest in 2010.

The objective of all proposed treatments is to increase forest ecosystem resilience to anticipated forest disturbances over the next 50-100 years such as wildfire, insect and disease outbreaks, big game and livestock use and climate change through the management of vegetation density, structure, composition and pattern. The proposed action seeks to restore many of the key forest structure characteristics common prior to Euro-American settlement of the region that are lacking in today's forests. These characteristic the absence of natural fire, road development, livestock grazing, and past timber management practices (Romme et. al. 2009). As a consequence, forests in the project area are more vulnerable to uncharacteristic stand-replacing fire and lack broad-scale forest successional structure characteristics that are thought to have been more prevalent historically.

Within forest vegetation zones adapted to frequent low-severity fires, the proposed action is intended to increase forest resilience to the effects of wildfires burning under extreme conditions. Implementation will result in more-open, early-development forest succession conditions by reducing canopy cover and favoring retention of fire-resistant tree species. In these zones, the proposed action will attempt to increase broad-scale forest resiliency to the expected effects of climate change by reducing stand density and favoring more drought tolerant species. In these low-severity fire-adapted forest types, timber harvesting associated with the proposed action will produce a limited amount of forest products value that will exceed the costs to removed small diameter trees and associated fuels.

Within cooler and moister, more high-severity fire-adapted vegetation zones, the proposed action will primarily increase early-development stand conditions currently lacking in these forests. Within the highest elevation forests of the project area these efforts will be directed towards increasing the suitability of forest habitat in the project area for the snowshoe hare, a key prey species for the threatened Canada Lynx. Where Lynx habitat improvement is not the primary objective in these zones, the proposed action will not only seek to increase early-development stand conditions, but will also promote components of these forests such as Douglas-fir and aspen that have been reduced through a century of past management activity. In many portions of these forest zones, timber harvesting associated with the proposed action will create forest product value that can not only be used to offset costs of implementing the proposed action in other vegetation zones, but also to support local forest product related sector.

Pinyon and juniper woodlands and mountain shrublands at the lowest elevations of the project area have great importance to ungulate herds within the project area as winter range habitat. The proposed action will seek to improve the quality of this habitat within previously managed areas using mechanical treatments and seeding, increasing forage quality and habitat suitability for big game species.

A broad-scale perspective is critical to address the landscape-scale scale objective of increasing forest resilience to disturbances such as wildfire, insect and disease outbreaks, big game and livestock use and expected climate change impacts on vegetation structure over the next 50-100 years. A broad-scale perspective, both in space and time, is even more essential since current and likely future budgetary constraints provide a finite amount of financial resources for forest management planning and accomplishments.

The success of this adaptive-management approach requires collaboration between internal Forest Service personnel and forest management stakeholders, collaborators and interested parties. A cornerstone of this effort is a concise and periodically updated project implementation plan. The Escalante Project plan will provide a general schedule of treatment activities and set forth trigger points for collaborator involvement and required communications and surveys between agency staff. Perhaps most importantly, this plan will form a framework for ecological and social monitoring activities associated with project implementation. Concise and actionable monitoring information is essential for an effective adaptive ecosystem management project such as the EFRS project, which spans tens of thousands of acres over a 7-10 year period. Broad collaborative involvement in ecological monitoring has been a highlight of recent forest restoration efforts on the Plateau and is a key feature of the Uncompahgre Plateau Collaborative Forest Landscape Restoration Program. The EFRS will build on this collaboratively-based monitoring foundation, informing projects throughout the course of action.

Because there are no unresolved conflicts concerning alternative uses of available resources, this EA analyzes only the proposed action without consideration of additional action alternatives (36 CFR, Part 220.7(b)(2)(i)). Based upon the effects of the proposed action, the responsible official will decide where and by what means treatments will occur.

INTRODUCTION

Document Structure

The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental effects that would result from the proposed action and no action alternatives. The document is organized into five parts:

- *Introduction:* This section includes information on the background and ecological context underlying the project proposal, the history of the project proposal and the purpose of and need for the project. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- *Discussion of the Proposed Action:* This section provides a detailed description of the agency's proposed action and the assumptions and analyses supporting the development and evolution of the proposed action following project initiation.
- *Environmental Consequences:* This section describes the environmental effects of implementing the proposed action. Within each section, the affected environment is described first, followed by the effects of the No Action Alternative that provides a baseline for evaluation and comparison with the effects of the proposed action.
- *Agencies and Persons Consulted:* This section provides a list of preparers and agencies consulted during the development of the environmental assessment.
- *Appendices:* The appendices provide more detailed maps and information to support the analyses presented in the environmental assessment.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Ouray Ranger District Office in Montrose, Colorado.

Background and Ecological Context

Geography and Ecology

The project area is located on the Uncompahgre Plateau, a broad geographic uplift with climates ranging from semi-arid lowlands at the lowest elevations to cold and wet subalpine highlands at the highest elevations. This broad landscape is dissected by deep drainages creating a diverse landscape of mesa tops and canyons. This topographic diversity lends itself to a wide range of vegetation types (See Appendix A, Map 1: Project Area Overview).

Naturally ignited, free-burning wildfires were an important component of the project landscape. Fire effects were influenced by vegetation composition, topography and climatic variables across the landscape. The interaction of these factors resulted in variation in fire heat output (intensity), severity (ground cover consumption and vegetation and tree mortality) and frequency across the project landscape. Fire regimes and vegetation zones within the project area include:

- Frequent low intensity fires in ponderosa pine-oak forests (17,900 acres).
- Semi-frequent, patchy mixed-severity fires in middle-elevation mixed-conifer forests of ponderosa pine, Douglas-fir, blue spruce, subalpine fir, Engelmann spruce and aspen. (34,400 acres).
- Infrequent stand replacing fires in lower elevation pinyon-juniper/mixed mountain shrub woodlands (61,000 acres) and high elevation spruce-fir/aspen forests (23,000 acres). Spruce-fir-aspen forests are the highest elevation areas within the project area and are typically very moist. The probability of a significant fire ignition is typically very low in these areas in all but the driest years.

Over approximately the last 130 years (generally the time period since Euro-American settlement of the adjacent Uncompahgre Valley), the project area has seen almost no significant wildfires, at least in part due to past forest management practices and the active suppression of wildfire (Brown and Sheppard 2003; Binkley et. al. 2008)). This has led to increases in tree densities across portions of the project landscape, as compared to the range of conditions common within these areas prior to the exclusion of fire from the landscape (i.e. historic range of variability).

The lowest elevations of the project area are dominated by pinyon and juniper trees and a mix of semi-arid shrub species (Utah serviceberry, mountain mahogany and Gambel oak, among others). While woody vegetation density has likely increased somewhat in these areas due to fire exclusion, these areas are generally within the historical range of variability. These areas serve an important habitat function for big game (elk, deer) within the project area, especially in open, early-development, shrub-dominated areas of this vegetation zone. Heavy browsing and grazing by big game populations within the project area has reduced the cover and palatability of vegetation within early-development patches of this ecosystem type.

Within middle elevation ponderosa pine-oak forests, a large percentage of forested acres have increased in tree density over the last 130 years replacing productive and diverse understory plant communities with trees and oak shrubs. The majority of these acres have higher densities of ponderosa pine, oak and often blue spruce, particularly in trees that have established since the last recorded fire on the landscape in 1879 (Binkley et. al. 2008, Romme et al. 2009; Matonis 2012). Historically these open,fire-maintained, park-like forests supported a diverse mix of grass and forb species important as wildlife and livestock forage. In their 2003 report “Preliminary Fire History in Ponderosa Pine Forests of the Uncompahgre Plateau”, Brown and Sheppard calculated median fire return intervals from five ponderosa pine sample chronologies and found a range of 8 to 17 years to be fairly consistent across this vegetation zone (Brown and Sheppard 2003). In the century preceding the last recorded 1879 fire, their data indicates larger-scale fires occurring on the plateau in 1785, 1818, 1842, and 1863. They found no evidence of larger-scale fire in any stand following the 1879 fire. Although this study focuses on ponderosa pine stands only, it is likely that some of these fires affected portions of warm-dry mixed-conifer stands as well. These historical fires tended to be of low severity, creeping across the forest floor consuming needles and branches and controlling tree regeneration. This vegetation zone also contains the lowest elevation occurrences of aspen, an important, fire-adapted, sun-loving deciduous tree species occurring in all forest types between the ponderosa pine and spruce-fir/aspen zones. Many aspen

stands within this vegetation zone are currently declining, possibly due to the phenomenon known as sudden aspen decline (Worral et al. 2010)

Within the mixed-conifer vegetation zones, lower-elevation, drier areas are comprised of Douglas-fir, ponderosa pine and aspen dominant stands (i.e warm-dry mixed-conifer) while higher-elevation, moister areas include Douglas-fir and aspen dominant stands (i.e. cool-moist mixed-conifer). Lower-elevation mixed-conifer-aspen forests are thought to be adapted to semi-frequent, mixed to low-severity fires which regulated the density of shade loving, fire susceptible tree species such as blue and Engelmann spruce and subalpine fir. Higher-elevation cool-moist mixed-conifer forests are more adapted to a larger percentage of mixed to high-severity fires. Within both of these forest types, high density patches of shade loving trees were a common component of historical forest structure. Historically, shade-tolerant trees established within these forests under fire-resistant trees between fire events, and shade-intolerant species are thought to have become established in open forest conditions created by mixed-severity fires. After a century of fire exclusion, there is considerable evidence that the density, continuity and extent of patches of shade-loving species within the project area has increased, especially within ponderosa pine-oak and warm-dry mixed conifer types (Binkley 2008; Romme et. al. 2009; Matonis 2012). Today, many stands within the mixed-conifer vegetation type contain high densities (500 to greater than 1000 stems per acre) of small to mid-diameter trees, connecting and growing beneath once isolated patches of dense trees (See Figure 1). In the warm-dry mixed-conifer vegetation zone, once common, open forest conditions, suitable for regenerating shade intolerant species, particularly ponderosa pine and aspen, are lacking (LANDFIRE 2013). Together, these changes have increased the likelihood of a large extent, dangerous and costly high-severity wildfire. In the event of such a wildfire under current conditions, fire-resistant old and large-diameter tree species such as ponderosa pine and Douglas-fir would likely be killed by intense fires spreading through tree crowns.

Crown fires were infrequent, but did occur historically within high elevation spruce-fir-aspen forests. These fires typically killed a very high percentage of trees in stands where they burned. High densities of aspen sprouting often followed these fires in some sites, while in other sites spruce slowly reestablished over time. Active fire suppression over the last century has likely excluded some fires that would have burned in this forest type, although cool-wet climatic conditions over the past century may also explain some of the lack of fire during this period (Romme et. al. 2009). This has likely reduced the complexity of the landscape-scale mosaic of burned and unburned areas, but generally this effect is much less pronounced as compared to the more fire-adapted ponderosa pine/oak and mixed-conifer forests. While still within the broad range of historical variability, this forest type contains minimal areas of early-development, stand initiation conditions. The lack of early-development or stand-initiating conditions in these forest types has important habitat implications for the threatened Canada Lynx, as Snowshoe hare, the primary prey species of the Lynx, are dependent on the dense horizontal tree cover within early-development and late-development multistoried forest conditions in this vegetation zone.

Figure 1: Warm-dry Mixed Conifer Forest containing old, shade-intolerant ponderosa pine and high densities of young small diameter and shade-tolerant subalpine fir and spruce.

Commercial Forest Management History

The Uncompahgre Plateau has a history of over 100 years of timber management. Nearby towns of Montrose, Delta and Grand Junction contain some of the few remaining large sawmills in the Southern Rocky Mountain Region and a dozen small forest specialty product milling operations. The commercial forest management history of the project area can be separated into at least three broad categories with different associated time periods, harvest methods and ecological legacies:

Euro-American settlement through the mid-20th century:

In this time period, harvests removed easily accessible large diameter ponderosa pine and Douglas-fir, shifting species composition somewhat towards shade tolerant species. Compared to more recent forest management activities, these harvests were of low-intensity, leaving a mature component of these tree species intact.

Mid-twentieth century through 1980s:

Harvests in this period were often mid to high intensity “high-grading” or “shelterwood preparation” cuts of the highest-value portion of the existing tree volume. These harvests depleted some mixed-conifer stands entirely of Douglas-fir and ponderosa pine, leaving no seed source, but typically left a major component of the pre-harvest spruce and subalpine fir overstory. In most cases, advanced tree regeneration was not managed following harvest, shifting future species composition towards dense stands of low-value,

shade-loving subalpine fir and away from sun-loving Douglas-fir, Ponderosa pine and aspen. These efforts may have predisposed many stands to future spruce budworm outbreaks (see *Forest Insect Disturbances* below). These harvests, in most cases, did not appear to create early, stand-initiation conditions, but instead reduced the complexity and commercial value of mid to late development stand conditions.

Within this same time period, mechanical disturbance such as chaining and herbicide spraying was undertaken in the pinyon and juniper vegetation zone. These efforts were undertaken to reduce woody vegetation in order to stimulate forage production for livestock and big game species. Today, much of the early-development ecosystem conditions in this vegetation zone are a result of the woody vegetation reduction treatments of this era.

1980s-2002:

Due to local demand for the species, harvests in this period were mainly coppice harvest operations targeted towards producing and regenerating aspen, but also included limited selection harvests of spruce and salvage harvests of ponderosa pine, spruce and Douglas-fir. About 2/3 of the aspen stands within the project area successfully regenerated to young aspen following coppice harvests. About 1/3 of areas did not regenerate, probably due to a combination of factors including inadequate silvicultural practices, poor site selection and heavy browse by ungulates. Later harvests in this period consisted of individual tree and group selection in spruce-fir-aspen types and even-aged management in ponderosa pine. With few exceptions, the early-development stand conditions within higher elevation vegetation zones of the project area are a result of harvests completed during this period.

Range Management History

Forest Service records indicate that the Uncompahgre Plateau was once dominated by highly productive rangelands when white settlers came into the area in the early 1880s, including forest From that time until the early 1950's the natural resources of this landscape were impacted by excessive livestock grazing, resulting in degradation and deterioration. In the 1950's and 1960's livestock numbers and seasons of use were reduced. Allotments were divided into pastures to create manageable grazing units, with prescribed grazing seasons linked more closely to plant phenology. Fencing was constructed to help manage livestock, and the construction of water developments provided water sources other than that found in streams. Non-structural range improvements including chaining, roller chopping, and seeding were implemented in an effort to restore deteriorated rangelands and enhance soil and water quality. Long-term rangeland monitoring methods were developed and used to evaluate and manage rangeland conditions. Allotment management plans, first developed in the 1960's, continued to improve rangelands on the Uncompahgre Plateau. Much of this improvement was observed in the upland vegetation zones. More recently, in the 1980s, management began to emphasize riparian area use and condition. While issues still exist regarding range management within the project area, rangeland conditions have improved dramatically since the mid-point of the last century.

Forest Insect Disturbances

In recent history, several insect and disease outbreaks of varying intensities and severities have occurred in forest vegetation types of the project area:

A Plateau-wide spruce budworm outbreak over the last 10 years has defoliated both young and old Douglas-fir, subalpine fir and spruce trees, killing them or increasing their susceptibility to bark beetle attacks. The effects of this on immature and regenerating trees may have been exacerbated by the two-aged canopy conditions created as a result of shelterwood harvest operations (Fellin and Dewey 1986).

Outbreaks of bark beetles such as mountain pine beetle, Douglas-fir beetle and spruce beetle often cause localized or broad areas of extensive tree mortality. Climates is usually a primary causal factor for these outbreaks and are often exacerbated by forest structure conditions resulting from fire suppression and forest management activities similar to those applied within the project area (Fettig et. al. 2007). An ongoing Douglas-fir beetle has caused widespread large diameter Douglas-fir mortality across the project area for over a decade. Within the adjacent landscapes of the San Juan Mountains and the Grand Mesa, a spruce beetle outbreak is currently occurring at the landscape scale, killing tens of thousands of acres of mature Engelmann spruce (Eager 2012). Landscape scale resilience to potential bark beetles is associated with diversity of tree age structure (i.e. succession class or developmental stage) (Fettig et al 2007; Eager et al 2012).

Multiple Lines of Evidence

Multiple sources of evidence indicate changes in forest structure brought about by fire exclusion and timber management across the project landscape and other similar forested landscapes in the Southwest region of Colorado. These changes, along with regional assessments of anticipated climate changes in the region, indicate compromised ecosystem resiliency to uncontrolled fire disturbances and the potential for broad-scale impacts on forest structural diversity and function.

- Regionally, several assessments of historical and current forest conditions have been completed in Southwest Colorado each indicating similar causes for vegetation departures from the range of historical forest variability (Romme and McGarrigal 2005; Fulé et. al. 2009, Romme et. al. 2009, Matonis 2012).
- A wealth of vegetation survey data including Common Stand Exam Surveys, Dense Horizontal Cover surveys and LANDFIRE succession class and canopy cover data are available for forests within the project area. Analysis of these data sources, along with a recent comprehensive assessment of vegetation conditions completed by the GMUG National Forest, suggest that current vegetation composition, structure and pattern exhibit a substantial departure from that which existed historically, placing them in condition of reduced resiliency to wildfire and insect disturbance.
- The majority of climate models for the Rocky Mountain indicate a high probability of increasingly warming average (See Figure 2 below) and extreme temperatures, leading to reduced mountain snowpacks, higher tree susceptibility to insect and disease outbreaks, a potentially longer fire season and an associated increase in wildfire activity (Girvetz et. al.2009; Nydick et al. 2012).

Disturbances such as wildfire and insect have and continue to be a major factor responsible for shaping vegetation characteristics and wildlife habitats across the project landscape over time. An accumulation of evidence indicates that targeted vegetation treatments can be applied to moderate the impacts of these disturbances upon fire severity and wildlife habitat loss, benefiting local communities and enhancing ecosystem resiliency and diversity.

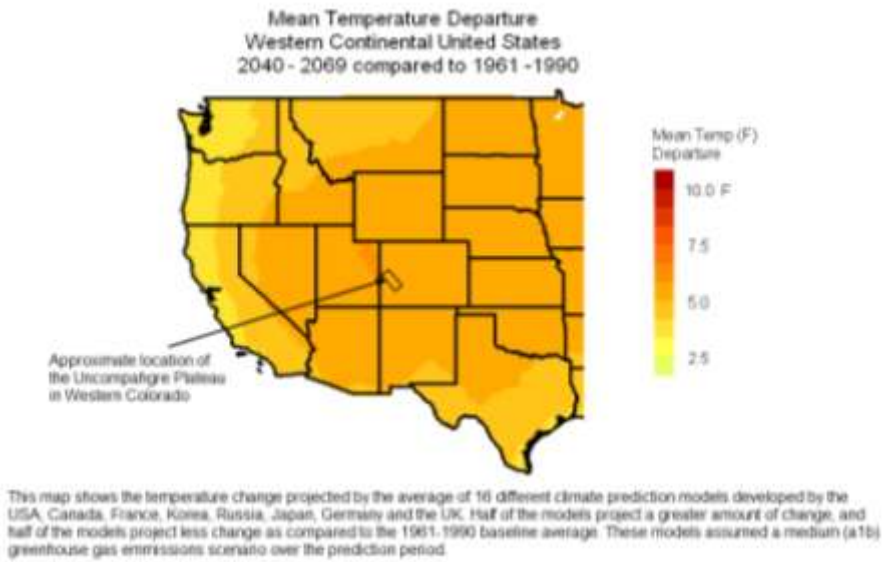

Figure 2: Projected increases in climate change in the Western US 2040-2060 (Girvetz et. al. 2009).

Purpose and Need for Action

Based on the information described above, the overarching objective of all treatments is to increase forest ecosystem resilience to anticipated forest disturbances over the next 50-100 years such as wildfire, insect and disease outbreaks, big game and livestock use and climate change through the management of vegetation density, structure, composition and pattern. There is a need to:

- Shift vegetation patterns, distribution and composition towards historical range of variability and a mosaic of conditions capable of facilitating the use of ecologically appropriate managed fire
- Protect human life and property from wildfire
- Increase the economic resilience of the local forest management and products sector
- Improve big-game wildlife habitat (forage)
- Improve primary prey species habitat for Canada Lynx

Here is how proposed treatments are to be applied to meet these needs:

- Near private inholdings within the project area, mechanical surface and ladder fuels reduction treatments will be used to reduce fireline intensity and the threat of crown fire behavior under extreme fire weather conditions. In some locations, focused coppice cutting units will be used to stimulate an aspen regeneration response to create long-term, fire-resistant vegetation conditions.

- In low and mixed-severity fire-adapted forest types such as ponderosa pine-oak and warm-dry mixed-conifer forests, evidence of the historical range of variability (HRV) within these areas will serve as the reference for middle and fine-scale forest restoration objectives. In general, forest restoration activities will increase the quantity of early-development (i.e. “early-seral” conditions) and open canopy, fire-maintained forest structures that have declined due to over a century of fire suppression.

- Within higher-elevation mixed to high-severity fire adapted forest types such as cool-moist mixed-conifer forests, creation of early-development successional conditions will be the goal of proposed forest harvest and non-commercial mechanical operations.

- Spruce-fir forests within the EFRS project have been identified as potential Canada Lynx habitat. Uneven-aged group selection harvests will be applied in currently unsuitable Lynx habitat to promote conditions capable of supporting populations of prey species.

- Low-elevation pinyon-juniper and mountain-shrub woodland ecosystems within the project area are often heavily used by big game species in the late fall through early spring months. Heavy use of these areas degrades their habitat value and puts game use pressure on private lands during these months. Within previously managed areas in this vegetation zone mechanical vegetation treatments and native seeding will be used to promote habitat and forage values within these areas.

- Much of the project area contains vegetation types adapted to frequent low to mixed severity fire, but has not experienced fire for the last century or more. Broadcast burning treatments will be applied in ponderosa pine-oak and warm-dry mixed-conifer forest zones, and focused in areas within and surrounding commercial and non-commercial mechanical treatment areas.

- Proposed mechanical treatments and commercial harvests will contribute to the economic resilience of the local forest management and products sector through ecologically and sustainable forest product utilization. In some areas, non-commercial mechanical treatments aimed at addressing forest degradation associated with past management activities will be the primary long-term approach to increasing sustainability and resilience in the forest management and products sector.

- Across the project landscape, important questions exist regarding the proper management of several distinct and unique vegetation types. Two applied silvicultural assessments will be used to experimentally evaluate potential

management options within these areas and to promote and strengthen relationships with applied forest ecology research collaborators.

Facilitating the use of fire as an ecological process throughout the Escalante landscape is a primary objective of the Escalante Forest Restoration and Management Project. Despite the beneficial ecological processes associated with fire, recent history has shown that most large and uncontrolled wildfires typically burn under very hot and dry conditions, often dangerous and destructive to human life, property, and economic activities. This project will promote the management of landscape-scale managed fires across fire adapted portions of the landscape as an essential and beneficial ecological process, while recognizing the potential risks of all fires, even ecologically beneficial ones, to human and non-human ecosystems.

This action responds to the goals and objectives outlined in the Amended Land and Resource Management Plan for the Grand Mesa, Uncompahgre, and Gunnison National Forests (USDA FS 1991), and helps move the project area towards desired conditions described in that plan; Interim Directive 2020-2008-1 in Forest Service Manual FSM 2000, Chapter 2020 “Ecological Restoration and Resilience; the goals and objectives developed by the Uncompahgre Mesas Forest Restoration and Demonstration Project Collaborative Workgroup.

Table 1: Mechanical and Prescribed Fire Treatment Overview

	Total Area	Operable Area	Mechanical Vegetation Treatments		Prescribed Fire	
			Commercial	***Non-Commercial***	***Pile Burn***	***Broadcast Burn***
Spruce-Fir-Aspen	22880	20793				
Group Selection Harvest			925-1963	500-1000*	y˚˚	n
Sanitation/Salvage Harvest			900-2000**	---	y˚˚	n
Wildland Urban Interface(Lynx)			700†		y	n
Cool-moist Mixed-conifer	18362	16383				
HRV-based Treatments˚			1000-4000	1653-9455	y˚˚	n
Sanitation/Salvage Harvest			900-2000**	---	y˚˚	n
Applied Silvicultural Assessment			200-500		y˚˚	y
Warm-dry Mixed-conifer	15992	12672				
HRV-based Treatments˚			3954-8213††		y˚˚	y
Sanitation/Salvage Harvest			900-2000**	---	y˚˚	n
Ponderosa pine-Oak	17913	13374				
HRV-based Treatments˚			5000-8100		y˚˚	y
Sanitation/Salvage Harvest			900-2000**	---	y˚˚	y
Applied Silvicultural Assessment			200-500		n	y
Pinyon-Juniper/Mountain Shrub	60932	32289				
Plantation Hand Thinning				468	y˚˚	y
Wildlife Habitat Improvement			---	3100-5000	n	y

* *Non-commercial acres will not be located within Lynx Analysis Units*

** Sanitation and Salvage efforts will be comprised of 900 to 2000 acres in total across the forested vegetation zones.

† Wildland urban interface treatments will largely consist of non-commercial mechanical treatments, but may include limited commercial harvest where necessary to accomplish fuels and fire-hazard reduction management objectives. These treatments will not be used to create early-development successional conditions, but instead to maintain stands in mid to late-development conditions. These acres are split between the two Lynx Analysis Units (LAUs) in the project area, with 50% of acres occurring in the LAU and 50% of the acres occurring in the Traver LAU. Includes coppice cutting as consistent with Biological Opinion and silvicultural recommendations.

†† To accomplish HRV-based treatment objectives within Warm-dry Mixed-conifer and Ponderosa pine-oak vegetation zones, mechanical treatments will be comprised of a mix of commercial and non-commercial treatments on each acre, therefore no separate acreages for commercial and non-commercial treatments have been estimated.

˚ Wildland Urban Interface acreages within these vegetation zones are a component of HRV-based treatment acres

˚˚ Pile burning may be used on a case-by-case basis in specific areas where slash accumulations exceed desired loadings for fuels objectives or to reduce coarse woody debris accumulations that may serve as host material for bark beetle infestation.

THE PROPOSED ACTION

Mechanical Treatments-General

The proposed action includes the use of a combination of commercial timber harvest and non-commercial mechanical fuels treatments and tree removal within each vegetation zone of the project area (*See Table 1: Mechanical and Prescribed Fire Treatment Overview*). Mechanical treatments may be accomplished by mechanical timber harvesters, or tracked or wheeled vertical shaft flails, mulchers or mowers. Chainsaws may also be used to reduce standing fuels, but most likely would be used on a limited scale. Chipping operations may be used to a limited extent for targeted fireline construction, but will not be applied for stand-level management. Whenever possible, typically non-commercial coarse woody debris and slash in excess of amounts identified to be retained on-site (i.e. available woody biomass) will be offered for removal in conjunction with commercial and non-commercial mechanical treatments.

Mechanical treatment units within the project area will be confined to slopes less than 35% throughout each vegetation zones. Areas with slopes less than 35% and greater than 100 feet from second order streams or higher comprise the operable area within the project landscape. In rare instances, temporary fireline and fuelbreaks treatments may be completed outside operable areas (i.e. on slopes exceeding 35%) with the objective of facilitating the use of prescribed fire across priority areas (*See Prescribed Fire section*).

Commercial mechanical treatments will be located within priority areas shown in Appendix A, Map 2: Commercial and Non-Commercial Treatment Priority Areas. Non-commercial treatments may take place outside these areas in order to create fuelbreaks and fireline necessary to facilitate broadcast burning within fire-adapted forest zones (i.e. mixed-conifer and ponderosa pine-oak vegetation zones).

Wildland-Urban Interface

The Proposed Action involves the management of National Forest land within the wildland urban interface, an area within a distance of ½ mile of private inholdings within the project area. Mechanical surface and ladder fuels reduction treatments will be used to reduce fireline intensity and the potential for crown fire behavior under extreme fire weather conditions to reduce negative impacts to human life, property, and economic activities. These efforts will be concentrated in two approximate locations within the project area: in the western portion of the project area near a 400 acre L-shaped inclusion of private inholdings and within a complex associated with approximately 3,700 acres of private land inholdings in the eastern portion of the project areas (See Appendix A, Map 2: Commercial and Non-Commercial Treatment Priority Areas).

Within the western project area, approximately 1,900 acres of WUI surround the 400 acre, L-shaped inholding. Previous coppice cutting in this area has proven successful in regenerating aspen. Aspen regeneration is generally resistant to all but the most extreme fire behavior. Aspen coppice cutting will be located along a steep north facing slope to the south of the private inholding and will serve as a barrier to fire spread from adjacent conifer-dominated

forests into the private inholdings. All WUI acres in this portion of the EFRS project area will be integrated with historical range of variability-based treatments in mixed-conifer and ponderosa pine-oak vegetation zones in the area.

Within the eastern portion of the project area, approximately 4,300 acres of WUI in the spruce-fir-aspen zone and 1,300 acres of WUI in warm-dry and cool-moist mixed conifer and ponderosa pine-oak vegetation zones surrounds a complex of approximately 3,700 acres of private land inholdings. Targeted aspen coppice cutting is proposed along slopes to the south of the private inholding in the spruce-fir-aspen zone. These areas will serve as a barrier to fire spread from adjacent conifer-dominated forests into the private inholdings. Within the approximately 4,300 acres of WUI areas encompassing these coppice cuts in the spruce-fir-aspen vegetation type, mechanical vegetation treatments will be have the objective of reducing surface and ladder fuels to reduce the potential for crown fire initiation and to reduce fireline intensity. The intent of such treatments is to leave vegetation canopy intact maintaining surface shading in these areas as to not increase fire ignition potential in these areas.

Within the 1,300 acres of WUI in the Eastern portion of the project area in warm-dry and cool-moist mixed conifer and ponderosa pine-oak vegetation zones, treatments intended to reduce negative impacts of wildfire to human life, property, and economic activity will be integrated with historical range of variability-based treatments. Ladder and surface fuel loadings and crown-continuity within these areas will be reduced closer to the low-end of the estimated-HRV and forest plan required ranges within these areas to ensure fuels and fire protection objectives are met.

Within WUI areas in the cool-moist and warm-dry mixed-conifer and ponderosa pine-oak zones in both the eastern and western portions of the project area, broadcast burning treatments will be applied where mechanical vegetation treatments have been applied. Burning may include limited amounts of non-mechanically treated vegetation inclusions or adjacent areas. For further information on prescribed broadcast burning treatments, see the *Prescribed Fire* section of the Proposed Action.

Ponderosa Pine Commercial Harvest and Non-commercial Mechanical Treatments

Between approximately 5,000 and 8,100 acres of commercial harvest and non-commercial mechanical treatments are proposed within the ponderosa pine-oak vegetation zone (See Appendix A, Map 2: Commercial and Non-Commercial Treatment Priority Areas). These areas include portions of the previously described wildland-urban interface. Stand-level objectives will be guided by recent and ongoing studies of historical forest structure and composition within the project area (Binkley et. al. 2008; Matonis 2012) and broader regional studies of ponderosa pine-oak departure from historical (i.e. pre 1875) forest structure. Prescriptions will attempt to create conditions in these stands similar to what would be expected if 3-5 low to moderate-intensity fires had occurred since disruption of historical fire regimes around 1875.

Many stands within this vegetation zone have been previously managed using even-aged silvicultural approaches which created closed-canopy conditions and uniform spatial pattern. This differs significantly from the historical forest conditions which were characterized by clumps of trees with interlocking crowns interspersed with treeless openings (Binkley et. al. 2008, Romme et. al. 2009). Commercial and non-commercial treatments within this vegetation zone will have the broad objective of moving stand conditions toward spatial patterns consistent with historical conditions. These stand conditions should have a low potential for crown fire initiation and spread.

Forest openings and areas free from conifer dominance (i.e. aspen or oak dominated areas) are thought to be a feature of ponderosa pine-oak forests prior to 1875 (Binkley et. al. 2008; Romme et. al. 2009). Today, open stand conditions are largely lacking within this vegetation zone as compared to historical estimates of these conditions (McGarigal and Romme 2005; USDA FS 2006; LANDFIRE 2013). Treatments will attempt to recreate openings within the ponderosa pine-oak zone ranging in size from 0.25 to 1.0 acre across approximately 20-25% of harvested areas. Within these areas, conditions should favor development of understory plant cover and aspen regeneration in the short-term, and ponderosa pine regeneration over longer time frames.

Due to their relative scarcity within the project area, retention of large and old (predating 1875) ponderosa pine trees within this vegetation zone will be a stand-level objective of commercial harvests. Similarly, retention of small-diameter ponderosa pine will be an objective of commercial harvests and non-commercial mechanical treatments. An overall feature of both non-commercial and commercial treatments within this zone will be the promotion of multi-aged forest structure.

At a stand level, the degree to which commercial harvest will be employed relative to non-commercial mechanical treatments will be determined by the relative difference between current stocking, density and diameter distribution and estimated historical conditions. In instances where commercial sized trees dominate stocking, especially where past even-aged silviculture has been applied, commercial harvests will be used. In areas where non-commercial, small diameter non-commercial trees are in abundance, non-commercial treatments will be applied. In most stands, it is anticipated that a mix of both commercial and non-commercial treatments will be necessary to move stand conditions closer to the historical range of forest structure variability.

Warm-dry Mixed-conifer Commercial Harvest and Non-commercial Mechanical Treatments

Approximately 4,000 to 8,200 acres of commercial and non-commercial mechanical treatments are proposed within ponderosa pine and Douglas-fir dominant, warm-dry mixed-conifer vegetation zone (See Appendix A, Map 2: Commercial and Non-Commercial Treatment Priority Areas). These areas include portions of the previously described wildland-urban interface. Stand-level objectives will be guided by recent and ongoing studies of historical forest structure and composition within the project area (Binkley et. al. 2008; Matonis 2012), broader regional studies of mixed-conifer forest structure departures from historical (i.e. pre 1875) forest structure and by comparison of existing successional class structure to historical estimations of successional class ranges (GMUG NF 2006; LANDFIRE

2013). Prescriptions will attempt to create conditions in these stands similar to what would be expected if 2-3 low to mixed-severity fires had occurred since disruption of historical fire regimes around 1875.

Stand-level objectives will be guided by the conclusions of Binkley et. al. 2008, Romme et. al. 2009, and Matonis 2012. Binkley et al. 2008 found an average of 70 ft2/acres basal (range of 25 to 130 ft2/acre), with about 60 trees/acre (range of 30 to 110 trees/acre). About half of the mixed conifer stands in this study had less than 50 ft of basal area in 1875, not counting for a likely minor contribution of small trees, and perhaps major contribution of aspen trees. Stand level diameter distributions were characterized by many small diameter trees, lesser amounts of mid-sized tree and scattered old and large diameter Douglas-fir and ponderosa pine, and to a much lesser extent, blue spruce and Engelmann spruce. Stand level objectives will target a similar mix of stocking and density. These stand conditions should have a greatly reduced potential for crown fire initiation and spread. In mechanically treated areas, treatments should result in conditions largely resistant to crown fire initiation and spread.

Treeless patches within warm-dry mixed conifer forests of the project area were likely common prior to 1875 (Binkley et. al. 2008; Romme et. al. 2009). Today, open and early-development stand conditions are largely lacking within this vegetation zone as compared to historical estimates of these conditions (USDA FS 2006; LANDFIRE 2013). Similar to the ponderosa pine-oak zone, treatments in this vegetation zone will attempt to recreate treeless or aspen regeneration dominated openings ranging in size from 0.25 to 0.25 acre across approximately 20-25% of harvested and mechanically treated areas.

Historical forest conditions within these forests which were characterized fine-scale (less than 75 feet) clumps of overstory trees scattered randomly thoughout stands (Binkley et. al. 2008). Commercial and non-commercial treatments within this vegetation zone will have the broad objective of moving stand conditions towards a similar spatial pattern consistent with historical conditions.

Treatments within these forests will favor retention of ponderosa pine and Douglas-fir, especially in areas where these species are lacking when compared to stand-level evidence of past dominance (e.g. large, old snags and large diameter cut stumps). Density and stocking of shade tolerant subalpine fir and spruce species will be reduced significantly in throughout this vegetation zone, especially where there is no evidence of this species in stands prior to approximately 1875. Shade tolerant species in this zone will be retained primarily in mesic or fire-isolated microsites within operable acres and within north aspects and drainage bottoms within non-operable areas of this vegetation zone.

As in the ponderosa pine-oak zone, at the stand-level, the degree to which commercial harvest will be employed relative to non-commercial mechanical treatments will be determined by the relative difference between current stocking, density and diameter distribution and estimated historical conditions. In instances where a commercial sized mix of shade-tolerant tree species dominates stocking, commercial harvests will be used. In areas where mainly non-commercial, small diameter non-commercial shade-tolerant tree species are in abundance, non-commercial treatments will be applied. In most stands, it is anticipated that a mix of both commercial and non-commercial treatments will be necessary to move stand conditions closer to the historical range of forest structure variability.

Cool-moist Mixed-conifer Commercial Harvest and Non-commercial Mechanical Treatments

Approximately 1,000 to 4,000 acres of commercial treatment and 1,600 to 9,500 of non-commercial mechanical treatments are proposed within the Douglas-fir and spruce dominant, cool-moist mixed-conifer vegetation zone (See Appendix A, Map 2: Commercial and Non-Commercial Treatment Priority Areas). These areas include portions of the previously described wildland-urban interface (WUI). Stand-level objectives will be guided by recent and ongoing studies of historical forest structure and composition within the project area (Binkley et. al. 2008; Matonis 2012), broader regional studies of mixed-conifer forest historical structure (i.e. pre 1875) and by comparison of existing successional class structure to historical estimations of successional class ranges (USDA FS 2006; LANDFIRE 2013). Current forest successional class distribution within these forests differs somewhat from what would be expected under a historic disturbance regime, but not to the extent seen in warm-dry mixed-conifer and ponderosa-pine oak zones. Within this zone, the main characteristic of departure from estimated historical conditions is the relative lack of early-development or post-disturbance stand initiation conditions relative to mid-aged and stand conditions.

Estimates of early successional conditions from a recent analysis of 2008 LANDFIRE succession class data indicate that approximately 2% of the cool-moist mixed-conifer zone within the project area is currently within an early development stand condition. Estimates of early-development successional distributions for this forest type from a recent geographic area assessment for the Uncompahgre Plateau geographic report a 13-25% desired early-development successional class range for cool-moist mixed-conifer forests of the Uncompahgre Plateau. The difference between this desired range and the current estimated early-development conditions within the project area ranges from 2000 to 4000 acres. Proposed harvest activities will create stand initiation conditions moving overall succession class distribution within this desired range.

Early-development stand objectives will involve commercial and non-commercial canopy thinning and group selection harvests. Group selection harvests will remove 65-95% of existing tree cover in patches ranging in size 0.25 to 5 acres. Stand level objectives will include the retention of structural diversity elements such as Douglas-fir trees, advanced, shade-intolerant tree regeneration, and patches of overstory trees ranging in size from 0.1 to 2.5 acres.

Douglas-fir, a historically dominant and long-lived tree species within this vegetation zone has been reduced in many areas through past management activity to a point where a seed source for this species no longer remains. In these areas, locally sourced, genetically suitable ponderosa pine or Douglas-fir seedlings may be hand planted to help improve the representation of these species in the overall stand composition.

Non-commercial treatments within this vegetation zone will focus on promotion of complex stand structures and more resilient forest structure conditions to disturbance. These efforts will be focused heavily in areas where previous forest management and harvesting operations have altered stand development to a structural conditions that might have not have developed under a natural disturbance regime. Efforts will include non-commercial thinning of insect damaged advanced regeneration and thinning or cleaning of shade-tolerant species where they currently dominate open stand conditions.

Spruce/Fir Commercial Harvest and Non-commercial Mechanical Treatments

In addition to areas identified in the WUI, approximately 1,000- 2,000 acres will be commercially harvested within the spruce-fir-aspen vegetation zone of the project area (See Appendix A, Map 2: Commercial and Non-Commercial Treatment Priority Areas). These harvests will have the primary objective of diversifying forest structure in Canadian Lynx habitat, but will also create a source of commercial forest products for the local timber economy. Current forest successional class distribution within these forests is likely within what might be expected under an infrequent, high-severity disturbance regime. Although this forest zone is currently within the historical range of variability in forest structure, this vegetation zone contains a relative lack of early-development or post-disturbance stand initiation conditions relative to mid-aged and stand conditions similar to the cool-moist mixed-conifer vegetation zone (USDA FS 2006; LANDFIRE 2013).

Eight broad group selection harvest areas within the spruce-fir-aspen zone (See Map 2, Appendix A) will range from approximately 500-2000 acres in size.

Approximately 15-20% (75-420 acres) of each managed group selection harvest area will be harvested groups of a maximum size of 2 acres within lynx habitat and up to 3-5 acres outside lynx habitat areas. Within groups 65-95%, of existing tree cover will be removed.

In areas of the spruce-fir-aspen zone outside Lynx habitat, approximately 500-1000 acres of advanced regeneration and intermediate spruce and subalpine fir will be thinned to reduce overall tree density, move species composition towards spruce (in fir dominated stands) and increase overall tree vigor, similar to non-commercial mechanical treatments in cool-moist mixed-conifer forests.

Commercial Salvage and Sanitation Harvests

Between 900 and 2000 acres of commercial timber harvests of dead and dying beetle-infested or wind thrown trees will be used to respond to localized bark beetle infestations or dead trees scattered throughout the project landscape. These harvests are typically small operations and will provide a consistent source of wood products to the local timber economy. Where new infestations of spruce, mountain pine beetle or other less common bark beetles are identified, these harvests will be sanitation with the objective of preventing the spread of beetles to other non-infested trees. Snags will be left in accordance with the Forest Plan standards.

Salvage and sanitation harvests will typically consist of 3-5 salvage or sanitation cut units per year ranging in size from 40-50 acres each.

The expected distribution of insect infestations and windthrow events will make these contracts accessible to smaller timber purchasers and milling operations in the local area.

Salvage efforts will typically not require the creation of temporary roads. Temporary road construction up to 1/2 mile in length may be required to respond to newly identified beetle infestations.

Harvests, mechanical treatments or felling of hazard trees will be completed within 150 feet of National Forest System roads and trails to minimize the risk of falling trees to the general public.

Non-commercial thinning or other non-commercial vegetation management activities consistent with the management for the historical range of variability for the vegetation zone may be integrated with salvage or sanitation operations where stand-level issues exist.

Non-commercial Pinyon-Juniper/Mountain Shrub Wildlife Habitat Improvement

Between of 3,100-5,000 acres within the pinyon-juniper/mountain shrub vegetation zone will be treated using non-commercial mechanical treatments through the 8-10 year duration of this project (See Appendix A, Map 2: Commercial and Non-Commercial Treatment Priority Areas). Treatments will be focused in areas previously actively managed for winter and transition range habitat values. Past mechanical vegetation treatments in the pinyon-juniper vegetation type have included herbicide application, chaining and roller chopping as late as the 1960's to improve forage values for wildlife and livestock. Little has been done in the project area to maintain the winter range since this time and pinyon-juniper trees have regenerated within these areas to a point that mountain shrub species are declining. The mountain shrubs that are present show signs of heavy browse pressure and are much less palatable due to larger stem size.

A combination of mechanical vertical shaft flailing, mulching or mowing will be applied and followed by prescribed fire to diversify oak age class and mountain shrub species diversity. Mechanical treatments will be applied on approximately two thirds of the identified treatment areas (See Map 2, Appendix A).

Prescribed fire use will be avoided in areas dominated by sagebrush, which is sensitive to broadcast burning treatments.

Following mechanical treatments or prescribed fire, a locally derived seed mix of native grass, forb and shrub species will be applied to treated areas to increase understory cover and forage value.

Also within this vegetation zone are approximately 500 acres of planted ponderosa pine located on the northernmost extent of 25 Mesa along the Delta-Nucla Road and at the northern extent of the Pinyon-Juniper/Mountain Shrub zone along Transfer Road. These stands were planted from the 1940s to 1960s on relatively dry sites at the very lowest extent of the ponderosa pine-oak zone within sagebrush and grass dominated areas with very low ponderosa pine stocking. Trees within these plantations are currently spaced at 15 to 20 feet or less and have been growing very slowly. Non-commercial treatments will be applied within this vegetation zone to have the broad objective of diversifying tree spatial pattern through

creation of openings and the retention of clumps and reducing tree densities to levels more consistent with historical conditions. Prescribed fire will be applied within these stands where surface vegetation composition is not dominated by sagebrush.

Prescribed Fire

Prioritization Framework

The primary focus area for fuels and fire treatments within this project area will be in the elevation band where ponderosa pine-oak and warm-dry mixed-conifer forest types are dominant. These forest types are most at risk for losing ecosystem functionality from disturbance because they are the most departed from the historic range of variability.

A prescribed fire fuels treatment prioritization framework (See Figure 3) has been developed for the Escalante project. This prioritization framework can be explained in the following manner:

1) Areas that have been treated mechanically by either harvest or non-commercial mechanical treatments within the broader fire-adapted zone. These areas will have broadcast burning and possibly pile burning.

Priority 1 areas include Wildlife Habitat Improvement, Wildland Urban Interface areas within the western portion of the project area and plantation thinning areas within the Pinyon-juniper vegetation zone.

2) Untreated inclusions within harvested and non-commercial mechanically treated areas, within the fire-adapted zone.

Both priority 1 and 2 area combined total to approximately 24, 810 acres.

3) Those areas that are in the fire-adapted zone in between the areas where mechanical treatments will occur; approximately 56,376 acres.

4) Areas that have not been treated mechanically outside of the fire adapted zone. In most instances, this area will be outside of the primary burn unit and will be used as a contingency area where fire spread is unlikely; approximately 79,703 acres.

Approximate locations of specific priority areas shown above are shown in Appendix A, Map 3: Prescribed Fire Prioritization.

Prescribed fire may occur in any season, but will most likely occur during spring and fall burn windows. Additional prescribed fire design criteria are be dependent upon other resource area objective.

Fireline and Fuelbreak Construction

Prescribed fire operations will require control lines that serve to geographically contain fire effects. Roads, trails and natural features such as fire resistant vegetation types (aspen), snowlines and rock outcrops will be used as fire control lines whenever possible. When creation of fire control lines is necessary, they will be coincident with any required temporary roads used in timber harvest and will be promptly rehabilitated to prevent the establishment of additional motorized routes and monitored and treated to control invasive species establishment following use.

Each vegetation type and project area compartment may require targeted mechanical treatments to create fuelbreaks and firelines to facilitate the use of prescribed fire across the project landscape. This estimate is included in the non-commercial mechanical treatment acreage estimates for each vegetation zone.

Regulatory Requirements

Prescribed burning will be implemented according to an approved burn plan, which will be completed prior to implementing any phase of a prescribed fire. A Colorado State smoke permit will also be obtained prior to implementing any phase of a prescribed fire.

1	2	3	4
Harvested and mechanically-treated areas	**Untreated inclusions within or adjacent to harvested and/or mechanically treated areas (within operable areas)**	**Non-mechanically treated or harvested areas † (inoperable areas)**	**Non-mechanically treated or harvested areas (operable and inoperable areas) outside fire-adapted zones††**
a) Ponderosa pine-oak b) Warm-dry mixed-conifer c) Cool-moist mixed-conifer(broadcast slash and slash piles*) d) Spruce-fir-aspen (slash piles only*)	a) Ponderosa pine-oak b) Warm-dry mixed-conifer c) Cool-moist mixed-conifer** d) Spruce-fir-aspen**	a) Ponderosa pine-oak b) Warm-dry mixed-conifer c) Cool-moist mixed-conifer d) Spruce-fir-aspen	a) Cool-moist mixed-conifer b) Spruce-fir-aspen

* Slash piles burning where necessary to meet fuel hazard reduction objectives.
** Inclusions of non-fire adapted forest types within burn units in fire-adapted forest zones. Intentional prescribed fire ignitions will be kept to a minimum within these areas.
† Where necessary to accomplish prescribed fire objectives in priority areas 1 and 2. Intentional prescribed fire ignitions will be kept to a minimum within non-fire adapted forest types included within these areas
†† Contingency areas. Fire spread into these areas is unlikely. In the event of an ignition in these areas fire will be suppressed.

High — **Rx Fire Priority** — **None**

High — **Risk of uncharacteristic Fire** — **Low**

>2 — **Missed fire return intervals** — **None**

Figure 3: Prescribed Fire prioritization framework for the EFRS project area.

Slash Treatments

For any of the mechanical treatment proposals described above, a range of slash treatment strategies will be implemented to reduce the fire and insect risks associated with slash accumulations:

Relatively low slash loadings are anticipated from timber or other mechanical operations in the ponderosa pine-oak and warm-dry mixed-conifer vegetation zones. In these areas, slash will be lopped and scattered to facilitate safe post-harvest broadcast burning.

In cool-moist mixed-conifer and spruce-fir-aspen stands, post-harvest or mechanical treatment slash should generally be retained on site to discourage browse and create tree regeneration microsites, but may be piled and burned where fuel loadings are extremely high or where fire could be used to reduce bark beetle habitat quality.

In all forest vegetation types, coarse woody slash larger than three inches in diameter will be retained on-site to promote soil structure development and variability in surface microclimates. A minimum and maximum fuel loading will be specified in association with all harvests and fuels treatments. Within areas of heavy large diameter spruce (> 6 inches in diameter, small end) bucking (i.e. cutting) of residual large diameter coarse woody slash to short lengths may be required to reduce buildup of spruce beetle populations.

In extremely dense conifer stands or in stands adjacent to private inholding or other infrastructure values, harvest-generated fuels may be grapple or hand piled to reduce surface fuel hazard or a level conducive to achieving an effective and beneficial post-harvest underburn. Slash piles will be burned by the Forest Service in accordance with agency protocols.

Removal of slash in a raw or processed form (e.g. bundles or chips) to be utilized for energy production, landscaping materials or other purposes may also be utilized as a slash treatment method. Slash removal will be encouraged with all mechanical treatment contracts, consistent with coarse woody slash retention levels identified in project design criteria.

Applied Experimental Silvicultural Evaluations

Experimental silvicultural evaluations may be completed within the project area to address site-specific forest management questions within the project landscape (See Appendix A, Map 2: Commercial and Non-Commercial Treatment Priority Areas). The results of this formal scientific observation and reporting of treatment outcomes will benefit local and regional land management efforts and the broader forest ecology scientific community. Requirements for each evaluation are: 1.) Compliance with all applicable laws and regulations and best management practices relating to the management and implementation of activities on National Forest lands, 2.) Assessment of silvicultural treatments specifically intended to manage for forest conditions consistent with the historical range of variability or those expected in the near future given climate change estimations for the forest vegetation type, 3.) Direct coordination with academic or agency research institutions, 4.) Professional publication of evaluation outcomes by research partners and 5.) A formal summary and presentation of research results for dissemination to all interested stakeholders.

- Sudden aspen decline is currently occurring across hundreds of acres of low-productivity, low-economic value aspen stands at the edge between ponderosa pine-oak forests and pinyon-juniper/mountain shrublands at lower elevations within the project area. Many of these stands are in a condition where localized aspen clones may not be capable of regenerating naturally or with standard aspen regeneration approaches. A combination of non-commercial mechanical treatments and prescribed fire will be evaluated within up to 200-500 acres of declining aspen stands to evaluate management approaches capable of regenerating aspen within these areas.
- Cool-moist Mixed-Conifer forests of a mix of Douglas-fir, Engelmann spruce and aspen within the project area and across the Uncompahgre Plateau are located at the lower end of the typical elevation range for spruce in the Southern Rocky Mountain region. Stands within the project area are also located where significant climate warming is expected to occur over the next 50 years (Girevetz et. al. 2009; Nydick et

al 2012). Vegetation within these areas has been identified as particularly susceptible to disturbance induced forest structure and composition changes associated with a warmer climate. A combination of non-commercial mechanical and commercial harvests will be employed within a 200-500 acre area comprising the lower end of the spruce-fir/aspen vegetation zone and the upper end cool-moist mixed-conifer zone to specifically evaluate non-traditional silvicultural approaches intended to promote resilience in low-elevation spruce fir stands in the context of expected climate changes. Treatments may employ a combination of coppice cutting, clearcutting, individual tree selection and group selection silvicultural approaches, application of prescribed fire as well as targeted reforestation activities such as seeding or slash manipulations to mimic expected stand conditions following mixed to high severity fires. These activities will be consistent with mechanical treatment acreages for the cool-moist mixed-conifer zone and forest management direction from the GMUG Amended Forest Plan (1991).

These acreages are consistent with the 1000 acre limit for silvicultural assessments completed with a categorical exclusion authorized under Section 404 of the Healthy Forest Restoration Act (16 U.S.C. §6554).

Trails and Transportation

Common to the mechanical and prescribed fire treatments described above the following would occur under this proposed action.

Road Systems

Existing roads will be used for equipment access to the extent road location and condition permit reasonable access. Implementation of mechanical treatments and harvests will attempt to minimize temporary road construction whenever possible. No permanent roads will be constructed under this project. Following their use for harvest, temporary roads will be obliterated, which involves recontouring where significant sideslope exists, elimination of ditches, outsloping the roadbed, removal of ruts and berms, effectively blocking the road to normal vehicular traffic where feasible, and construction of drainage features such as cross ditches and water bars. Invasive species monitoring will occur after road obliteration and will be followed by weed treatments where needed.

Haul Routes

The most likely major haul routes in the project area are either down the Delta/Nucla road (National Forest System Road (NFSR) 503) to Delta or across the Divide road (NFSR 402) to old Highway 90 (NFSR 540) and down to Montrose. Timber hauling during the normal operating season will not be allowed on weekends or holiday weekdays to minimize the likelihood of conflicts with recreationists. If requested by the timber sale purchaser, winter haul and snowplowing of these roads may be permitted, subject to agreement by the Forest Service.

Road Decommissioning

Roads and trails identified in the Uncompahgre Travel Plan Record of Decision of 2002 will be decommissioned as a result of this project. These routes may be used as haul routes during project implementation, but following use, these routes will be decommissioned as outlined in the travel plan decision.

Trail Use and Maintenance

Several motorized and non-motorized trails are located within the project area. Use of these trails will be maintained in a manner to protect the safety of recreationists. In general, if the current trail consists of an existing historical timber haul road, this road may be used during management activities and rehabilitated to the desired trail use condition following use. If the trail consists of single-track (i.e. Parallel Trail) the trail will not be used, altered or restricted in association with vegetation management activities. Wherever possible, felling or removal of hazard trees within 150 feet of system trails and road will be completed in association with proposed harvest and non-commercial mechanical treatments.

Forest Vegetation Zone Assumptions

As previously described, the EFRS project area contains several forest vegetation zones ranging from productive, cold and wet forests at the highest elevations to hot and dry, shrub dominated woodlands at the lowest elevations. Broad vegetation zones within these extremes transition somewhat predictably with changes in elevation, and as such, elevation zones have been chosen as the underlying assumption behind the vegetation model used within this analysis. This elevation model is further supported by ground survey data and aerial photo interpretation. This model is also conceptually simple, making it valuable for analysis and practical application during project. Despite the usefulness of this model, it or any other model of vegetation composition and structure is imperfect. Fine-scale variation in other factors such as aspect, slope, slope-position, soil depth or soil drainage, past harvest activity, as well as random factors, influence current and historic forest species composition and structure. Many of these fine-scale factors are important in maintaining spatial heterogeneity of forest composition, structure and ecological function throughout the EFRS project area ecosystems.

An implicit goal of the proposed forest restoration activities within the EFRS project is to retain and promote compositional and structural diversity where present within the project area landscape to support the overall project objective of increasing forest ecosystem resilience. Inconsistencies between fine-scale and predicted vegetation composition and structure are anticipated within all vegetation zones. Where discrepancies exist between the actual and predicted vegetation composition and structure, proposed treatments will follow ground-based fine-scale evidence instead of predictions of vegetation composition and structure. However, the maximum acreage of proposed treatments will be constrained by the acreage of proposed actions contained within the EFRS proposed action. For instance, the proposed acreage of group selection harvests within spruce-fir-aspen forests will not increase if additional fine-scale evidence obtained during project accomplishment indicates a broader range of spruce-fir-aspen than previously predicted.

Project Implementation Plan and Monitoring Activities

Project Implementation Plan

Annually, a concise project implementation plan will be updated to provide a general schedule of treatment activities and set forth trigger points for collaborator involvement and required communications and surveys between agency staff. This plan should form a framework for ecological and social monitoring activities associated with project. This plan should be available to all interested parties and will be shared with collaborators at the Uncompahgre Plateau CFLRP monitoring meeting held each spring. Each annual project plan should include but will not be limited to the following:

Proposed Action Implementation Details

- Location and acreage
- Treatment Types
- Required or Desired Pre-treatment Surveys

Monitoring Projects

- Proposed annual monitoring activities
- Monitoring objectives
- Collaborators involved
- Data collection procedures

Important monitoring outcomes

Implementation of proposed activities is anticipated to occur from west to east throughout the project area over the next 10 years (See Appendix A, Map 4: Tentative Mechanical Treatment Prioritization). Exceptions to this general pattern are salvage and sanitation efforts and wildlife habitat improvement mechanical treatments in the pinyon-juniper/mountain shrub zone. Salvage and sanitation efforts will be annual opportunistic harvests of windthrown and insect infested or killed trees where they occur throughout the project area. Wildlife habitat improvement mechanical treatments will occur as funding becomes available and will likely begin within treatments east of the Roubideau Special Area within the eastern portion of the project area.

Monitoring

Monitoring associated with the EFRS project should include present and past surveys associated with project design and implementation, pre and post treatment ecological monitoring and landscape-scale assessment of restoration treatment effects on landscape structure and function.

Monitoring efforts may involve contributions from academic partners at Colorado State University, the University of Montana, the Rocky Mountain Research Station, the Colorado Forest Restoration Institute (CFRI), the Uncompahgre Plateau Project, Public Lands Partnership and any members of the interested public to monitor project treatment outcomes. The broad, multi-stakeholder monitoring group should evaluate treatment results to improve future management practices. Monitoring efforts are an integral component of the EFR project and are split into several components:

Continued learning from Ecological Monitoring associated with Ongoing Forest Restoration Demonstration Efforts:

The Uncompahgre Mesas Forest Restoration Demonstration Project has served as a valuable adaptive management aid for the development of this project. Community-based collaborative monitoring has occurred over the 3 years of this project and is expected to continue for several more years. Monitoring outcomes and lessons learned from the this project will continue to contribute to fine-scale variation in implementation of treatments proposed with the EFRS project.

Forest Service Exams, Implementation Surveys and Evaluations:

Design criteria and mitigation measures associated with the proposed action include dense horizontal cover surveys, bird surveys and invasive weed population monitoring efforts and surveys of treatment impacts that will take place over the course of the EFRS project period. The Forest Service may also collect additional fine-scale forest structure and fuels information useful for understanding changes in forest conditions and hazards over time. Whenever possible, survey locations should be permanently marked in the field and survey information should be incorporated into existing databases to facilitate long-term ecological monitoring efforts. When feasible, this information will be made available to monitoring collaborators for analysis and interpretation purposes.

Ongoing Multi-party Monitoring:

Collaborative monitoring efforts not only provide input to the adaptive management process, but ongoing collaborations with one or more external partners will provide an inherent window of transparency into forest restoration i efforts and outcomes.

<u>Fine-scale</u>

Contract scale monitoring efforts will involve some level of pre-treatment and post-treatment ground-based monitoring involving external partners. Monitoring objectives will vary based upon public input and variation in forest conditions and proposed actions throughout portions of the project area. At a minimum, data collected should include photo points describing fuel and forest structure conditions before and after treatments are applied. Data may be collected and/or analyzed by community partners, contractors, high school interns. employees, academic partners or the Forest Service

Broad (Landscape)-scale

Ecological monitoring efforts within the project area should be coordinated with the Uncompahgre Plateau CFLRP restoration indicators monitoring effort. This ongoing effort includes input from local publics on the development of wildfire, watershed, wildlife and understory plant community ecological indicators, as well as strategies and tactics for assessing changes of these indicators across the Uncompahgre Plateau landscape. An example of an ongoing, landscape-scale monitoring effort is a current assessment of wildfire hazard across the EFRS project landscape being completed by partners at the CFRI with contributions from Forest Service specialists and project stakeholders (*Matonis, personal communication*). Landscape-scale monitoring may include evaluation of vegetation changes and/or crown fire hazard using remotely-sensed data sources (LANDFIRE data; National Agriculture Imagery Program data; LIDAR)

Academic Monitoring and Evaluation Efforts

The GMUG National Forest has a history of, economic, forestry and applied ecological research with academic and agency researchers. These efforts typically lead to refereed journal publications or white-papers documenting restoration successes and challenges and serve as another level of transparency into forest restoration efforts and outcomes. Academic monitoring and evaluation efforts associated with the CFLR project must be tied to the proposed applied silvicultural examinations, but could also be associated with a research question proposed by academic partners throughout the course of the project.

Decision Framework

The decision to be made is whether or not to implement the proposed action as described or to take no action at this time. If the action alternative is selected, the final decision will include the general location and timing of activities and the design criteria for implementation which include silvicultural practices, supplemental surveys, 'sideboards' for treatment areas (slope restrictions, resource protection measures etc.). If the action alternative is selected the final decision will include commitments to collaboration, reporting, schedules, and monitoring. The final decision would also include an estimate of the byproducts produced by restoration and forest health treatments and a commitment to design timber sale and stewardship contracts. The deciding official for this project is the Ouray District Ranger.

Public Involvement

Process

The proposed action was developed through an informal collaborative process beginning with the design of the Uncompahgre Mesas Forest Restoration Demonstration Project which was

first implemented in 2009. The EFRS project is a similar landscape, and contains similar broad and fine-scale forest structure objectives and similar commercial and non-commercial mechanical and prescribed fire treatments to this project. The group included the Uncompahgre Plateau Project (UP Project); several environmental organizations including the Black Canyon Audubon Society, Colorado Wild, and Western Colorado Congress; the Colorado State Forest Service; the Colorado Forest Restoration Institute at Colorado State University (CFRI); and the USDA Forest Service. Collaborators were involved with developing principles to guide the implementation and have participated in ecological monitoring associated with this project.

The Escalante Forest Restoration and Stewardship project has evolved through a similar and concurrent process. The project initiation letter was issued by the Ouray District Ranger in July of 2011. Field trips to forest restoration activity areas within the Uncompahgre Mesas Project Area have occurred with various partners since this time to discuss the outcomes of the Uncompahgre Mesas project and to discuss the goals and objectives for the upcoming EFRS project. In March of 2012, a public meeting was held to introduce the project concept and project area and objectives to partners. Another public meeting in May of 2012 was held with stakeholders to develop principles and goals to guide forest restoration activities within the Escalante areas. In November of 2012, a public meeting was held to discuss the draft proposed action for the EFRS project. Stakeholder participation in crafting the forest restoration principles document and in discussion of the draft proposed action was used in developing a formal proposed action for the EFRS project released for a 30 day formal public review and comment period December, 14 2012. A notice of this proposed action was published in the Montrose Daily Press and an exhaustive list of interested parties and collaborators, landowners and forest permittees were specifically notified by email or mail about the project details and the opportunity to comment.

Comments

Several letters, emails and phone calls from a group including landowners, long-time Ouray District, ex-agency employees, forest economic activity stakeholders and county government officials were received at the Ouray District Office during the 30 day comment period. The overwhelming majority of comments specifically expressed support for the project although two responses were critical of elements or the entirety of the proposed action. Substantive comments, critical of the proposed action or included design features addressed in this EA are discussed specifically below. All other comments and Forest Service responses to these comments are contained in the project record file at the Ouray District office in Montrose, Colorado.

A comment referred to a lack of discussion of the influence of historical range management activities across the Uncompahgre Plateau. Based on this comment, a discussion of the influence of this activity on development of current range conditions within the project area has been addressed within this EA.

Another comment was received regarding range management and the best management practice of resting broadcast burned areas for 1-2 years following burning. While this specific design feature was not incorporated into the proposed action, it did lead to internal discussions regarding range management practices. Range management objectives for the

project area will incorporate desired conditions from the Uncompahgre Rangeland Initiative and the Horsefly Rangeland Assessment. Management actions required to meet desired objectives may include resting of burned areas 1-2 years, but include more or less intensive actions and restrictions based upon many other factors. These factors could include, but are not limited to the type of animal, intensity of grazing, seasonal and annual precipitation variation and the season, severity and extent of broadcast burning. Due to the wide range of factors affecting the desired objectives, no specific resting period will be included as a design feature.

A comment was received mentioning the need to specifically identify areas with unroaded character within the EFRS project area to defer from commercial harvest activities. In response to this comment, a more detailed consideration of the proposed actions within unroaded[*] and lightly roaded portions of the project area was undertaken. Unroaded areas requiring extensive temporary road construction to meet forest structure objectives have been specifically excluded from proposed commercial mechanical treatments to maintain their primitive character and due to other potential travel management and economic considerations. The remaining areas of commercial mechanical treatment have been identified (See Appendix A, Map B), and will require segments of less than ¾ mile for completion of restoration treatment activities.

The previous comment is related to a broader set of comments relating the need for the Forest Service to be more specific and clear in the discussion of the locations, acreages and types of proposed actions, especially due to the large extent of the project area and proposed activities (Although another comment mentioned the proposed action was too prescriptive and inflexible). The reception of these comments has stimulated an analysis and revision effort to develop a more specific and targeted proposed action:

- An analysis was undertaken comparing existing successional class information (LANDFIRE 2013) to broader desired conditions from forest successional dynamics modeling completed for the Uncompahgre Plateau in 2006 (USDA FS 2006). This analysis has led to the clarification between commercial and non-commercial treatment acres within the cool-moist mixed-conifer zones.

- A re-evaluation of the prescribed fire component of the proposed action was undertaken to address the specificity and clarity of this component of the proposed action. This effort has led to a prioritization of locations within the project area for different types of proposed prescribed fire activity.

- Commercial and non-commercial proposed actions have been organized by vegetation zone and specific priority areas for each proposed action type within the project landscape. Locations of stands or mechanical treatment units below the priority area scale have not been identified, as the EFRS Interdisciplinary Team has indicated that flexibility in specific fine-scale activity and the location, orientation, shape and

[*] Unroaded areas, in this context, do not include identified Roadless Areas. No commercial or non-commercial treatments area proposed within portions the Kelso Mesa Roadless Area within the EFRS project area.

interspersion of these units within each vegetation zone would allow provide the greatest likelihood for accomplishing desired treatment objectives and future conditions.

- Local information describing the range of historical forest structure conditions is currently available for specific areas of the project landscape where treatments are proposed. Efforts to supplement this existing dataset are ongoing, and will continue throughout the course of the project period.

Several comments were received relating to the proposed decommissioning of temporary road and pre-existing non-system or use-created roads. Comments received questioned the ability and commitment of the Forest Service to truly decommission these roads. These comments have been addressed in the design criteria for decommissioning roads. Further, the recent decommissioning of four sections of non-system and temporary road completed during the fall of 2012 within the Uncompahgre Mesas project area highlight the Forest Service commitment to decommissioning roads of this sort during forest restoration contract.

Comments were received regarding economic scale of proposed the proposed commercial salvage and sanitation efforts of beetle infested and windthrown trees. These efforts, while typically of a small-size and total economic value, will not be restricted to a total value of $10,000 or less. All salvage sales prepared on the Ouray District in the recent history have been awarded to local timber purchasers, thereby supporting local economies. It is possible that in the event of a large localized beetle infestation or windthrow event, a larger sized effort would be more efficient economically and in improving forest health. This scenario would be more likely in a higher timber value market. For these reasons, no restrictions will be placed on the size and value of salvage and sanitation timber sales.

We received a large summary of opposing views related to the effects of clearcutting, alternative means for reducing the risk of wildfire damage to homes, dead and dying tree harvests related to insect and wildfire activity, road damage to fisheries and watersheds and concerns with the use of glyphosate herbicides. When applicable to the proposed action, these opposing views have been analyzed by project interdisciplinary team specialists. All other opposing views tangentially related or not applicable to the proposed action have been addressed specifically to this effect. Responses to these opposing views are available in the project record at the Ouray District office in Montrose, CO.

Issues

The Forest Service has developed the proposed action in a regional collaborative effort over a period of approximately 90 weeks. Partners in this process have been the Uncompahgre Plateau Project, cooperating state and federal land and wildlife management agencies, a number of interested citizens, County governments, environmental groups, and the Colorado Forest Restoration Institute and other researchers at Colorado State University. In the course of collaboration, all conflicts/issues concerning alternative uses of available resources have been resolved. In accordance with 36 CFR 220.7(b)(2)(i), this EA need only analyze the proposed action without consideration of additional action alternatives.

Design Criteria

The design criteria listed below would be applied as appropriate to all the activities described in the proposed action. Items not listed below that will also be applied include the design criteria/mitigation measures described in the Escalante Forest Restoration and Stewardship Project Biological Assessment and the Rocky Mountain Region Forest Service Handbook 2509.25 Watershed Conservation Practices Handbook (USFS 2006).

Cultural Resources

Programmatic agreements between the Forest Service and the Colorado State Historic Preservation Office (SHPO) shall be in place prior to implementation of the proposed mechanical and prescribed fire vegetation treatments. These agreements outline the process for inventorying cultural resources, documenting survey results and conclusions and minimizing or avoiding potential effects on cultural or historic resources.

Locations of known cultural resource sites needing protection shall be shown on internal working maps which are not subject to public disclosure, and shall be appropriately identified during project activites so that these resources are avoided and protected from potential impacts.

For any sites for which avoidance of impacts using the agreed methods is not possible, project activities shall be halted in that area until additional consultation with SHPO and American Indian tribes can be completed.

If any new cultural resource sites are discovered, project activities shall stop and an archeologist will be contacted immediately. The archeologist will determine how the site would be protected and what additional consultation would be necessary.

Vegetation and Fuels

Timber sale and stewardship contract activities will be designed to be economically efficient, to provide attractive offerings to local forest industry and to maximize the value of funds spent. Silvicultural prescriptions and timber and stewardship contracts will be designed to provide an adequate volume of timber per acre, a mix of desirable tree species, and an adequate average sized saw log in order to minimize the cost of hazardous fuels mitigation and forest restoration work across the analysis area.

Using ground-based field work, a certified silviculturist will describe in a written Silvicultural prescription which trees will be cut and removed, and which trees will remain which each treated stand. The silviculturist will apply the following design criteria;

Ponderosa Pine Zone

Harvests within this vegetation zone should be comprised of multi-aged individual tree selection, commercial crown thinning and non-commercial thinning from below. The overall objectives should be to reduce stocking and density to levels within the range that existed in

pre-settlement pine forests, which in some cases is close to one-half or more of their current density. Prescriptions should utilize the site-specific information describing historical forest structure reference conditions (i.e. Binkley 2008; Matonis 2012) or more recent or site-specific information in development of silvicultural prescriptions whenever possible.

Harvests and non-commercial thinning should retain multiple size and age classes. In an effort to move stands toward a more multi-aged structure, cutting should also favor the retention of a component of suitable younger cohorts.

Existing snags should be retained at or above the Forest Plan Standard (USDA FS 1991). Retention of large and old (predating 1875) ponderosa pine trees within this vegetation zone should be a stand-level objective of commercial harvests.

Selection harvest within even-aged ponderosa pine stands should be intended to primarily diversify tree spatial pattern and age structures at the stand scale. In areas where historical spatial patterns have been homogenized to a uniform (15 to 25 foot spacing) pattern, prescriptions should utilize treatments that create spatial heterogeneity at fine-scale. Where fine-scale tree aggregation is present within these stands, aggregated trees should not be thinned to a uniform spacing.

Retention of a broad range of stockings and tree densities should be the goal at fine-scales (i.e. stand scales). For instance, within a cut-unit or stand at the scales of approximately 20-200 acres, a consistent average stocking should not be desired across the entire stand. Instead, the objective should be to obtain an average, post-treatment stand density and stocking comparable to the historical average, while retaining areas within the stand well-above the average (i.e. clumps/groups) and areas well below the average (i.e. openings).

In most pine stands with a spruce component, the relative representation of blue spruce should be reduced to between about 5 to twenty-five percent of total basal area, dependent upon the blue spruce density, diameter distribution and proximity to fire control lines.

Treatments should not result in heavy accumulations of surface fuels at the bases of live trees. All activity fuels should be pulled back an adequate distance from tree boles to allow live trees to withstand heat intensity generated from these fuels when burned.

Treatments should attempt to recreate treeless openings within the ponderosa pine-oak zone ranging in size from 0.25 to 0.5 acres across approximately 20-25% of harvested areas, a conservative estimate of historical conditions

Generally, prescribed fire may be used whenever feasible to reduce activity fuels, to create a post-fire nutrient pulse and to create conditions suitable for establishment of ponderosa pine regeneration.

Warm-Dry Mixed-Conifer Zone

Harvests within this vegetation zone should be comprised of multi-aged individual tree selection, commercial crown thinning and non-commercial thinning from below. The overall objective should be to reduce stocking and density to levels within the range that existed in pre-settlement pine forests, which in some cases is close to approximately half the current densities. Prescription should utilize site-specific information describing historical forest structure reference conditions (i.e. Binkley 2008; Matonis 2012) or more recent or site-specific information in development of silvicultural prescriptions. Prescriptions should attempt

to create conditions in these stands similar to what would be expected if 2-3 low to mixed-severity fires had occurred since disruption of historical fire regimes around 1879.

Treatments within these forests should favor retention of ponderosa pine and Douglas-fir, especially in areas where these species are lacking when compared to stand-level evidence of past dominance (e.g. large, old snags and large diameter cut stumps). In areas where they were once the dominant tree species, but greatly reduced or eliminated through past harvest, genetically suitable Douglas-fir or ponderosa pine seedlings may be hand planted to help improve the representation of these species in the overall stand composition.

Existing snags should be retained at or above the Forest Plan Standard. This may include retention of Douglas-fir Beetle killed snags during salvage harvests. Retention of large and old (predating 1875) ponderosa pine trees within this vegetation zone should be a consistent stand-level objective of commercial harvests.

Density and stocking of shade tolerant subalpine fir and spruce species may be reduced significantly throughout this vegetation zone, especially where there is no evidence of these species in stands prior to approximately 1875. Shade tolerant species in this zone should be retained primarily in mesic or fire-isolated microsites within operable acres and within north aspects and drainage bottoms within non-operable areas of this vegetation zone.

Historical forest conditions within these forests were characterized by fine-scale (less than 75 feet) clumps of overstory trees scattered randomly throughout stands (Binkley et. al. 2008). Commercial and non-commercial treatments within this vegetation zone should have the broad objective of moving stand conditions towards a similar spatial pattern consistent with historical conditions.

As in the ponderosa pine-oak zone, retention of a broad range of stockings and tree densities should be the goal at fine-scales (i.e. stand scales). For instance, within a cut-unit or stand at the scales of approximately 20-200 acres, a consistent average stocking should not be desired across the entire stand. Instead, the objective will be to obtain an average, post-treatment stand density and stocking comparable to the historical average, while retaining areas within the stand well-above the average (i.e. clumps/groups) and areas well below the average (i.e. openings).

Treatments should not result in heavy accumulations of surface fuels at the bases of live trees. All activity fuels should be pulled back an adequate distance from tree boles to allow live trees to withstand heat intensity generated from these fuels when burned.

Treeless or aspen dominated patches within warm-dry mixed conifer forests of the project area were likely common prior to 1875 (Binkley et. al. 2008; Romme et. al. 2009; Matonis et. al. 2012). Similar to the ponderosa pine-oak zone, treatments in this vegetation zone should attempt to recreate treeless openings ranging in size from 0.25 to 0.5 acre across approximately 20-25% of harvested and mechanically treated areas.

Aspen coppice cuts may occur to a relatively limited extent within this zone within WUI areas in the western portion of the project area to regenerate aspen. Coppice cuts should be limited

to sites with a high potential for aspen regeneration success as identified in Johnston (2001). Aspen coppice cut units will not exceed 40 acres in size.

Cool-moist Mixed-conifer Zone

Stand-level objectives should be guided by recent and ongoing studies of historical forest structure and composition within the project area (Binkley et. al. 2008; Matonis 2012), broader regional studies of mixed-conifer forest historical structure (i.e. pre 1875), and by comparison of existing successional class structure to historical estimations of successional class ranges (USDA FS 2006; LANDFIRE 2013). Within this zone the main characteristic of departure from estimated historical conditions is the relative lack of early-development or post-disturbance stand initiation conditions relative to mid-aged and stand conditions (Ibid). Treatment locations should be located as much as possible within mid-development stand conditions in this vegetation zone, as late-development conditions are currently close to the low-end of the desired range within this vegetation zone.

Early-development stand objectives should be the primary goal of commercial harvests within this vegetation zone. Harvests should include commercial and non-commercial canopy thinning and group selection harvests. Group selection harvests should remove 65-95% of existing tree cover in patches ranging in size 0.25 to 5 acres.

In group selection harvest areas, residual group structure should include the retention of structural diversity elements such as Douglas-fir trees of all age classes, advanced spruce regeneration, and patches of overstory trees ranging in size from several trees to 2.5 acres. In areas where early-development stand conditions are not the primary stand level objective, efforts should be focused heavily in areas where previous forest management activity and harvesting operations have altered stand development to structural conditions that might not have developed under a natural disturbance regime. This may include non-commercial thinning of insect damaged advanced regeneration and thinning or weeding of subalpine fir and declining spruce where they currently dominate stand conditions.

In areas where they were once the dominant tree species, but greatly reduced or eliminated through past harvest, genetically suitable Douglas-fir seedlings may be hand planted to help improve the representation of these species in the overall stand composition.
Aspen coppice cuts may occur to a relatively limited extent within this zone within WUI areas in the western portion of the project area to regenerate aspen. Coppice cuts should be limited to sites with a high potential for aspen regeneration success as identified in Johnston (2001). Aspen coppice cut units will not exceed 40 acres in size.

Spruce-fir-aspen Zone.

These harvests should have the primary objective of diversifying forest structure in Canadian Lynx habitat, but will also create a source of commercial forest products for the local timber economy. Current forest successional class distribution within these forests is likely within what might be expected under an infrequent, high-severity disturbance regime. This vegetation zone contains a relative lack of early-development or post-disturbance stand initiation conditions relative to mid-aged and late-development stand conditions similar to the cool-moist mixed-conifer vegetation zone, as such, early-development stand objectives

should be the primary goal of commercial harvests within this vegetation zone (USDA FS 2006; LANDFIRE 2013).

Eight group selection harvest areas within the spruce-fir-aspen zone should range from approximately 500-2000 acres in size.

Approximately 15-20% of each managed group selection harvest area (75-420 acres) may be harvested. Group selection harvests should remove 65-95% of existing tree cover in patches up to 2 acres in size within lynx habitat and up to 3-5 acres outside lynx habitat areas. Up to an additional 5% of the group selection harvest area may contain some amount of tree cutting as necessary to access and remove commercial timber. Group selection cut unit layout should be implemented to minimize the creation of temporary roads and skid trails necessary to complete harvest activities.

Groups should be located where existing advanced regeneration is inadequate and forest conditions consist of single-aged stands. This shall be a consistent feature of group selection harvest within spruce-fir-aspen types in potential Lynx habitat. Group selection marking within potential Lynx habitat should require coordination with zone wildlife staff using a programmatic agreement with the US Fish and Wildlife regarding group selection harvests.

Following harvest, natural regeneration of spruce, fir and aspen should be favored over artificial regeneration methods. Regeneration monitoring and/or survey should follow all harvests. If regeneration is determined to be inadequate, planting and site preparation activities necessary to reforest group areas may be initiated.

If spruce beetle activity becomes evident within these zones, immediate sanitation/salvage harvest may be undertaken to reduce beetle populations within this forest type as described in Mixed-Conifer Commercial Harvest and thinning section. Sanitation actions should be consistent with lynx habitat management guidelines where applicable.

In areas of the spruce-fir-aspen zone outside Lynx habitat, approximately 500-1000 acres of advanced regeneration and intermediate spruce and subalpine fir may be thinned to reduce overall tree density, move species composition towards spruce (in fir dominated stands) and increase overall tree vigor, similar to non-commercial mechanical treatments in cool-moist mixed-conifer forests.

Aspen coppice cuts may occur to a relatively limited extent within this zone within WUI areas in the eastern portion of the project area to regenerate aspen. Coppice cuts should be limited to sites with a high potential for aspen regeneration success as identified in Johnston (2001). Aspen coppice cut units will not exceed 40 acres in size.

Fuels and Managed Fire

Surface Fuels Treatments

Piling treatments may be considered when the levels of activity fuels are expected to exceed levels safe for broadcast burning, most likely after commercial treatments. Grapple piles can

then be burned in the winter when snow is on the ground or during wet conditions during late-summer to minimize fire spread and reduce scorching on the residual stand. Fire from pile burning may be allowed to creep within unit boundaries at the discretion of fire managers, as consistent with burn plans.

Handpiled slash may be burned in the winter when snow is on the ground or during the monsoon season when ground moistures are higher to minimize fire spread and reduce scorching on soils and the residual stand. Fire from handpiles may be allowed to creep within unit boundaries at the discretion of fire managers.

Mastication of activity generated fuels may be needed on a limited basis. Areas for this treatment could include buffer zones directly adjacent to private property as a way to mitigate the effects from burning such as smoke or, where soil scorch from pile burning is a concern.

A site specific burn plan shall be developed before any planned ignition occurs.

Burn Requirements

Prescribed burning shall not be conducted without an approved site specific burn plan with standards for smoke management. All prescribed fires must comply with the regulations for smoke management within the Colorado State Implementation Plan. Burn plans would be implemented to minimize the possibility of the burn affecting “smoke sensitive” areas in accordance with the State of Colorado Regulation 9. Regulation 9 includes provisions for a permitting process that regulates all open burning and prescribed fire within the State.

Prescribed Fire Mitigation Measures

To comply with forest plan standards for residual material, burn plans should be designed to mitigate effects of prescribed fire on coarse woody material during prescribed fire operations where potential conflicts may exist.

Prescribed fire burn plans should take into account silvicultural prescriptions for allowable mortality to individual tree species and diameter classes. Prescribed burns within timber management areas should include a silvicultural prescription signed by a certified Forest Service silviculturist.

Fire management personnel should contribute to the annual project planning and consult with district range staff during development of prescribed burn plans. Efforts should be directed to reduce potential impacts to range allotments and ensure that permittees are informed of planned actions. Consultation should also take place between district or zone wildlife biologists and fire management personnel to ensure adherence to all forest plan or threatened species requirements.

Wildlife

200 - 300 snags (in all stages of development) should be retained per 100 acres.

Late-development created openings should be less than 300 ft in width.

In spruce-fir-aspen and cool-moist mixed-conifer zones, 5-12% or more of the surrounding or adjacent areas (where biologically feasible) should be managed for late-development forest classification and should occur in irregular shaped patches. Designated spruce-fir and mixed conifer late-development patches shall be no smaller than 30 acres in size and should average 100-200 acres in size whenever possible. In addition, other stands within the same zone should be designated so that these stands can be managed on extended rotations in order to develop their late-development structure and values so that these stands will serve as late-development replacement stands.

Treatments should maintain 10-20 tons of logs and other down woody material per acre for species dependent on this material for their habitat (i.e. Pine Marten).

No activities shall be allowed within ¼ mile of an active northern goshawk nest from March 1 to July 31 if they would cause nesting failure or abandonment. A no harvest area centered upon all newly discovered, active goshawk nests to protect potential reuse of nests in future years.

Treatments should provide 20% of pole or mature tree stands adjacent to nesting sites with at least 150 ft^2 of basal area. Provide at least one class 1 log adjacent to nesting sites (Northern Goshawk).

As determined by the zone wildlife biologist, prior to beginning project activities, implementation should involve survey and marking of snags containing nest cavities and other signs of wildlife use.

On-going surveys for raptors should be conducted prior to treatment operations, to determine locations of individuals or populations of these species and allow for the mitigation measures as appropriate (timing, buffers, etc).

Late-summer and fall burning and fall and winter mechanical treatments are recommended within the pinyon-juniper/mountain shrub vegetation zone to avoid impacts to nesting Brewer's Sparrow.

Range

Overall range vegetation management objectives, and existing and desired condition information for range allotments within the EFRS project area are found in the Environmental Assessment and Decision Notice for the Uncompahgre Rangeland Initiative (1996) and the Horsefly Rangeland Assessment and Decision Notice (2003). Both are incorporated by reference as part of the Escalante Environmental Analysis.

An implementation schedule should be developed that is adaptive in nature, provides for range vegetation objectives as well as restoration objectives, and is sensitive to permittees economic needs. Layout of patch, group selection and intensive individual tree selection cuts should be done in coordination with Forest range personnel to comprise relatively large cumulative acreages to minimize ungulate browsing and favor aspen regeneration.

The EFRS implementation plan and schedule should identify type, fine-scale location and timing of proposed restoration treatments so that grazing management prescriptions and/or

treatments can be adapted to respond to changing conditions, priorities, and also meet the objectives of the Escalante Restoration Project and the Uncompahgre Rangeland Initiative.

Permittees should be given advanced notice of planned treatments in order to allow time to adapt to stocking and/or seasonal and management adjustments cooperatively with the district range staff. Treatments may be scheduled, staged or deferred so that restoration objectives can be met in a manner sensitive to existing, ongoing livestock grazing activities with minimal disruption.

Range improvements damaged as a result of commercial and non-commercial mechanical or prescribed fire activities should be repaired immediately.

Group selection harvesting should not take place on the Club-Campbell; Forty-seven; Basin; Cottonwood, or Sheep Creek allotments. This does not include non-commercial reductions of ladder fuels surrounding private inholdings and removals of dead and dying hazard trees within 200 feet of the Divide Road (NFSR 402).

Invasive Weeds

Invasive weed management efforts within the EFRS project area should follow analysis, recommendations and guidelines described within the most recent of the GMUG National Forest Invasive Species Action Plan.

Annually, vegetation management personnel should collaborate on project layout and design. During layout of commercial and non-commercial mechanical treatment or prescribed burn units, forest vegetation management personnel should evaluate invasive risks, analyze potential treatment areas for invasive weeds within high risk sites to identify prevention practices and minimize weed establishment and spread.

Throughout the implementation period of the proposed action, the Forest Service should maintain flexibility to defer cut units or stands within priority areas from treatment due to the discovery of significant new invasive plant populations with potential to disrupt the functioning of native plant communities. These populations should be aggressively treated with the appropriate management tool, as deemed necessary by invasive weed program personnel. This may include treatment with herbicides, grazing, cultural, and biological methods, consistent with the GMUG forest invasive species action plan. No weed control techniques unmentioned the Invasive Species Action Plan (2011) shall be implemented to control weeds within the project area.

Seeding of sites determined to be at a higher risk of invasive species infestation due to vegetation type, existing canopy cover, proximity to existing infestations or degree of disturbance from timber harvest and/or fuel treatments should occur immediately following treatment with a native seed mix appropriate to the site.

Commercial and non-commercial mechanical operations should be restricted to uninfested areas before moving to known weed-infested areas. Staging areas shall be located in weed-free locations within the project landscape. Avoid or minimize all travel through weed

infested areas, or restrict to periods of times when the spread of seed or propagules is least likely.

Consult with District Invasive Species specialist whenever spring burning on sites with heavy cheatgrass cover or in ponderosa pine/gambel oak and warm-dry mixed-conifer plant communities is proposed. Spring burning is the most injurious to perennial plants. Since cheatgrass is a winter annual, it is less affected by spring burning than perennial plants, and may increase on the site due to reduced competition from perennials.

Any vegetative material used for restoration activities should be either certified or tagged as being free of noxious plants as directed by Regional order number 02-97-01 and 02-97-02. Seed following restoration treatments where needed to minimize risk of invasive establishment and meet project objectives in understory. Seed mixes will be developed on a site-by-site basis using native seed or genetically local seed varieties when available.

To minimize the risk of invasive species infestation, all temporary roads constructed should be seeded with the appropriate seed mix during obliteration. Additional invasive species infestation may also occur on permanent system roads associated with hauling, fire line construction, road decommissioning, landings, skid trails and mechanical treatment areas. These sites should also be revegetated, particularly those in the pinyon-juniper, ponderosa-pine/Gambel oak; and warm dry mixed conifer plant communities.

Following revegetation, monitoring and herbicide treatments for targeted invasive species should be completed. In the mixed-conifer types, where conditions are currently relatively free of invasive species, monitoring for a minimum of 3 to 5 years following treatments in conjunction with herbicide treatments should be completed.

Native plant materials should be the first choice in revegetation for restoration and rehabilitation of native ecosystems where timely natural regeneration of the native plant community may not occur. Non-native, non-invasive plant species may be used when:

- Needed in emergency conditions to protect basic resource values,
- As an interim, non-persistent measure designed to aid in the reestablishment of native plants,
- When native plant materials are not available,

Additional design criteria to mitigate invasive weed risk may also be implemented based on the best available science, local knowledge, and changing priorities or objectives for the landscape as consistent with the GMUG Invasive Species Action Plan.

Soil and Watershed Resources

Soil Resources

Treatments should use existing skid roads, trails, and landings that are in acceptable locations and limit the number and extent of new ones.

Skid trail locations should be agreed to by the Forest Service in advance of construction; spacing should be approximately 100 feet or more apart. Skid trails should be water barred at least every 100 feet on slopes greater than 20% or as needed depending on slope and ground conditions and slash placed on main trails as needed to control erosion.

Implementation should promote winter operations on frozen or snow covered ground when feasible.

Road decommissioning efforts should remove any road ditches, culverts, site-prepare, drain (install water bars, out-slope, or re-contour), de-compact (i.e. “rip”; 80% or more of the road bed to a depth of 6 to 10 inches), re-vegetate (seed and mulch), and close system roads to be decommissioned, temporary, and intermittent use roads and other disturbed sites within one year after use ends.

Ten to twenty tons per acre of coarse wood other woody slash should be retained following all treatments to provide protective surface cover and for future soil health and productivity.

Treatment contracts should prohibit deposition of masticated material greater than 3” deep or minimize the aerial extent of coverage.

The total length and width of constructed lines should be minimized. Blading to expose bare mineral soil displaces the nutrient and organic matter enriched surface horizon and increases the risk of erosion.

Avoid direct ignition of concentrated areas of dry masticated materials that are 2” or more deep.

Patterns and strategies during prescribed burning should be used to minimize litter layer losses on slopes greater than 25%.

Treatment should avoid dozer line construction on slopes greater than 30%

Where fire lines create cut slopes, slopes should be re-contoured by pulling side cast or fill material back, seeded and scattered with slash if available.

Fire lines should be outsloped or water barred according to the following table:

Table 2: Waterbar Spacing, Skid Trail and Fireline Construction

Slope (%)	Spacing in feet
< 20	75 or as needed
20 - 35	50 -75
35 – 60	25 – 50

After use, soil and litter should be pulled back into the fire line, seeded, and scattered with slash if available.

Riparian areas and wetlands

Ground disturbing activities should be avoided within the Water Influence Zone (WIZ) in order to minimize the loss of litter and ground cover. Activities that minimally disturb the ground and are necessary to achieve management area objectives may occur. The definition of the WIZ for various water related features is as follows:

Table 3: Watershed Influence Zone Delineations

Feature	Outside Edge of Watershed Influence Zone (WIZ)
Perennial Stream	100 ft minimum from Stream Bank
Intermittent Stream	25 ft minimum from Stream Bank
Seeps/Springs/Wetlands	50 ft from the source or edge of associated wetland whichever is greater
Ditch	Edge of Right of Way

Skid trails, temporary roads, or landings should not be located in intermittent or ephemeral streams or parallel to them to prevent bank damage, surface compaction, and the loss of ground cover that exposes bare mineral soil. *(Ephemeral Stream - A stream that flows only in direct response to precipitation in the immediate locality (watershed or catchment basin), and whose channel is at all times above the zone of saturation.)*

Direct fire ignition should not be applied within the WIZ of perennial streams, springs, or wetlands unless required in order to protect canopy cover and forest floor layers. These areas should be pre-treated using mechanical or targeted hand treatments to reduce heavy fuel loads if necessary.

Machines should not be used to construct fire line within the WIZ.

Water Quality

Temporary crossings over perennial and intermittent streams should be designed to prevent the restriction of the expected flood flows or be removed prior to the termination of seasonal operations. Forest or district watershed staff should be consulted during the selection of final alignment.

Crossings should be made perpendicular to direction of any stream flows at designated locations.

Temporary stream crossings (including culverts and all fill material in the active channel) should be removed following use and channel geometry and shape should be restored. Channel banks should be seeded using certified local native plant seed as practicable.

Recreation and Travel Management

Road Obliteration

All temporary or pre-existing, non-system or user created roads should be obliterated. Obliteration will include:

- Obstructing entrances from intersections with system roads
- Effectively blocking the road to normal vehicular traffic
- Adherence to road decommissioning and obliteration guidelines stated in the *Soil Resources* design criteria.

Safety

To ensure the safety of the public using the project area system roads and trails, the contractor should implement a specific traffic control plan developed by the Forest Service prior to commencing contract operations. This plan should be approved by the contract administrator and will include the installation and maintenance of temporary traffic controls to provide Forest users with adequate warning of potentially hazardous conditions arising from contract activities. Unless waived in writing by the District Ranger, no hauling of logs or large equipment should be allowed on weekends or holiday.

When contract activities that could result in injury to the recreating public, such as tree cutting, yarding, or masticating, are in progress within or adjacent to Forest Service roads, trails, or recreation sites, the contractor should provide flagmen, post signs, erect and maintain barricades, guards, construction signs, warning signs, or detour signs as necessary to warn and protect the public at all times from injury or damage as a result of contractor's operations. In addition, contractor should provide for the area a watchman whose sole duty shall be to warn and advise the public of any hazards present in the areas as a result of this contract.

Timber Hauling

Winter hauling and snowplowing may occur if an agreement between the contractor and the Uncompahgre Valley Trail Riders Association is negotiated to the satisfaction of the District Ranger. Log and heavy equipment hauling on plowed roads should be restricted to non-holiday weekdays. If winter hauling is approved, the contractor should be required to post appropriate safety signs along roads and trails.

Recreation

The public should be notified of logging activity through media such as local newspapers and the Forest website.

Creation of landing piles or decking of commercial sawtimber should not be done within 100 ft of campground. Logging slash should be removed within 100 feet of developed rec sites, as much as feasibly possible. Harvested tree stumps within 100 feet of campgrounds should be

6 inches or less, as much as feasibly possible. Felling or removal of hazard trees should be completed within 150 feet of developed recreation sites (campgrounds, trailheads, etc.).

Single track trail corridors shall not be used for hauling or equipment transportation and as such, shall not be widened in association with vegetation management activities. Existing single-track trail character shall not be altered, or restricted in association with vegetation management activities.

Recreation personnel should be consulted annually to coordinated the on the ground activities that may impact the public, utilization of routes, and project design criteria implementation.

Lands

Irrigation ditches within the project area have been mapped and should be incorporated into the project design and layout to minimize impacts. Private property boundaries should be located within the WUI and utilized to avoid trespass on private lands.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section summarizes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the proposed action.

Vegetation and Fuels

Pinyon-Juniper Mountain-shrub—Affected Environment and Environmental Consequences

Affected Environment

Pinyon-juniper/mountain shrub zone is the lowest elevation zone within the Escalante Project Area, extending from the Forest Boundary on the northeast side of the area grading into the ponderosa pine-oak zone at higher elevations. There are approximately 61,000 acres of pinyon-juniper/mountain shrub within the EFRS project area. This vegetation is quite variable in its composition, density and age class. At higher elevations pinyon pine (*Pinus edulis),* is often the dominate tree with juniper (*Juniperus spp.*) minimally present or non-existent while at lower elevations juniper may dominate with limited pinyon present. In the mid-elevations both pinyon and juniper are present in varying compositions. There are typically a variety of shrubs, including mountain mahogany (*Cercocarpus spp.*), sagebrush (*Artemesia spp.*), oakbrush (*Quercus gambelii*) and serviceberry (*Amelanchier utahensis*), as well as numerous grasses and forbs, in the understory or in interspaces within the pinyon-juniper zone/mountain shrub. The density of pinyon-juniper stands ranges from quite open, particularly on southern facing slopes or flatter areas at lower elevations to higher densities found on north facing slopes and at higher elevations. Some of the density differences are also due to past treatments. Age classes are variable across the landscape although young stands (less than 50 years old) are rare except in areas that were previously treated mechanically and are now being reclaimed by pinyon and juniper trees or in areas where young pinyon and juniper are moving into more open grasslands and sage parks. Middle aged stands (50-150 years old) are more common on the landscape and could be a result of fire exclusion since the late 1800's, possibly due to the introduction of domestic grazing and fire suppression. Older stands and old growth stands (greater than 150 years old) are somewhat rare and often confined to more remote areas and north facing slopes.

Early-development, shrub-dominated conditions within this vegetation zone provide important winter and transition season range for wildlife and early-season forage for livestock. As previously mentioned, early development conditions are rare within this zone, and little has been done in recent years to maintain this habitat component. Pinyon and juniper trees have regenerated within these areas to a point that mountain shrub species are declining. The mountain shrubs that are present show signs of heavy browse pressure and are much less palatable due to larger stem size.

Also present within this vegetation zone are small, sagebrush (*Artemesia spp.*) parks scattered throughout the project area. Portions of these sagebrush areas are contained within previously mechanically treated areas. There is anecdotal evidence that this habitat component is declining in prevalence due to conifer encroachment over time. This habitat type, while resilient to wildfire disturbance at broad scales, can be negatively affected if a large portion of isolated areas are burned at high severity.

Two areas within this vegetation zone, one area along 25 Mesa Road (NFSR 503) and one along Transfer Road (NFSR 508) contain ponderosa pine ponderosa pine plantations. These plantations, planted in the mid to latter half of the last century, were historically shrub dominated communities. Since these dry areas typically could not support trees historically, the diameter and height growth of these planted trees has been slow. Slow growth rates are further reduced by the relatively dense conditions within these forested areas.

Environmental Consequences –No Action Alternative: Direct, Indirect and Cumulative Effects

No mechanical treatment or prescribed burning would occur under this alternative. There would be no direct effects under this alternative. Wildfire would continue to be managed with protection and/or resource benefit objectives as appropriate. This alternative does not reduce or increase fuels by mechanical treatments or prescribed fire, and as such fuel continuity and loadings will increase incrementally through time, increasing the potential for a large extent and high severity wildfire (although this event is likely within the historical range of variability for this vegetation zone).

Environmental Consequences –No Action Alternative (Ponderosa Pine Plantations): Direct, Indirect and Cumulative Effects

The possibility for tree mortality associated with the current dense stand conditions will continue to increase within pine plantations. These plantations areas are located in relatively warm and dry sites outside of or at the lowest elevation extent of the historical distribution of ponderosa pine. These conditions could be exacerbated by continued drought conditions or warmer conditions associated with climate. Mortality could be directly related to drought or as an indirect result of mountain pine beetle caused mortality associated with drought conditions. Current high crown continuity and heights to live crown within these stands also predisposes these stands to crown fire under extreme fire weather conditions (Brown et. al. 2004).

Environmental Consequences –Action Alternative: Direct, Indirect and Cumulative Effects

Mastication of pinyon and juniper trees within the project area will directly reduce current canopy cover within treated areas. More light will reach the ground and growth rates of understory vegetation will increase. Since these areas are already somewhat open, and contain only small diameter trees and shrubs, fuel loadings will not be increased dramatically. Prescribed fire treatments within these areas will reduce fuel loadings, and may also stimulate an additional sprouting response within the mountain shrub community.

The influence of pinyon and juniper trees within treated areas will be reduced greatly for several decades of more following treatment. Sprouting shrub species will dominate woody

vegetation community following treatment, providing browse for wildlife and livestock, especially during periods outside the normal growing season. The understory will be dominated by grass and forb species, providing fine-fuels capable of increasing surface fire spread rates in the event of a wildfire. Over time, these areas will slowly be encroached by pinyon and juniper trees from the edges of the mechanically treated units, slowly blending the treated acres into the adjacent pinyon-juniper dominated landscape.

Environmental Consequences –Action Alternative (Ponderosa pine plantations): Direct, Indirect and Cumulative Effects

Thinning will diversify tree spatial pattern and age structures at the stand scale. The potential for density associated tree mortality will decrease somewhat within thinned plantations, although this potential will not be eliminated due to potential drought and the location of plantations at lowest elevation (i.e. driest) extent of the historical distribution of ponderosa pine.

In an effort to move stands toward a more multi-aged structure, cutting will also favor the retention of a component of suitable younger cohorts whenever present within these stands.

Immediately following harvest, activity fuels (limbs & tops) will occur at varying levels across treated stands. Once cured, these activity fuels will present a fuels hazard that would promote active fire spread during dry conditions.

Prescribed fire to consume activity fuels and to prepare soils for conifer regeneration may result in some level of residual tree damage and mortality.

Pole products, fuelwood or small sawtimber sized trees will be supplied to the local forest products industry and many jobs are sustained and/or created.

Ponderosa Pine-oak—Affected Environment and Environmental Consequences

Affected Environment

This is the coniferous forest cover type that occupies the lowest elevations of the project area. In the lower portion of its range, ponderosa pine occurs in more or less pure stands, although it is often associated with Gambel oak and aspen. In the mid- and upper-portions of pine's range and along north aspects, aspen, Douglas-fir and blue spruce are associate species. At lower elevations, tree and shrub species common within the pinyon-juniper/mountain shrub zone are present within dry sites and on southerly aspects.

Overall the ponderosa pine-oak zone is likely more dense with small diameter trees, contains less open and fire-maintained developmental conditions and is more-susceptible to stand-replacement fire than the plateau's historical[*] pine forest (McGarigal and Romme 2005; USDA FS 2006; Binkley, et al., 2008, LANDFIRE 2013). Most accessible pine stands throughout the project area show evidence of past harvest activity over the last century. Less

[*] For the purposes of this proposed action the term "historical" conditions refers to pre European settlement (pre 1879) forest conditions.

intensive harvests mainly removed scattered large-diameter, old trees. More intensive harvests that have occurred since the 1950s also removed these trees and thinned the residual stands to a uniform spacing. Portions of this vegetation zone within the Lockhart-Iron Springs, Love-Mesa and Transfer-Highway 90 compartments have been underburned in the last 15 years. Current stand structure is comprised mainly of even-aged, single-storied stands. Trees are generally less than about 130-140 years old and most are the result of the very good regeneration conditions that occurred in the wet, early decades of the 20th century.

Pine is a fire-tolerant species; once it outgrows the seedling stage, it develops thick bark that insulates it against the damaging heat of surface fires. The ponderosa pine ecosystem is well-adapted to frequent, low-intensity fires that reduce the amount of low-lying live and dead vegetation, limit tree density by killing most very young pine seedlings. These fires increase the height to live tree crowns by scorching lower crown foliage, providing these trees with additional resilience to future wildfires. Surface fires create open, early-development stand conditions that allow young oak and aspen to establish and discourage spruces and other shade-tolerant fire-sensitive species from acquiring dominance. Historically, pine forests were open-crowned with trees occurring in relatively dense groups interspersed with openings ranging in size between about 0.1 acre to about 0.5 acre (Binkley et. al. 2008). The combination of high heights to crown bases, openings and discontinuous crown cover made historic stands resistant to stand-replacement fire.

As a means of reintroducing fire to the landscape, post-harvest prescribed fire will occur within approximately five years of harvest, dependent upon suitable burning conditions. The result of burns would be a reduction in surface and ladder fuels, creation of conditions favorable to the growth of grasses, forbs, and shrubs and also creation of areas of bare mineral soil which allow ponderosa pine seedlings to germinate and establish.

Mountain pine beetle (Dendroctonus ponderosae) can cause broad-scale mortality in ponderosa pine dominant stands. High density stand conditions, high basal areas and old-age structure are all associated with pine beetle mortality events (Romme et. al. 2009). These conditions are all common across the project landscape, although there is currently very limited mountain pine beetle activity within isolated portions of the project area. Probability of a broad-scale outbreak within these conditions is associated with drought conditions.

Environmental Consequences — No Action Alternative

Direct Effect

There will be no direct effects of a no action alternative.

Indirect Effects

In the absence of major disturbance, no management action within these forests would likely result in the slow reduction of mid-successional forest structure classes and a concomitant increase in late-development successional classes within the project area. Early-development and open fire-maintained portions of the landscape would slowly transition into mid or late-development classes. Fine-scale disturbance such as stand-scale bark beetle outbreaks,

windthrow, and drought caused mortality events would likely maintain a small percentage of the landscape in the early-development classes over time. Further, portions of these vegetation zones contain limited amounts of areas where tree growth is not possible due to extremely shallow or rocky soils.

Canopy cover would likely increase somewhat over time. Portions of the landscape in an open condition would gradually become less common, while closed conditions with greater than 50-70% cover would become more common. No management action would have minimal effect on current aspen regeneration rates.

Cumulative Effects

A no action alternative, over time, would not mitigate any of the effects of past management activities within these vegetation zones in the short to mid-term.

Ponderosa-pine, especially where removed extensively due to past harvests would maintain limited ability to regenerate in stands where it was previously dominant. In the event of a broad-scale, high severity fire, where ponderosa pine is currently present, the seed source for these species could be reduced, limiting the ability of these stands to develop a similar forest structure to the pre-harvest stand condition.

With a no action alternative, potential crown fire hazard would likely increase gradually through time within these elevation zones, although during most years the probability of such an event would be small. In much of these zones, crown fire hazard is already thought to exceed the historical range in these vegetation types (Romme et. al. 2009). This hazard would be further increased under an expected warmer climate over the next 50 years (Nydick et al. 2012) Under warmer climate scenario, longer than average fire season length and extreme fire behavior conditions could be more prevalent (Nydick et al. 2012). Canopy cover, canopy continuity and surface fuel loadings all associated with tree mortality following fire within these vegetation zones would gradually increase over time. The combined effects of a warming climate, increasing fuel loads and increasing fuel continuity could eventually result in more severe and homogenous fire effects, although the exact quantification of this effect is not possible.

Environmental Consequences—Action Alternative

<u>Direct Effects</u>

Commercial harvest and non-commercial mechanical treatments will substantially reduce total tree canopy density in ponderosa pine stands. About 1/3 to 3/4 of existing basal area will be removed in harvest. Spatial distribution of residual trees will be irregular and aggregated at short distances (<30 feet), although opportunity for clustering of trees at the finest scales is limited in some stands because previous cutting has resulted in a somewhat uniform and open distribution of individual trees.

Harvest will temporarily increase the amount of surface fuels from tops, limbs, and cull material. Mechanical treatment of areas outside commercial units will dramatically reduce ladder fuels, particularly dead and dying trees affected by western spruce budworm

defoliation. This ladder fuel reduction will be accompanied by a temporary increase in surface fuels during the period prior to underburning.

Crown fire hazard within treated areas will be reduced through increasing the height to live tree crowns, and decreasing crown bulk density (Brown et. al. 2003). In the event of a large crown fire moving into the project area, fire behavior will be moderated towards surface fire. Suppression resources will have more opportunities to safely manage fires under most fire weather conditions.

Burning will result in some tree mortality from bole and crown scorch. Pine over about eight inches DBH will be least affected. Similar size spruce will incur more fire mortality than pine. Conifer seedling and saplings, especially fir and spruce, are most likely to be killed, which is consistent with the project objective to reduce ladder fuels. Burning will occur under fuel-moisture and weather conditions using a burn plan developed following completion of commercial and non-commercial mechanical treatments.

Indirect Effects

The reduction in canopy density from mechanical treatment and prescribed burning will allow more sunlight to reach the forest floor, creating conditions more favorable to the reestablishment of grasses, forbs, and shrubs. Grasses and forbs are expected to increase after prescribed fire treatments and when cured, will be available as fine fuels during wildfire. These fine fuels have a high surface area to volume ratio and tend to burn with high rates of spread but with much lower severity than dead woody fuels.

Pine, spruce and fir will also likely regenerate. Prescribed fire treatments or wildfire may kill most of these seedlings, but those that remain will form a new cohort. Over the long term, overstory trees retained in this project will eventually develop into large trees, and some of the regeneration originating from these treatments will become more fire-resistant and successfully established. Stands will eventually develop old-forest characteristics: large-diameter trees in a clustered spatial distribution, more open canopy overstory and understory, with fire-killed snags. There will be a reduced likelihood of a stand-replacing fire event.

Diversification of ponderosa pine age structure through the creation of both early-development and open fire-maintained stand structures through the proposed action and use of harvest best management practices should reduce the overall probability of broad-scale mountain pine beetle outbreak both within and outside the project area landscape.

Where aspen occurs as an associated species, fire will stimulate regeneration assuring the retention of this declining diversity element. Project-wide, in both pine and mixed-conifer types, a large acreage will be aspen regenerated, so it is likely that across the project landscape, aspen regeneration will not be over-used as browse, although in patches, aspen may be heavily browsed. Gambel oak will also sprout as a result of harvest and burning.

Cumulative Effects

In many instances in fire-adapted vegetation zones throughout the EFSR project area, past harvests have been inconsistent with disturbance processes in fire-adapted forests. These harvests have typically maintained stands within closed-canopy, mid-development succession classes rather than promote development of low basal area per acre, fire-

maintained open conditions and early-development conditions. Major impacts of past harvest approaches on landscape succession include:

- Selection harvests, particularly those occurring prior to the 1990s, typically removed old and fire-resistant trees within these stands, a major component of late-development successional stages.
- Inadvertent retention of late-development, shifting-mosaic conditions within canyons and steep-sided drainages within the project landscape.
- Maximization of tree stocking across broad areas through even spacing of residual trees. These conditions, to some degree, limit the development of complex vertical and horizontal forest stand structures associated with development of late-development succession classes.

Implementation of the proposed action within these zones, when combined with the effects with of past management practices will:

Specifically diversify horizontal spatial structural diversity within many areas where these characteristic have been reduced through past management activity

Retain large and old tree individuals where these landscape components are lacking.

Since ponderosa pine regeneration may be lacking or sporadic within these zones, typically advance ponderosa pine regeneration will be retained where present.

Generally retain late-development stand conditions within drainages, canyons and topographic swales. Within these areas, this succession class may be reduced slightly through proposed prescribed fire activities.

The overall combined effect of the proposed action and past management activity will be to reduce landscape scale canopy cover and increase the percentage of the landscape in early development and open fire maintained-conditions. The proposed action would have a positive effect on protection of life and property and reduction in the potential for a severe wildfire across the landscape.

Warm-Dry Mixed-Conifer—Affected Environment and Environmental Consequences

Affected Environment

Mixed-conifer stands in the project area, including both warm-dry and cool-moist types have the greatest tree species diversity of any forest cover type on the Plateau. Stands consist of ponderosa pine, Douglas-fir, Engelmann and blue spruces, subalpine fir, and aspen. In the absence of fire, tree density in most mixed-conifer stands has dramatically increased. The oldest trees tend to be ponderosa pine and Douglas-fir, although in the past four or five decades, the number of these trees has been reduced by timber harvest, old age and continuing bark beetle activity. Regeneration and intermediate trees are comprised of the more shade-tolerant subalpine fir, the spruces, and Douglas-fir. In most stands pine, which requires relatively open conditions to successfully regenerate, is under-represented in the young age classes and is virtually absent in some stands. In the past decade, subalpine fir, Douglas-fir, and to a certain extent the spruces have been heavily impacted by western

spruce budworm defoliation. A substantial percentage of these trees have been killed directly or indirectly by the budworm and represent heavy ladder fuels. Many stands in the mixed-conifer type are structurally pre-disposed to stand-replacing fire. All stands have a mid-canopy layer of sapling- and pole-size trees comprised predominantly of subalpine fir, the spruces, and Douglas-fir.

Aspen is primarily a seral species within this vegetation type and others throughout the project area, as it is mixed with conifers in nearly all areas. Aspen rarely occurs as a co-dominant tree, and is more typically in an intermediate crown position, usually in groups or small patches interspersed within the conifer canopy. Most aspen trees are less than about 12-inches in diameter, and because of poor form and defect, are not usually of commercial value. Aspen is clearly declining in dominance across most of its range within these vegetation zones, being replaced by shade-tolerant conifers. In some areas, especially on the upper slope position on north facing slopes, Gambel oak can be found growing as tree form, especially on convex, north facing slopes.

Current stand basal area per acre ranges from about 100 ft^2 per acre to over 200 ft^2 per acre including aspen, or 40 to 180 ft^2 considering conifers only, although extreme fine-scale areas of higher and lower stocking are likely present throughout the project area. Historic stand density within a recent study of historical forest structure within mixed-conifer forests of the Uncompahgre Mesas project area reported historical basal areas ranging from 25 ft^2 to 130 ft^2 (Binkley, et al. 2008). These values do not include aspen, nor do they include smaller trees that would have decomposed since 1879 without leaving detectable evidence. The CFRI concludes "…some of the current mixed-conifer forests probably have higher densities of shade-tolerant, small- and medium-size conifers than would have been typical in past centuries." This finding is consistent with LANDFIRE succession class analysis of the warm-dry mixed conifer, which indicates a lack of early-development stand conditions across this vegetation zone as compared to targets proposed in the Geographic Area Assessment for the Uncompaghre Plateau completed by the GMUG National Forest in 2006 (USDA FS 2006; LANDFIRE 2013)

The historic disturbance regime in this cover type has been mixed-severity fire, with a higher component of surface fire than in the higher-elevation cool-moist mixed-conifer zone. A mixed-severity fire regime includes, in some areas slow-moving surface fire that consumes duff and litter and kills some low-lying vegetation, while in other areas, mid-canopy fuels ignite and carry fire to the main canopy for short runs, killing groups of overstory trees. The result is the creation of stands diverse in terms of horizontal and vertical structure, species composition, and spatial distribution of vegetation (Romme et al. 2009).

While Brown and Sheppard did not sample any cool-moist mixed-conifer stands in their 2003 Uncompahgre Plateau fire study, they suggest that their findings may apply to "dry-site mixed-conifer forest" where pine is associated with Douglas-fir, which is analogous to the warm-dry mixed-conifer zone within the project area (Brown and Sheppard, 2003). It is likely that the fire-free period since 1879 has resulted in stand current conditions historically typical. Based on research in similar forest types from the San Juan National Forest within the region, it is reasonable to assume that the warm-dry mixed conifer type has missed 2-3 mixed-severity fires due the effects of fire suppression and exclusion over approximately the last 130 years (Romme et. al. 2009).

Large and old ponderosa pine and Douglas-fir trees were selectively logged from this vegetation zone in the 20th century, reducing their representation well below the historic species mix. Douglas-fir is also declining in representation due to an ongoing Douglas-fir beetle outbreak and the effects of spruce budworm (*Choristoneura spp*.) defoliation. Average pine composition in the CFRI report was approximately 3 to 83 percent of total stand basal area averaging 40 percent (Binkley et al. 2008). Douglas-fir was even more variable, with stocking averaging approximately 35% of these stands on average, ranging from 1 to 99 percent of the total stand basal area.

Within this zone, mountain pine beetle (*Dendroctonus ponderosae*) can also cause broad-scale mortality in ponderosa pine dominant stands. High density stand conditions, high basal areas and old-age structure are all associated with pine beetle mortality events (Romme et al. 2009). These conditions are all common across the project landscape, although there is currently very limited mountain pine beetle activity within isolated portions of the project area. Probability of a broad-scale outbreak within these conditions is associated with drought conditions.

Environmental Consequences: No Action Alternative

Due to the similarity between these vegetation zones, the effects of a no-action alternative listed for the ponderosa pine-oak zone apply to the warm-dry mixed-conifer zone. The following effects of a no-action alternative in this zone are in addition to the effects listed for the ponderosa pine-oak zone

Direct Effect

There will be no direct effects of a no action alternative.

Indirect Effects

Overall risk of a broad-scale bark beetle infestation within these forest types would also slowly increase. A broad-scale Douglas-fir beetle outbreak has been occurring for at least the last 10 years within the project area. A no action alternative will gradually increase the potential for the continuance of this outbreak to occur in areas not already affected, although a majority of the Douglas-fir acreage susceptible to bark beetle infestation has already been affected. Ponderosa stands would continue towards a condition of susceptibility to mountain pine beetle. The combined effects of continuing drought and a warming climate could increase the possibility of a broad-scale beetle outbreak.

Cumulative Effects

Douglas-fir, especially where removed extensively due to past harvests or reduced due to bark beetle associated mortality, would maintain limited ability to regenerate in stands where it was previously dominant. In the event of a broad-scale, high severity fire, where Douglas-fir is currently present at a low-density or in the understory, the seed source for this species could be eliminated, limiting the ability of these stands to develop a similar forest structure to the pre-harvest stand condition.

In the absence of fire, two-story stand conditions would persist in many previously harvested stands where advanced shade tolerant regeneration was not managed following harvest. In these stands, species composition would remain skewed towards shade tolerant species, with minimal ability to develop a structure similar to the pre-harvest forest condition.

Environmental Consequences: Action Alternative

Direct Effects

In stands treated by commercial timber harvest, about 30 to 60 percent of existing conifer basal area will be removed in harvest. Most aspen may be retained because of low commercial value, but aspen should be targeted for burning during the post-harvest underburn. Residual stand stocking should range from about 60 to 150ft^2 per acre including aspen, or about 30 to 100 ft^2 considering conifers only. Cutting methods should preferentially remove shade tolerant species such as spruce and subalpine fir and retain Douglas-fir and ponderosa pine, when present. Spatial variability and clustering of overstory trees will be retained after cutting.

Ladder fuels should cover between 20 and 30 percent of both commercial and non-commercial treatment areas. These ladder fuels will contribute to torching of live overstory trees in association with prescribed fire, but the overall amount of torching associated with these fuels should be greatly reduced compared to conditions associated with wildfire under the no action alternative.

Activity slash could be piled in WUI stands to leave 10-20 tons per acre of coarse woody slash (i.e. slash greater than 3 inches) throughout treated areas. Where piles are created through management activity they will exist for a short time and will typically be burned within 2-5 years following completion of mechanical treatments. Broadcast burning after harvest and mechanical treatments should reduce residual surface fuels somewhat, particularly fuels less than 3 to 5 five inches in diameter. Surface fuels following treatments should range between 10 and 20 tons per acre outside the WUI and be retained at levels closer to 10 tons per acre within the WUI.

Indirect Effects

The reduced canopy cover resulting from logging or mechanical treatments will create conditions favorable to the re-establishment and growth of grasses, forbs, and shrubs, which will improve understory vegetation abundance and diversity. Ponderosa pine should be capable of regenerating under the open conditions created through treatment, but shade-tolerant conifers will also continue to regenerate in areas of high-crown cover following treatments. These young conifer cohorts will eventually serve as ladder fuels, but future burning will help maintain ladder fuels at a level that will facilitate mixed-severity fire.

Implementation of the proposed action treatments will reduce the probability of crown fire initiation and spread throughout these stands. This will be accomplished primarily through reductions of canopy cover, canopy continuity and increasing the height to live tree crowns through harvests of small diameter trees, all key factors associated with crown fire initiation and spread (Brown et. al. 2004). Continuing collaboration efforts between the Ouray District

and the Colorado Forest Restoration Institute should improve quantification of crown fire hazard across the project landscape.

Burn severity within these types associated with potential wildfires, especially under extreme conditions, will be reduced through the proposed action. Harvesting and mechanical fuels treatments of the sort proposed will reduce ladder fuels, increase crown base heights and reduce overall canopy fuel loading and continuity.

Douglas-fir, a typically long-lived species, is a major forest structure component of late-development successional classes. Old and large diameter Douglas-fir is typically highly susceptible to Douglas-fir beetle attack (Schmitz and Gibson 1996). As described in the Spruce-Fir-Aspen/Cool-Moist mixed-conifer indirect effects, proposed treatments will reduce stand basal area and density and have the effect of increasing resilience to future Douglas-fir beetle outbreaks within the cool-moist mixed-conifer zone (Ibid).

Diversification of ponderosa pine and Douglas-fir age structure through the creation of both early-development and open fire-maintained stand structures through the proposed action should reduce the overall probability of broad-scale beetle outbreaks both within and outside the project area landscape.

Reductions in canopy cover and crown continuity should also increase an aspen regeneration response within these forest vegetation zones. This response may be similar to, but perhaps less pronounced and patchier than the aspen regeneration response expected in the higher elevation vegetation zones.

Some tree windthrow is likely to occur as a result of harvest, although most of this vegetation zone is found on lower elevation sites have a more-protected topographic position being less prone to windthrow than higher elevation areas within the spruce-fir zone. Confining intensive harvests to small groups and canopy openings will further limit the amount of windthrow.

Prescribed fire will cause some crown and bole scorch that could lead to an increase in the Douglas-fir beetle populations. Pheromones may be used and will help reduce the extent of post-burn beetle-related mortality. Following prescribed fire, some areas will convert to grass dominated surface fuel type which will potentially increase rates of spread depending on how soon the grasses and forbs respond under the residual tree canopy and the effect of wildlife and livestock grazing. While rates of spread could increase under this alternative, overall fire intensity would be less than under a no action alternative.

Cumulative Effects

In many instances in fire-adapted vegetation zones throughout the EFSR project area, past harvests have been inconsistent with disturbance processes in fire-adapted forests. These harvests have typically maintained stands within closed-canopy, mid-development succession classes rather than promote development of low basal area per acre, fire-maintained open conditions and early-development conditions. Major impacts of past harvest approaches on landscape succession include:

- Selection harvests in ponderosa pine dominant stands, particularly those occurring prior to the 1990s, typically removed old and fire-resistant trees within these stands, a major component of late-development successional stages.

- Inadvertent retention of late-development, shifting-mosaic conditions within canyons and steep-sided drainages within the project landscape.
- Maximization of tree stocking across broad areas through even spacing of residual trees. These conditions, to some degree, limit the development of complex vertical and horizontal forest stand structures associated with development of late-development succession classes.

Implementation of the proposed action within these zones, when combined with the effects with of past management practices will:

- Diversify horizontal spatial structural diversity within many areas where these characteristic have been reduced through past management activity
- Retain large and old tree individuals where these landscape components are lacking.
- Since ponderosa pine regeneration may be lacking or sporadic within these zones, typically advance ponderosa pine regeneration will be retained where present.
- Generally retain late-development stand conditions within drainages and canyons. Within these areas, this succession class may be reduced slightly through proposed prescribed fire activities.

The overall combined effect of the proposed action and past management activity will be to reduce landscape scale canopy cover and increase the percentage of the landscape in early development and open fire maintained-conditions. The proposed action would have a positive effect on protection of life and property and reduction in the potential for a severe wildfire across the landscape.

Cool-Moist Mixed-Conifer—Affected Environment and Environmental Consequences

Affected Environment

The cool, moist, mixed conifer community contains dominant Douglas-fir with varying amounts of blue spruce, Englemann spruce and subalpine fir components as well. The lack of a dominant ponderosa pine component and the relative prevalence of a dominant mature Engelmann spruce component within this vegetation zone makes it discernible from the warm-dry mixed-conifer zone. This vegetation type is also relatively dense and contains moderate surface fuel loadings, significant ladder fuels, and a more closed canopy than the lower elevation communities. Rarely aspen is found in pure aspen dominated stands. In most cases where this occurs, it is the result of past coppice cutting harvests completed in the mid-1980 to early 2000s time period. Some of these coppice cuts did not successfully regenerate due to multiple factors, indicating that coppice cutting may not be the optimal silvicultural approach across much of this vegetation zone (Johnston 2001).

This forest type is currently still within the range of forest conditions expected under historical conditions. Metrics developed by McGarigal and Romme (2005) indicate that seral stage distribution is currently the primary characteristic of these forest zones that is diverging from historical conditions. Matonis (2012) in an analysis of comparison of current conditions to historical (~1875) conditions in cool-moist mixed-conifer stands within the EFRS project area

found a broader range of historical stand structures than currently exists today. In 1875, this vegetation zone contained more treeless or minimally stocked stands than currently exists today. This may be due to the time since the last moderate to high-severity wildfire, but could also be partially due to fire exclusion and suppression within these forests. In general, both within the project area and the broader landscape, open, early-development conditions are lacking while at the same time mid to late-development conditions are over-represented (GMUG N.F. 2006, LANDFIRE 2013). The increase in early seral conditions through the proposed action moves the overall landscape composition closer to conditions with a high probability of being within the historical range of variability for this vegetation type.

Cool-Moist Mixed-Conifer Environmental Consequences - No Action Alternative

Direct Effects

There will be no direct effects of a no action alternative.

Indirect Effects

In the absence of major disturbance, no management action within cool-moist mixed-conifer forests would likely result in the slow reduction of mid-successional forest structure classes and a concomitant increase in late-development successional classes. Early-development portions of the landscape would slowly transition into mid-development classes. Fine-scale disturbance such as stand-scale bark beetle outbreaks and windthrow events would likely maintain some percentage of the landscape in the early-development class over time.

No management action would have minimal effect on current aspen regeneration rates. There is some research to suggest that a lack of disturbance in aspen dominated forests suitable for regenerating aspen, coupled with heavy browse pressure by ungulates, could result in aspen clone die-off over time. It is unclear exactly what percentage of the landscape that is susceptible to this potential outcome (Worral et.al. 2010).

Overall risk of a broad-scale bark beetle infestation within these forest types would also slowly increase. Currently, an epidemic spruce bark beetle outbreak is occurring within adjacent spruce dominated landscapes in the region (Eager 2012). In the event of a broad-scale spruce beetle outbreak within the project area, widespread tree mortality would likely occur across a large percentage of the landscape as a very small percentage of the landscape currently exists in an early-development condition, typically resistant to bark beetle infestation.

A broad-scale Douglas-fir beetle outbreak has been occurring for at least the last 10 years within the project area. A no action alternative will gradually increase the potential for the continuance of this outbreak to occur in areas not already affected.

Cumulative Effects

A no action alternative, over time, would not mitigate any of the effects of past management activities within these vegetation zones.

Douglas-fir, where removed extensively due to past harvests, would maintain limited ability to regenerate in stands where it was previously dominant.

In the absence of fire, two-story stand conditions would persist in many previously harvested stands where advanced shade tolerant regeneration was not managed following harvest. In these stands, species composition would remain skewed towards a shade tolerant species, with minimal ability to develop a structure similar to the pre-harvest forest condition.

With a no action alternative, potential crown fire hazard would likely increase gradually through time within these elevation zones. This hazard would be further increased under an expected warmer climate over the next 50 years. Canopy cover, canopy continuity and surface fuel loadings, all factors associated with tree mortality following fire, would gradually increase over time. This could likely result in more severe and homogenous fire effects (Brown et al. 2004).

Environmental Consequences - Action Alternative

Direct Effects

Within the cool-moist mixed-conifer types openings in the canopy will be created as a result of group selection and heavy selection harvests will either directly increase early seral conditions or promote further development of late-seral conditions. The proposed action would result in approximately 2000 to 4400 acres of early seral targeted treatments. The reduced canopy cover resulting from logging or mechanical treatments will create conditions favorable to the re-establishment and growth of grasses, forbs, and shrubs, which will improve understory vegetation abundance and diversity.

Since the cool-most mixed-conifer is adapted to fire more so than the spruce-fir zone, burn severity under natural fire regime would probably be less severe than what it currently might be given over a century of fire suppression. Early development conditions within this zone should strive to retain legacy structures and a variable composition of forest components that might have developed after a mixed-severity fire. Such structures would include snags, old fire-resistant Douglas-fir and coarse woody surface fuels (i.e. downed logs, slash, etc…).

Where creation of early development conditions is not the primary management objective in cool-moist mixed-conifer forests, mechanical treatments will improve overall objectives of forest health, productivity and resiliency as well as support overall objective of management for conditions that will allow the safe and ecologically appropriate use of managed fire across fire-adapted zones of the landscape.

Indirect Effects

Where suppressed aspen sprouts are present in the understory, harvests with an early-development successional class objective will also likely stimulate a sprouting response within these vegetation zones. Aspen regeneration will likely respond in a dispersed manner

throughout selection harvested areas, but more likely sprout in dense patches within group selection areas.

Group and selection harvests will be dispersed and occur on a scale that will distribute the effects of browsing animals, ensuring development of early seral forest conditions. Young conifer trees will eventually re-occupy these openings, growing and contributing vertical and horizontal structural diversity to the stand.

Stand mortality events related to spruce beetle (*Dendroctonus rufipennis*) are capable of causing widespread mortality in mid to late developmental classes in these forests. Spruce beetle outbreaks are currently occurring across spruce dominated landscapes in the region (Eager 2012) and are often associated with forest conditions mid to advanced development classes (Holsten et al. 1999). Increases in age class diversity across the project area will have the effect of increasing broader forest resilience to potential future outbreaks of spruce beetle.

Douglas-fir beetle (*Dendroctonus pseudotsugae*) is also common across the project landscape within the cool-moist mixed-conifer zone. High tree densities and late-development stand conditions with high stand basal areas of large and old trees both predispose Douglas-fir dominant stands to bark beetle mortality (Schmitz and Gibson 1996). Proposed treatments will reduce stand basal area and density and have the effect of increasing resilience to future Douglas-fir beetle outbreaks within the cool-moist mixed-conifer zone.

Group selection and individual tree selection harvests will likely influence the likelihood of individual trees blowing down at fine scales, but should not result in a significant change in potential blowdown at broader scales, especially since most of this vegetation zone is found on lower elevation sites have a more-protected topographic position being less prone to windthrow than higher elevation areas within the spruce-fir zone.

The lack of recent wildfires or other recent broad-scale disturbance events may indicate that the probability of an eventual high-severity wildfire event within this vegetation zone may be increasing, although this scenario may be more dependent on climate as the past fire history in these forests (Romme et. al. 2009). The proposed action will diversify successional class composition within the project, mimicking the effects of fires that may have burned into these forests in the absence of fire suppression, reducing the overall severity of an individual fire event. It will also diversify the effects of an eventual wildfire on Douglas-fir mortality, the primary fire adapted species within these vegetation zones.

Cumulative Effects

Past harvests within high elevation mesic forest vegetation zones were typically inconsistent with natural disturbance processes such as fire and insect outbreaks common within these forests. Major effects of past harvests include:

- Limited creation of conditions representing early-development stand initiation succession classes using “shelterwood prep cuts” or “high grading”. These efforts typically reduced high value large-diameter forest structure components that take long periods of time to develop. The result of this effort across the project landscape appears to be maintenance of stands within mid-development stages at the expense of the creation of early-development conditions and late-development succession classes.

- Creation of a two-story stand conditions, featuring retention of a few residual, high value trees and an understory comprised of an advanced regeneration mix of shade tolerant and intolerant species. This structure predisposed many stands to a spruce budworm (*Choristoneura spp.*) outbreak across the EFSR landscape for at least the last decade (Fellin and Dewey 1986).
- Heavy reductions of fire-resistant Douglas-fir within mixed-conifer stands. In many cases, the seed source for Douglas-fir was removed, limiting the ability of this species to regenerate in these stands.
- Reduction of stand-scale spatial complexity of forest structure with treatments intended to completely favor aspen. Many past aspen harvests appear to have been clearcuts of mixed conifer and aspen stands, reducing fine-scale species diversity and spatial complexity to produce high per-acre aspen and conifer sawtimber volume and promote development of aspen. While a majority of these clearcuts within the project area were successful in regenerating aspen, approximately a third were not.

The proposed action will attempt to mitigate the effects of some of these past management processes and attempt to primarily increase early-development stand conditions within these vegetation zones in several ways:

- Group selection and heavy individual tree selection harvests will maintain and promote development of stand horizontal and vertical complexity while simultaneously promoting shade intolerant species such as aspen.
- Low-value, shade intolerant species such as subalpine-fir and other heavily defoliated conifers (part of spruce budworm affected stands) will be reduced where consistent with other land management mandates that are part of the GMUG forest plan Retention of high densities of these species in association with group and individual tree selection harvests would create stand conditions that would be unlikely to develop under a mixed to high severity fire regime. Subalpine-fir and other heavily defoliated conifers would also be unlikely to develop into the high-value species desirable in mid to late-development succession classes.
- Douglas-fir will be promoted through harvest methods or direct planting, as this species is somewhat drought tolerant and more resistant to the effects of fire than other species in mesic, high-elevation conifer stands.

Spruce-fir-aspen—Affected Environment and Environmental Consequences

Affected Environment

The spruce/fir vegetation community is found at the highest elevations along the divide of the Uncompahgre Plateau. It varies in composition from mostly spruce to mostly subalpine fir, dependent on site characteristics, but also upon the amount of timber harvesting has been done in the past. In some areas, past timber harvest removed most of the spruce component from many stands while leaving advanced subalpine fir regeneration with a sparse overstory of Engelmann spruce.

Aspen occurs mixed with conifer throughout the majority of the spruce-fir-aspen zone of the project area, with the exception being a few stands that are nearly pure spruce at the highest elevations of the project area between Houser Road and the junction of Divide Road and Highway 90 area. Aspen is typically found mixed (i.e. “seral” aspen) with conifers or in small pure patches surrounded by conifers. In many portions of this vegetation zone, aspen is the dominant tree, while Engelmann spruce and subalpine fir are present. Aspen stand ages tend to correspond with widespread fires thought to have occurred during the latter half of the 19th century (Binkley et. al. 2008). Rarely is aspen found in pure aspen dominated stands. In most cases where this occurs, it is the result of past coppice cutting harvests completed in the mid-1980 to early 2000s time period. As previously mentioned, some of these coppice cuts did not successfully regenerate due to multiple factors, indicating that coppice cutting may not be the optimal silvicultural approach across much of this vegetation zone.

In recent decades, there has been widespread mortality of subalpine fir and some spruce on this landscape due to an ongoing spruce budworm outbreak. As such, downed woody debris loadings have increased over the past decade, and exceeds 20 tons per acre in some areas. Because of the current overstory canopy density, the grass/forb/shrub layer productivity is low, although vegetation is beginning to respond to canopy gaps created by mortality, providing a fine-fuel layer to carry fire in some places. Given the increasing surface fuel loadings, infilling ladder fuels, and the closed nature of some of these stands within the project area some locations may be able to support substantial stand replacing fire within the next 2 or 3 decades.

Forest structure conditions within the spruce-fir-aspen zone are probably within the historic range of variability for this forest type, although it is likely that there are areas that would have been burned during the past century if not for fire suppression and exclusion efforts. There may be a slowly increasing uniformity in age class and structure across this vegetation zone, especially in mid to late-development conditions and a lack of early-development stand initiation conditions that would develop after a moderate to high severity fire (McGarigal and Romme 2005; Romme et. al. 2009; LANDFIRE 2013). The apparent lack of early-development condition may be more due to climatic conditions over the past century (i.e. wet and non-conducive to fire ignition and spread) than the effects of fire exclusion and suppression. Fire and fuels issues within this vegetation zone mainly relate to the presence of infrastructure such as communication sites, powerlines, travel corridors, and isolated parcels of private land in the eastern portion of the project area located approximately between Transfer Road and Highway 90. As a priority for fire regime specific restoration treatments the spruce-fir-aspen vegetation zone is a very low, however, site specific treatments should be developed to protect the aforementioned infrastructure.

Perhaps one of the most important features of the spruce-fir-aspen zone is its importance to sensitive wildlife species with legal protections (See Wildlife Affected Environment and Environmental Consequences). Of particular concern is the Threatened Canada Lynx, which is thought to inhabit the spruce-fir-aspen zone on the Uncompahgre Plateau. An important component of Lynx habitat is dense, coniferous vegetation cover, either in young regenerating stands (i.e. early-development conditions) or in old-age, multi-story stands. The Southern Rockies Lynx Amendment, an amendment to the 1991 GMUG Forest Plan, provides vegetation management guidelines for the management of Lynx habitat (USDA FS 1991). These guidelines restrict vegetation management to activities that either promote dense horizontal cover, minimize effects of vegetation management on horizontal cover loss

or focus vegetation management in high priority areas (USDA FS & USDI FWS 2009). Harvest and vegetation management activities within this vegetation zone are linked closely to the goals and objectives contained within the Southern Rockies Lynx Amendment

Environmental Consequences –No Action Alternative

Direct Effects

There will be no direct effects of a no action alternative.

Indirect Effects

In the absence of major disturbance, no management action within spruce-fir-aspen zone would likely result in the slow reduction of mid-successional forest structure classes and a concomitant increase in late-development successional classes. The few early-development portions of the landscape would slowly transition into mid-development classes. Fine-scale disturbance such as stand-scale bark beetle outbreaks and windthrow events would likely maintain some percentage of the landscape in the early-development class over time.

Canopy cover would likely increase somewhat over time. Portions of the landscape in an open condition would gradually become less common, while closed conditions with greater than 50-70% cover, already fairly prevalent in these zones, would become more common. No management action would have minimal effect on current aspen regeneration rates. There is some research to suggest that a lack of disturbance in aspen dominated forests suitable for regenerating aspen, coupled with heavy browse pressure by ungulates, could result in aspen clone die-off over time. It is unclear exactly what percentage of the landscape that is susceptible to this potential outcome, although if prevalent within the project area, this scenario is more likely at lower elevations (Worral et.al. 2010).

The risk of a broad-scale spruce bark beetle infestation within these forest types would also slowly increase. Currently, an epidemic spruce bark beetle outbreak is occurring within adjacent spruce dominated landscapes in the region. In the event of a broad-scale spruce beetle outbreak within the project area, widespread tree mortality would likely occur across a large percentage of the landscape as a very small percentage of the landscape currently exists in an early-development condition, typically resistant to bark beetle infestation.

Cumulative Effects

A no action alternative, over time, would not mitigate any of the effects of past management activities within these vegetation zones.

Two-story stand conditions would persist in many previously harvested stands where advanced shade tolerant regeneration was not managed following harvest. In these stands, species composition would remain skewed towards a shade tolerant species, with minimal ability to develop a structure similar to the pre-harvest forest condition. Within potential Lynx habitat, these conditions, although potentially undesirable from a commercial forest products perspective, are desirable from a lynx habitat perspective.

As in the cool-moist mixed-conifer zone, under a no action alternative, potential crown fire hazard would likely increase gradually through time within these elevation zones. This hazard would be further increased under an expected warmer climate over the next 50 years. Canopy cover, canopy continuity and surface fuel loadings, all factors associated with tree mortality following fire, would gradually increase over time (Brown et al. 2004). It is likely that this condition, while not socially or economically desirable, would not be outside the historical range of fire effects for this vegetation zone.

Environmental Consequences – Action Alternative

Direct Effects

Within the spruce-fir-aspen type openings in the overstory canopy will result from executing group selection cutting and from construction of skid trails and temporary roads to access groups. Stand basal area in areas immediately surrounding group selection areas will be reduced by approximately 20% from the combined effects of group selection harvest and transportation. Across the broader project landscape an approximately 6% of the landscape is within an early-development condition. Canopy removals specified in the proposed action in addition to the portion of the landscape already in an early-development condition in total will result in 9-13% of the landscape in an early-development condition. This percentage is at the low end of the identified successional distribution in the GMUG National Forest Geographic Assessment for the Uncompahgre Plateau geographic area.

Consistent with the Southern Rockies Lynx Amendment Guidelines, treatments within identified Canada Lynx habitat should be located within mid-development stand conditions or late-development stand conditions lacking understory tree regeneration (i.e. dense horizontal cover). Such conditions are fairly common within the spruce-fir-aspen zone where identified lynx habitat is located and should not present a major implementation challenge. These conditions are typically associated with even-aged spruce regeneration that has occurred following widespread wildfire during the 1870-1880 timeframe, and with past non-stand initiating harvests (shelterwoods and high-grade harvests). Avoidance of late-development conditions should also not be an ichallenge as most late-development areas appear to be located on the periphery or outside of the operable harvesting areas.

Indirect Effects

Where suppressed aspen sprouts are present in the understory, harvests with an early-development successional class objective will also likely stimulate a sprouting response within these vegetation zones. Aspen regeneration should respond in a dispersed manner throughout selection harvested areas, but more likely sprout in dense patches within group selection harvested. Within proposed coppice cut areas in the WUI, a concentrated and intense regeneration response is expected following overstory removals.

Group and selection harvests should be dispersed and occur on a scale that will distribute the effects of browsing animals, ensuring development of early seral forest conditions. Young conifer trees will eventually re-occupy these openings, growing and contributing vertical and horizontal structural diversity to the stand. Within the spruce-fir-aspen zone, dense

regenerating forest structure (i.e. dense horizontal cover) should increase the suitability of habitat for snowshow hares (USDA FS & USDI FWS 2009). These increases in younger age-classes, especially of shade intolerant species, should increase age class diversity across the project landscape.

Stand mortality events related to spruce beetle (Dendroctonus rufipennis) are capable of causing widespread mortality in mid to late developmental classes in these forests. Spruce beetle outbreaks are currently occurring across spruce dominated landscapes in the region (Eager 2012) and are often associated with forest conditions mid to advanced development classes (Holsten et al. 1999). Increases in age class diversity across the project area should have the effect of increasing broader forest resilience to potential future outbreaks of spruce beetle.

There is potential for large and potentially stand initiating disturbance events in this forest vegetation zone. Blow down events are not uncommon since this vegetation zone is located along the crest of the Uncompahgre Plateau and is somewhat exposed to the effects of the wind. Group selection and individual tree selection harvests will likely influence the likelihood of individual trees blowing down at fine scales, but should not result in a significant change in potential blowdown at stand scales or broader.

As in the cool-moist, mixed-conifer types, spruce-fir-aspen forests have not experienced fire in over a century, but this may be more due to climate than management for fire-suppression and exclusion (Romme et. al. 2009). Again, the lack of recent wildfires or other recent broad-scale disturbance events may indicate that the probability of an eventual high severity fire event within this vegetation zone may be increasing, although this scenario may be more dependent on climate as the past fire history in these forests (Ibid). The proposed action will diversify successional class composition within the project, mimicking the effects of fires that may have burned into these forests in the absence of fire suppression, reducing the overall severity of an individual fire event.

Cumulative Effects

Past harvests within the spruce-fir-aspen zone were typically inconsistent with natural disturbance processes such as fire and insect outbreaks common within these forests. Major effects of past harvests include:

- Limited creation of conditions representing early-development stand initiation succession classes using “shelterwood prep cuts” or “high grading”. These efforts typically reduced high value large-diameter forest structure components that take long periods of time to develop. The result of this effort across the project landscape appears to be maintenance of stands within mid-development stages at the expense of the creation of early-development conditions and late-development succession classes.
- Creation of a two-story stand conditions, featuring retention of a few residual, high value trees and an understory comprised of an advanced regeneration mix of shade tolerant and intolerant species. This structure predisposed many stands to a spruce budworm outbreak across the EFSR landscape for at least the last decade (Fellin and Dewey 1986).

- Reduction of stand-scale spatial complexity of forest structure with treatments intended to completely favor aspen. Many past aspen harvests appear to have been coppice cuts of mixed conifer and aspen stands, reducing fine-scale species diversity and spatial complexity to produce high per-acre aspen and conifer sawtimber volume and to promote development of pure aspen regeneration. While a majority of these coppice cuts within the project area were successful in regenerating aspen, approximately a third were not.

The proposed action will attempt to mitigate the effects of some of these past management processes and attempt to primarily increase early-development stand conditions within these vegetation zones in several ways:

- Coppice cuts should be limited to sites with a high potential for aspen regeneration success as identified in Johnston (2001), and where development of pure aspen stands will serve a WUI fire hazard reduction objective.
- Group selection harvests should maintain and promote broad-scale horizontal complexity within the spruce-fir-aspen zone. Over the short to mid-term this should promote shade intolerant species such as aspen. Over the longer-term, this should increase conifer regeneration, increasing dense horizontal cover values.
- Low-value, shade intolerant species such as subalpine-fir and other heavily defoliated conifers (part of spruce budworm affected stands) will be reduced where consistent with other land management mandates that are part of the GMUG forest plan, specifically the Southern Rockies Lynx Amendment (USDA FS & USDI FWS 2009). Retention of high densities of these species in association with group and individual tree selection harvests creates a stand condition that would be unlikely to develop under a mixed to high severity fire regime. Subalpine-fir and other heavily defoliated conifers would also be unlikely to develop into the high-value species desirable in mid to late-development succession classes.

Wildlife and Fish

Affected Sensitive Species

Sensitive species analyzed in this EA were identified from a list of Forest Service Region 2 sensitive species based on known or historical occurrence and/or the presence of suitable habitats within the project area. Based on an evaluation of the existing species, the current condition of habitat within the project area, the distribution of species across the Forest, and the effects of the proposed action, it is determined that the EFRS Project 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 for pygmy shrew (*Sorex hoyi*), Townsend's big-eared bat (*Corynorhinus townsendii*), northern goshawk (*Accipiter gentilis*), boreal owl (*Aegolius funereus*), Lewis' woodpecker, American three-toed woodpecker *(Picoides tridactylus)*, flammulated owl (*Otus flammeolus*), olive-sided flycatcher (*Contopus borealis*), purple martin (*Progne subis*), northern leopard frog (*Rana pipiens*), and Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*). The Escalante Forest Restoration and Stewardship Project Biological Evaluation (USDA Forest Service, 2013), located in the EFRS project record file, contains further analysis of the effects of the proposed action on sensitive wildlife species.

Management Indicator Species

Management Indicator Species (MIS) are those species that have been selected by national forests within their Forest Plans to represent the habitat needs of a larger group of species requiring similar habitats. Descriptions of the habitat relationships, distributions and trends, population trends and status, and summaries of their associated Forest Plan Directions, Standards and Guidelines for the forest MIS, are described in the Management Indicator Species Assessment for the Grand Mesa, Uncompahgre and Gunnison National Forests (2005) as well as the 2005 amended Forest Plan. The MIS species with documented presence and/or known primary habitat within the EFR analysis area that could potentially be affected by the proposed actions within the Analysis Area are summarized in Table 4 below. Primary habitat is based on field surveys, a review of the literature, and forest mapping of the vegetation.

Table 4: MIS Species within the EFRS project area

Common Name	Scientific Name	Habitat Association
Rocky Mountain Elk	Cervus elephus	General habitats, habitat effectiveness, transportation
Abert's squirrel	Sciurus aberti	Ponderosa pine
Brewer's sparrow	Spizella breweri	Sagebrush
Northern goshawk	Accipiter gentiles	Aspen/conifer
Merriam's wild turkey	Meleagris gallopavo	Pinyon/Juniper, oak, mtn. shrub, ponderosa pine
Pine (American) marten	Martes Americana	Spruce-fir
Red-naped sapsucker	Sphyrapicus varius	Aspen
Colorado River Cutthroat Trout*	Oncorhynchus spp.	Aquatic

*Water depletions which may affect the Colorado River Cutthroat Trout will not occur with the implementation of the action or no action alternatives; therefore, no further analysis is necessary for this species.

Environmental Consequences—Management Indicator Species: Direct, Indirect and Cumulative Effects

Rocky Mountain Elk

Direct impacts, such as injury or mortality, to the elk from the proposed action are not anticipated, due to sufficient high quality habitat adjacent to the treatment areas. The most likely case of injury or mortality would be during prescribed or managed fire.

Increased human activity and associated visual and audible disturbances may temporarily displace individuals from treatment units during harvest activities. Similar affects would result from prescribed or managed fire. Adjacent undisturbed habitats, which are also capable of meeting the needs of elk for feeding and cover, are widely distributed in the analysis area and would be available to elk during project activities. Sufficient hiding cover will remain in

adjacent undisturbed areas within the analysis area where the disturbed areas will remain more open providing more available forage.

Construction of temporary roads would affect elk habitats. Road construction and reconstruction would not affect the “open” road density of the analysis area because the new roads would not be open to public use and would be closed and obliterated following completion of the project. No change in the local elk populations would be expected. The population size or condition of the elk herd at the landscape scale is not anticipated to change as a result of this project.

Where recreational activity, livestock grazing, road building, housing development fall within and adjacent to the analysis area over the next decade, these land uses have the potential to affect elk through loss or degradation of summer range, production area habitat, winter, and transition range and could result in direct mortality during construction activities, and/or displacement from habitats. While the Action alternative would have a minimal impact on the species, the potential for displacement during project activities incrementally adds to overall impacts on elk, although over time, these impacts should generally benefit the elk and its habitat.

Abert’s Squirrel

Treatment of the area may temporarily affect Abert’s Squirrels in stands affected, primarily in ponderosa pine-oak and warm-dry mixed-conifer vegetation zones. The understory of these stands has a large oak component and will be affected by the treatment. Oak does re-sprout and will continue to be a component in the future. The majority of the ponderosa pine on the Plateau is currently considered to be moderate quality habitat for Abert’s Squirrels. This project will not degrade the quality of habitat.

Brewer’s Sparrow

There is a maximum of 3,138 acres potentially treated within the pinyon-juniper/mountain-shrub zone over the next 8-10 years. This bird is known to occur on the forest and is expected to occur in its habitat within the EFRS Project area. The proposed action for this project includes the retention of all sagebrush as this is a unique vegetation type on the forest. Management activities associated with this project would most likely occur over winter. Activities in early fall or spring could potentially displace individuals in the vicinity. These displacements would most likely be due to noise, visual, or smoke disturbances.

There may be cumulative affects to the Brewer’s Sparrow upon vegetation management, monitoring and recreation associated with the proposed action. Fall burning and fall and winter mechanical treatments would be recommended to avoid impacts to nesting birds. these design features will greatly lessen impacts to this species. The additive impacts to this species is not expected to result in a loss of viability in the planning area, nor to cause a trend towards federal listing or a loss of species viability range-wide.

Northern Goshawk

Under the Proposed Action, over the next 8-10 years, treatment activities will take place within 17,530 and 32,297 acres of suitable goshawk habitats. Goshawk foraging within the treatment units may be temporarily affected due to project-related human activities, as well as smoke, which may cause goshawks to forage in undisturbed areas. This effect to foraging goshawks and their prey is minor and temporary due to the short-term nature of individual project activities and the availability of suitable foraging habitats within unaffected portions of the analysis area.

Sanitation and salvage harvesting within the treatment units may alter the current canopy closure within spruce/fir stands but will not result in a shift of either of these structural classes to below 40 percent canopy closure. Group selection is prescribed for areas in the spruce-fir-aspen habitat zone. Individual openings created by removal of groups of trees should not exceed two tree heights (maximum of 2 acres). Project work in spruce-fir will maintain appropriate habitat characteristics for goshawk foraging and post-fledging areas. Coppice cuts in aspen would reduce goshawk habitat in small areas adjacent to private land, but the majority of the mature aspen in the analysis area would not be treated. Due to the large suitable habitat area of this species, managed and prescribed fire could affect individuals and prey species in the area of such fire causing individuals to move to undisturbed areas.

There will be cumulative affects to the Northern goshawk from timber harvest, vegetation management, opening and closing roads, prescribed fire, monitoring, recreation, land development, and tree planting associated with the proposed action. The following design features will greatly lessen impacts to the goshawk:

- Pretreatment monitoring for goshawk nests
- Adherence to Forest Plan snag densities and active nest avoidance standards,
- Adherence to Forest Plan nesting habitat requirements
- Minimizing fall burning and promoting winter logging to reduce impacts to nesting individuals.

The additive impacts to this species is not expected to result in a loss of viability in the planning area, nor to cause a trend towards federal listing or a loss of species viability range-wide.

Merriam's Wild Turkey

Short-term direct effects to Merriam's Wild Turkey during harvest include visual or auditory disturbance or displacement of individuals from machinery, vehicles and humans. Long-term direct effects as a result of changes in forage and cover. Individual nests could be directly lost or abandoned as a result of project activities, but turkeys may re-attempt nesting elsewhere if project actions are detrimental. Long-term effects in cover type and abundance are unlikely to cause substantial impacts to turkeys, as they utilize a wide variety of habitats, including mountain shrub types, in this area. Slash from logging operations and dense aspen regeneration, as well as dense mountain shrub habitats, can provide nesting habitat post-project.

The project would affect up to 7,280 acres of potential summer turkey habitat, which is .02% of the total summer turkey habitat on the Plateau. The existing condition summer habitat capability level (0.52) would remain the same under the proposed action. None of the ongoing or reasonably foreseeable future activities within this area, when combined with the proposed action, are likely to contribute to long-term cumulative impacts to this species.

Pine (American) Marten

Direct effects, such as injury or mortality, to the marten from the proposed Action would not be likely, due to their ability to leave disturbance areas. Some individuals of the various marten prey species may be directly affected if they are unable to leave the treatment areas. Suitable habitats for the marten and its prey species will be disturbed, as described in the habitat effects discussion above. Under the Proposed Action, a range from 7,600 to 14,500 acres (18-35%) would be treated within the 41,240 acre cool-moist mixed-conifer and spruce-fir vegetation zones. These habitat zones provide the majority of marten habitat.

Indirect impacts to marten would occur during the project. Increased human activity and associated visual and audible disturbances may temporarily displace individuals from treatment units during treatment activities. Smoke could also temporarily displace individuals or prey in the event of prescribed or managed fire. Following completion of activities, the type and degree of human disturbance is expected to return to current levels. Mitigation measures have been included as part of the alternatives in order to maximize marten habitat suitability within the treatment areas. These measures are presented in the Design Features section above and include preserving down woody debris, preserving snags, and limiting the size of any created openings.

Activities associated with the treatment of slash may result in the modification or disturbance of down woody debris that provides suitable resting, denning, or hunting habitats within the treatment units. Existing down woody material would be affected along skid trails and other areas of ground disturbance including burned areas. The spruce beetle treatments may affect important marten microhabitat features, such as down woody material, but there will continue to be connectivity with other unaffected microhabitat features both within and outside the treatment units.

Potential impacts from temporary road construction and reconstruction will be minimal due to the limited area that will be affected and the relatively large area of suitable habitats that will not be affected. The total acreage of these activities will be substantially less than the total acreage of the treatment units and minimal in relation to the amount of adjacent undisturbed habitats.
Marten may be displaced from the treatment units both during and after treatment; however, their overall use of the analysis area is expected to remain the same as current levels.

Cumulative effects associated with the proposed actions relate to timber harvest, vegetation management, opening and closing roads, fire, monitoring, recreation, land development, and tree planting. Cumulatively, these actions will negatively affect the American marten and its habitat. The greatest affects towards this species is expected to occur in the WUI treatment areas. It will be important to adhere to Forest Plan Standards and Guidelines for this species to lessen these impacts. Given that the project is designed to be implemented over 8-10

years it will minimize the effects to marten habitat in any one year and attempt to meet HRV goals while minimizing impacts to habitat. It is recommended that managed and prescribed fire be excluded in spruce/fir and cool-moist mixed-conifer especially within suitable marten habitat. Where this goal is unfeasible, it will be important to attempt to maintain connectivity with adjacent suitable habitat especially where large blocks of habitat do occur. The additive impacts to this species is not expected to result in a loss of viability in the planning area, nor to cause a trend towards federal listing or a loss of species viability range-wide.

Red-naped Sapsucker

Within the EFRS project area, the red-naped sapsucker primarily utilizes forests of late-development spruce-fir-aspen forest in close proximity to stands of willow. Mature and old growth forests contain key habitat elements for cavity nesting species. The red-naped sapsucker utilizes the numerous snags or live trees with damage or rot for nest trees. These trees are easier to excavate cavities in than sound, hard snags and live trees. Insect activity is also normally associated with snags, damaged trees, and down logs. Secondary habitat includes the younger stands of aspen and aspen/conifer in mid-development structural conditions.

There could be up to approximately 4440 acres of commercial mechanical treatments within the spruce-fir/aspen stands, which is 3% of the ERRS project area spruce-fir/aspen stands and only .002% of the forestwide red-naped sapsucker habitat. All Human activity on roads could displace individuals for short time periods, a third of potential treatment areas are located in the WUI and already adjacent to continuously used human activity areas. Further, group selection harvests within potential Lynx Habitat (20-40% of commercial treatment acres) will be located primarily in mid-development forest structural classes. Therefore, there would be no impact to the red-naped sapsucker populations in the project area or to broader the forestwide populations.

Where recreational activity, livestock grazing, road building, housing development fall within and adjacent to the analysis area over the next decade, these land uses have the potential to affect red naped sapsucker populations through loss or degradation of through loss or degradation of aspen, willow and spruce-fir-aspen habitat. While the Proposed Action would have a minimal impact on the species, the potential for displacement during harvest activities may incrementally add to overall impacts on red-naped sapsucker likely to occur in the GMUG National Forests.

Colorado River Cutthroat Trout

No direct effects to common trout species will occur since vegetation treatments will occur upstream of existing populations and water depletions will not occur with the EFRS proposed action. Indirect effects from vegetation treatments could result in the delivery of fine sediments to downstream habitat. However, given the current condition of habitat and location of the units, impacts to common trout habitat are not likely to be measurable.

Affected Threatened or Endangered Species (Canada Lynx)

In 1999, the CDOW reintroduced lynx into Colorado. CDOW is coordinating lynx monitoring efforts in southwestern and central Colorado. According to the Canada Lynx Conservation Assessment and Strategy (Ruediger 2000), all potential lynx habitat should be considered occupied by lynx. Although no recent sightings of Lynx have occurred on the Uncompahgre Plateau, the EFRS project area contains potential Lynx habitat located within the Traver Mesa and Spring Creek Lynx Analysis Units (LAU).

The GMUG, in cooperation with the USFWS, revised their lynx habitat modeling and LAU boundaries in 2010. Since this time, the accuracy of the vegetation layer on the Plateau was in question. During the summer of 2012, crews conducted dense horizontal cover and vegetation type surveys within the Traver Mesa LAU in areas where the accuracy of the vegetation layer was in question. A total of 694 plots were conducted representing 6,900 acres within a 10,500 acre area to represent a 1 plot per 10 acre spacing. Drainages were not evaluated because the proposed action is going to avoid these areas. A majority of the plots indicated that dominant ponderosa pine or Douglas-fir existed across the surveyed area. If ponderosa pine or Douglas-fir species are in the top three dominate classes, then it is not considered Lynx habitat. Currently the GMUG vegetation layer is being updated with the collected data from these plots. Additional DHC/Veg plots are planned during the summer of 2013. With the collected information and as part of this analysis the Forest will propose dropping any habitat from the habitat layer that DHC/ Vegetation surveys indicate are not habitat based on vegetation type and species present. The Forest will continue to update the US Fish and Wildlife Service with the progress of this analysis Areas not containing a spruce-fir-vegetation type (i.e. Douglas-fir or ponderosa pine dominant stands) will be excluded from the potential Canada Lynx habitat layer, and proposed treatments within these areas (warm-dry and cool-moist mixed-conifer zones) will have no impact upon the Canada lynx.

Effects of the EFRS proposed action within Lynx habitat and the objectives, standards and guidelines of the GMUG Forest Plan and the Southern Rockies Lynx Amendment (SLRA) were reviewed at length in the Biological Assessment (BA) for the EFRS project area (USDA FS 2013). The major finding of this assessment is that the proposed action, as described within the BA for the EFRS project, May Affect, likely to adversely affect the Canada lynx or its preferred habitat. This finding is based upon the following assumptions of the EFRS proposed action within the EFRS project area.

- Spruce-fir group selection, pre-commercial thinning and aspen treatments are concentrated in an area already receiving a large amount of public use and that is managed for high levels of year-round recreational use.
- No habitat linkage areas occur in or adjacent to the project and analysis area, therefore linkage habitats will not be affected.
- Lynx habitat will be modified by all proposed treatments in a manner considered to be a temporary change and is consistent with all the standards within the GMUG Forest Plan (2008).
- Activities will convert up to 2780 acres of spruce-fir lynx habitat to “currently unsuitable condition”, over the next 10 years.
- Small aspen focused treatments may convert stands, for a very short term, to a “currently unsuitable” condition on up to 100 acres over the life of the project. Aspen

stands usually regenerate so quickly, that the saplings are above snow level within 3 years. . Treatments would follow SRLA objectives, and in the long-term, would improve existing habitat by increasing regenerating stands and available snowshoe hare habitat.

- Incidental removal (accidental damage to young regeneration, or skid trail clearing) associated with salvage harvest is estimated to be 336 (20% of treated area) acres over the life of the project. Denning structural features (habitat) on the Uncompahgre Plateau are currently not limiting.
- Temporary roads constructed for the treatments would be closed and decommissioned upon completion of the treatment activities.
- There would be no net increase in designated over-the-snow routes, and therefore no expected increase in competition for prey from other species such as coyote or bobcat.
- Habitat monitoring would continue for the next 5-6 years to determine areas lacking in Dense Horizontal Cover and in need of group selection treatment in a way to favor uneven aged stand management.
- Annual reports will be sent to USFWS to update changes in vegetation layers that may affect the “Suitable lynx habitat” layer in each LAU.

For further information regarding the direct, indirect and cumulative effects of the proposed action on the Canada Lynx, and more detailed information on the US Forest Service consultation with the US Fish and Wildlife Service regarding the EFRS project, refer to the Escalante Forest Restoration and Stewardship Project, Biological Assessment, contained within the project record file.

Range

Affected Environment

The analysis area encompasses portions of 11 active grazing allotments (Table 5) with 18 term grazing permit holders. Ranch operations vary greatly from one permittee to another. These variations in operation include moving livestock to or from private, State, or BLM lands onto adjacent FS lands in the fall and spring; trucking and then trailing cattle to the allotment, and trucking to the allotment entirely. Range improvements within the analysis area include approximately 200 miles of pasture and allotment boundary fences; more than 200 water developments; stock trails, corrals; and seven cow camps. The allotments have rotational grazing systems in place, and current allotment management plans implementing improved range management practices. Specific information regarding range vegetation management objectives, and existing and desired condition information, is found in the Environmental Assessment for the Uncompahgre Rangeland Initiative (1996), and the Horsefly Rangeland Assessment (2003). Both are incorporated by reference as part of the Escalante environmental analysis.

Existing rangeland vegetation conditions within the analysis area vary widely. Understory vegetative species composition, diversity, and richness are highly variable and are highly associated with the different vegetation zones within the project area. Operable acres within each vegetation zone and allotment are shown in Table 6

Table 5: Permitted Livestock and Season of Use

Allotment	Permittee	Permitted Livestock #	Season of Use
25 Mesa C&H	Lazy HX; Dickerson	481 cow/calf	June 6 to October 20
Basin C&H	Richards & Richards; Smith	749 cow/calf	June 1 to October 15
Boyden-Monitor C&H	Boyd; Clark; Rumble	936 cow/calf	June 1 to October 15
Club-Campbell	Weimer	615 cow/calf	June 1 to October 19
Cottonwood C&H	Carver; Naslund	570 cow/calf	June 1 to October 15
Dry Fork C&H	Campbell	522 cow/calf	June 6 to October 18
Forty-seven C&H	Garvey	356 cow/calf	June 1 to October 15
Kelso C&H	Gore	510 cow/calf	June 10 to October 24
Red Canyon-Dry Fork S&G	Donley	1000 ewe/lamb	June 26 to August 25
Roubideau C&H	Burch; Cobb	531 cow/calf	June 4 to October 25
Sheep Creek C&H	Cooper; Carver	571 cow/calf	June 6 to October 15

Table 6: Operable Acres by Vegetation Zone by Allotment

Allotment	Pinyon-Juniper Mountian Shrub	Ponderosa Pine-Oak	Warm-dry Mixed-conifer	Cool - moist Mixed conifer	Spruce-fir-aspen	Total operable acres in analysis area
25 Mesa	4372	1320	1868	2273	2303	12,136
Basin					409	409
Boyden-Monitor	9693	3850	5002	4706	7353	30,603
Club-Campbell				26		26
Cottonwood					36	36
Dry Fork	4593	4918	2933	4470	432	17,345
Forty-Seven				273		273
Kelso	7543	1760	1914	2807		14,022
Lazy Y		13	50	850	5358	6,272
Red Canyon/Dry Creek				1	518	519
Roubideau	6145	1417	897	980	3815	13,154
Sheep Creek					568	568

Environmental Consequences

No Action Alternative

Direct Effects

There would be no direct effect of a no action alternative.

Indirect and Cumulative Effects.

Without a catastrophic wildfire event, established vegetation is likely to continue to decline due to increasing basal area and overstory woody canopy cover, herbivory and continued expansion of existing invasive weed populations. Permittee operations would be affected in the short and long-term due to declining forage capability, and a subsequent reduction in permitted livestock number and/or season of use and increasing management costs.

If the proposed action is not implemented, the risk of a catastrophic wildfire event remains and increases over time. This would potentially impact rangeland vegetation by reducing forage capability, native plant abundance, density and species composition in the short term as sites recover. It would also likely result in the widespread establishment and expansion of invasive species within the analysis area, which would also impact native plant abundance, density, species composition and forage capability (*See Invasive Weeds Section, Indirect Effects*). Permittee operations would also likely be affected in the short and long-term due to declining forage capability, a subsequent reduction in permitted livestock number and/or season of use and increasing management costs.

Climate change is likely to alter plant communities, and precipitation patterns in a way that affects plant growth, herbaceous canopy cover, distribution of species and vegetation types, and annual productivity (Finch and others 2012). Climatic variability and consequently, the frequency and intensity of droughts and floods are predicted to increase (Ibid). Future precipitation availability to range vegetation establishment and growth will depend on the degree of warming and the effects locally on snowpack and evapotranspiration. Temperature increase and precipitation changes are likely to result in a shift of species distribution and reorganization of rangeland communities.

Action Alternative

The proposed action responds to a need to increase forest resilience to potential disturbance mechanisms over the next 50-100 years by implementing active restoration treatments to affect the management of vegetation density, structure, composition and pattern. Increasing resilience within the ecosystem would also increase resistance to invasion and improve the ability of this landscape to recover following disturbance.

Direct Effects

Mechanical treatments may reduce forage in the short-term due to soil disturbance and understory vegetation damage, depending upon the season when treatments are completed. Direct effects on range vegetation will be minimal if treatments are completed during the winter and late fall and more substantial if completed during the summer and early fall. Treatments will increase light and moisture availability to understory vegetation. These increases should directly promote growth of established understory vegetation.

Mechanical treatment and burning operations could result in displacement of livestock and permittee operations in the short-term, depending upon the duration and scheduling of treatments. In most cases, mechanical treatments should result in a much shorter term displacement of livestock, since typically range vegetation will be minimally affected by livestock.

Burning in the short-term should result in nutrient flush, increase soil nitrogen, remove litter and remove live vegetation. In the long-term litter should increase as dead and dying vegetation falls to the ground. In localized areas of high intensity burn sites, newly established range plants may be killed as a direct result of the fire. However, on other sites with lower burn intensities, soil nutrients should increase and thus should favor well-established plant communities. Where rangeland conditions are fair or good it is expected these sites should move in an upward trend. Where rangeland conditions are poor to fair and static these sites may move in a downward trend or stay static dependent on seeding success and presence of invasive species.

Indirect and Cumulative Effects

Landscapes in the project area, especially within the ponderosa pine-oak and warm-dry mixed-conifer zones may become more dominated by open parks, savannahs and park like stands of timber. Desirable herbaceous vegetative diversity and richness would likely increase in many of these areas. Mason et. al. 2009 concluded that non-commercial and commercial treatments may increase herbaceous production in dry mixed conifer stands. However, vegetation response in non-commercial treatments may be limited and 4 years or more may be required before vegetation differences are observed. On more mesic sites, vegetation response in the overstory and understory may be more visible after just 2 or more years (Ibid). In general, understory production response following treatment will be associated with the degree of tree basal area reduction and associated canopy cover reduction.

Results of a northern Arizona study (Moore et. al. 2006) indicate that a productive and diverse understory in Ponderosa Pine forests provides a variety of benefits, including protection of soil from erosion, increased forage capability for wild and domestic ungulates, increased fine fuels for surface fires, and biodiversity. Restoration treatments that reduced the dominance of the woody overstory canopy increased total herbaceous standing crop of the understory cool season vegetation until impacted by drought. Warm season grasses responded minimally to restoration treatments, possibly due to limited abundance prior to those treatments

The design and layout of restoration treatment units, as well as the type of equipment, intensity and timing of treatments are significant factors that will determine the effects of

restoration treatments on understory plant composition, canopy cover, and density. There will also be different vegetation responses for cool versus warm season grasses, and forbs. Generally, late summer and fall burns would be more detrimental to warm season grasses, while spring and early summer burns would be more detrimental to cool season grasses during the active part of the growing season. Non-native plants may increase with levels of treatment disturbance, but understory species richness may also likely increases (Schwilk et al. 2009). Richness increases will likely be composed of fire-adapted plant species and species that are favored by more xeric forest floor conditions (ibid).

Pre-treatment condition will have an impact on understory dynamics. Where understory species richness is relatively low, silvicultural and prescribed burning treatments should have a more significant effect than where species richness is already higher (Dodson, et. al. 2008). Species richness on those sites will be reduced initially, as well canopy cover, but species diversity is expected to increase in the short term.

Overall, the indirect effects of implementing the proposed action are anticipated to be neutral to positive on permittee operations in the long-term, and negative to neutral in the short term, provided that an implementation schedule is developed and followed. The proposed activities for the short-term could result in: a short or long-term modification of grazing operations, including shorter grazing season, fewer permitted livestock, a grazing rotation that alters the sequence, timing of use, or season of use for one or more pastures, increased range improvement maintenance or increased costs for permittee management practices, including salting and riding for the duration of the project. These actions may be needed to avoid specific treatment areas or types of treatments. The actual costs will depend on the specific changes made, and whether the permittee reduces herd size, purchases or leases additional pasture or grazes owned hay ground resulting in the need to purchase additional hay for the winter months. These actions could be implemented to allow for vegetation recovery following restoration treatments, or to increase fine fuel loading for prescribed fire on a site specific basis in coordination with the permittee and the District range specialist.

There are large wild ungulate populations in the analysis area. It is anticipated that these herds will utilize the newly treated areas, and burned areas for forage. Livestock may be excluded from use for a time, but it is assumed these new open areas may become usable forage for the long-term. Portions of patch cut areas may not regenerate or slowly regenerate with aspen due to heavy grazing by wild and domestic ungulates. The design and scale of patch cut treatment should minimize t

Cumulative actions that would have an effect on permittee operations include additional restoration activities within or adjacent to the analysis area, specifically the Uncompahgre Mesas Project Area. Forage capacity within these adjacent landscapes should recover or improve sooner than areas within the project area since these treatments will be completed before or during the early phases of the EFRS project. These areas could provide additional range capacity within several of the project area allotments.

The effectiveness of the proposed action in mitigating the anticipated effects of climate change is extremely difficult to predict due to climatic variability, and the uncertainty of how plant communities may be altered. While the effects of proposed action are anticipated to reduce the risk of a large-scale catastrophic wildfire, the specific effects are complex and

difficult to predict. The combination of past, present and future management practices may result in significant cumulative impacts to forage capability, plant communities, sustainable rangeland ecosystems, and grazing operations within the analysis area for short periods of time. Generally, the cumulative effects over the long-term would appear to be less intense, would occur on a more frequent basis, and on a smaller scale than those associated with the no action alternative.

Invasive Species

Affected Environment

Invasive species are a persistent management problem across the forest landscape. Unlike other resource areas, the ultimate desired condition of successful invasive species resource management is an environment free of invasive species. Across the project landscape, management for such a condition is not economically or technically feasible. As a result, invasive species management may attempt to eliminate some populations of invasive plants, but more often employs techniques and mitigation measures intended to reduce the spread of new and existing invasive weed populations.

Invasive species, in most cases, are alien plant species to the landscape. Propagules, either plant material or seeds were brought from other landscapes to the project landscape and populations were able to establish and expand. Propagules either exist in known populations or at unknown levels present within the soil seed bank or as isolated or scattered individuals or populations throughout the project area.

Invasive plant species typically favor disturbed forest conditions for establishment. Disturbed conditions could be characterized by plentiful growing space with minimal competition with other plants where light and/or moisture are in great supply. These conditions often allow invasive plant populations or seeds suppressed by non-optimal growing conditions to establish and expand, outcompeting native plant population in these environments (Harrod and Reichard 2001).

To some degree, the spread of existing invasive plant populations may be inhibited due to the lack of disturbance over the past century within the project landscape (Keeley 2006). This lack of disturbance has led to the development of dark, closed canopy forest conditions and, in some cases, surface fuel accumulations that may give invasive plants little opportunity to expand (ibid).

This seemingly beneficial effect of fire exclusion on invasive weeds is ultimately not sustainable, as free-burning fires are an unavoidable feature of the project landscape and climate. Increasing canopy and surface fuel loadings and continuity increase the probability of high-severity fire effects from an eventual wildfire (Keeley 2006). These high-severity burn areas are highly associated with invasive plant population establishment (Crawford et al 2001) and are also associated with other undesirable ecological, social and economic factors. These often broad-extent events of thousands of acres or more are unplanned, which inherently complicates the management response to the ensuing invasive plant establishment and spread.

The intent of invasive plant management within the project area is intended to proactively manage existing and potential invasive plant populations in several ways:

- Using vegetation management to reduce the possibility of a broad-scale high-severity disturbance.
- Restricting the possibility of invasive plant propagules entering the project area.
- Applying mitigation measures to reduce the potential for invasive plants to establish within recently disturbed areas.
- Monitoring recently disturbed areas for signs of new invasive plant establishment
- Controlling invasive plant populations, using means available under the Forest. Invasive Species Action Plan (2011).

New invasive plant population establishment is always possible, as it is impossible to fully eliminate all potential vectors for invasive plant propagules to enter the project landscape or know what propagules are currently present within the soil seed bank. For these reasons, the potential for new invasive plant establishment is unknown. The following are invasive species known to occur within or adjacent to the project area. Management objective is to curtail the expansion of these species into additional watersheds, through the use of cultural, mechanical, biological, and chemical treatment methods.

Bull thistle (Cirsium vulgare)
This is a Colorado B List species found within and adjacent to the analysis area. Incidence of infestations is estimated to be relatively low. Bull thistle is typically a biennial. Seed production and seedling established are generally enhanced under disturbed conditions. Based on the current estimated level of infestations, the current objective at this time is eradication.

Canada thistle (Cirsium arvense)
This a Colorado B List species found throughout the analysis area. It is an aggressive perennial weed that reproduces by seed or vegetatively. Chemical treatments are ongoing primarily along roadsides. There are infestations of varying sizes across the Uncompahgre Plateau, many of which have not been inventoried or treated. The overall management objective for this species within the analysis area is containment.

Downy brome (aka cheatgrass) (Bromus tectorum)
This is a Colorado C List species. Cheatgrass is a winter annual that typically germinates in the fall and overwinters, resuming its growth in the early spring. It can significantly alter native vegetation composition through competitive exclusion of native species reproduction and the facilitation of wildfires. There are infestations of varying sizes across the Uncompahgre Plateau, most of which have not been inventoried or treated. The overall management objective for this species within the analysis area is to prevent new infestations and to contain existing infestations.

Hoary cress (Cardaria draba)
This is a Colorado B List species that has been observed in the Lee Reservoir area and the northern end of Monitor Mesa. Infestations to date have been small and localized and have been chemically treated sporadically. This is a relatively long-lived, rhizomatous perennial

weed that is generally found on disturbed sites. There have been no inventory efforts focused on mapping hoary cress infestations within the analysis area. The overall management objective for this species within the analysis area is eradication, based on the current level of known infestations.

Houndstongue (Cynoglossum officinale)
This is a Colorado B List species that reproduces primarily by seed and is a biennial. There are significant infestations of houndstongue across the Uncompahgre Plateau, including in Spring Creek Basin, on the WAPA right-of-way, Hanks Valley area, and Roubideau Canyon. No site specific inventories for this species have been conducted within the analysis area. Based on the current level of known infestations on the Plateau the management objective for this species is eradication in Roubideau Canyon and containment elsewhere.

Leafy Spurge (Euphorbia esula)
This is a Colorado B List species that reproduces by vigorous rootstalks and seed. A single infestation of leafy spurge was found near Ouray Spring approximately 10 years ago and was treated. No additional infestations have been found since that time. The management objective for this species is eradication.

Musk thistle (Carduus nutans)
This is a Colorado B List species that reproduces primarily by seed. It is typically a biennial, but may complete its life cycle as a winter annual or occasionally as an annual. No inventories for this species have been conducted within the analysis area; however it does occur on the Uncompahgre Plateau. Based on the current level of known infestations on the Plateau the management objective for this species is eradication.

Oxeye daisy (Chrysanthemum leucanthemum)
This is a Colorado B List perennial species that has infested relatively large areas within the analysis area, primarily in and around Cottonwood Basin and Sawmill Mesa, and also on 7N Mesa, and Round Park. Treatment efforts have been focused in the Cottonwood Basin area primarily. At this time, increased inventory and treatment efforts are planned starting in 2013, as staffing and funding allows. The overall management objective for this species is containment.

Russian knapweed (Acroptilon repens)
This is a Colorado List B species. It is an aggressive perennial weed that reproduces from seed and also from adventitious buds on a creeping root system. It was first observed on Love Mesa in approximately 2007, and subsequently treated with herbicides. There are significant infestations of this species below the national forest boundary on Delta-Nucla, old highway 90, and Transfer roads, and limited inventory to date of NFS lands. At this time, based on the limited data available regarding the extent of infestations on NFS lands, the overall management objective for this species is eradication.

Spotted knapweed (Centaurea maculosa)
This is a Colorado B List species that has been observed on the east end of the analysis area, on the Tri-State powerline right-of-way, as well as adjacent to the analysis area. It is a perennial that reproduces primarily by seed. There are significant infestations of this species below the national forest boundary on old highway 90. Chemical treatments have been on-

going for several years on the powerline right-of-way, and some inventory adjacent to the right-of-way has been completed. The overall management objective for this species within the analysis area is eradication.

Sulfur cinquefoil (Potentilla recta)
This is a Colorado List B species that was first observed in the 7N Mesa area in 2007 and in the adjacent Copper King area in 2008. Based on the locations where it was found, it is presumed to have come in on NFS lands on heavy equipment. It is a relatively aggressive and long-lived perennial weed. Chemical treatments are ongoing and have been highly successful in 7N to date. The overall management objective for this species within the analysis area is eradication.

Tamarisk (Tamarix ramosissima; T. chinensis; T.parviflora)
This is a Colorado List B species, and was first observed and chemically treated in approximately 2005 in the Lee Reservoirs area. In 2012 a new infestation was observed in Criswell Basin; treatment of this site and additional inventory to determine the extent of the infestation will be initiated in 2013. The overall management objective for this species within the analysis area is eradication.

Yellow toadflax (Linaria vulgaris)
This is a Colorado List B species, and has been observed within the analysis area in the 25 Mesa area since the mid 1930's. It is a short-lived perennial that reproduces by seeds and by vegetative buds on the roots. In recent years, chemical and biological treatment methods have been used with some success. The overall management objective for this species within the analysis area is containment.

Invasive species inventories intended to manage known and new invasive plant establishment are on-going within the analysis area. In 2011, some monitoring of system and temporary roads within the Uncompahgre Mesa stewardship contract areas and on the Tri-State right-of-way was initiated to evaluate the presence or absence of invasive species. This monitoring became the impetus to developing an adaptive invasives risk assessment protocol to assess and characterize sites for established invasive species as well as potential or new invaders to evaluate the effects of restoration treatments on invasives, and to provide planning information for future treatments. In 2012, an invasive weed risk assessment protocol was initiated using General Field Data, Rangeland Health Evaluation, and Noxious Weed Risk Assessment forms from the R2 Rangeland Analysis and Management Training Guide. Additional inventory and follow-up treatment work using this protocol is planned in 2013 based on the availability of staffing and funding. Chemical treatments along roadsides and in some larger infestations have been on-going for several years for most of the species on the above list with the exception of downy brome, tamarisk, and sulfur cinquefoil.

Environmental Consequences

No Action Alternative

Direct Effects

There will be no direct effect of a no action alternative on invasive weed populations. Isolated infestations of invasive species exist within the project area. Efforts to isolate and eradicate Colorado List B Species are ongoing as a result of the Forest Invasive Species Action Plan (2011).

Indirect Effects

Existing and new invasive species populations will have the potential to expand as a result of a catastrophic wildfire event. The probability of such an event remains and increases over time. These events could potentially be more severe and widespread than proposed restoration treatments. Non-native, invasives species establishment typically increases with increasing fire severity (Zouhar et al. 2008). Despite such a wildfire, invasive species monitoring and treatments would likely to continue at current levels, increasing the probability of invasive weed population expansion.

Effects of establishment and expansion of invasive species within the analysis area could include:

- Negative changes to native plant abundance, density, species composition due to the ability of invasives to aggressively complete for sunlight, water, nutrients, and space.
- Displacement of native plants and animals.
- Reduced forage capability for ungulates, including domestic livestock and wildlife.
- Increased soil erosion due to inability of some specific invasive species to provide effective ground or canopy cover, exposing soil to rainfall impacts, overland flow, and higher soil temperatures.
- Increased costs of mitigation and treatment.

Cumulative Effects

Without a catastrophic wildfire event, established non-native, invasive weed infestations would likely remain constant or increase gradually over time.

Land use activities such as motorized and non-motorized recreation, travel, road maintenance and/or grazing could potentially serve as vectors for invasive weed propagules into the project area. In a Montana study, spotted knapweed oxeye daisy, Canada thistle, and houdstongue were studied within treated areas with both mechanical and prescribed burn treatments. With the exception of Canada thistle, noxious weed were confined to roadsides areas (Birdsall, et al 2012). Roadside habitat contributed more to the distribution of invasive plant species than did silvicultural treatments in this relatively uninvaded forest, indicating the importance of weed control tactics along roads and underscoring the need to mitigate invasive species dispersal by motorized vehicles (Ibid).

Unknown or uncontrolled invasive plant populations in areas adjacent to the project area (i.e. private land or BLM lands) could also serve as a source for invasive species propagules. Some of these activities could also provide additional areas of bare soil conducive for invasive plant establishment. Populations of this sort could be discovered through other resource evaluations and surveys (i.e. range, recreation or timber survey), although the

overall potential for discovery would be minimal. If discovered, these populations could then be treated using a range of control options identified in the Invasive Species Action Plan (2011).

In the eventual situation of a catastrophic wildfire, the spread of existing invasive weed populations would likely increase dramatically. Increases would be proportional to the overall fire size and impacts. High-severity burn patches would be most likely areas for invasive plant populations to establish. New infestations of invasive plants would be stimulated by the previously mentioned activities that could introduce new invasive plant propagues into project area. It is likely that the effects of these uses on invasive weed spread, in addition to indirect effects, could easily outpace the Agency's ability to control invasive weed populations.

Action Alternative

Direct Effects

There would be few direct effects of the proposed action on invasive species. Mechanical and prescribed fire treatments could temporarily increase existing invasive plant cover and density where invasive species currently occupy the area, but it is likely that some species would decrease slowly following treatments with the rebound of native plant populations. Almost all studies addressing the effects of silviculture treatments on exotic plants have found an increase in at least one exotic species following treatment (Sutherland and Nelson 2010).

There is also a chance that new invasive weed propagules could be introduced through mechanized equipment or revegetation material. Adherence to invasive species design criteria should minimize the chances of this occurring.

Indirect Effects

Overall the proposed action is anticipated to be neutral to in terms of reducing overall acreage infested by invasive plant species. There is potential that ground disturbance and canopy openings caused by the proposed activities could lead to a short-term increase in the occurrence of certain invasive species (thistles, cheatgrass, and other common non-natives) already present within the project area. Yellow toadflax, for example grows best on disturbed soils, such as depleted rangelands, sparsely vegetated soils, roadsides and post-wildfire areas (Sing et. al. 2011).

Invasion potential is highest in lower elevation vegetation zones such as the warm-dry mixed-conifer, ponderosa pine-oak and pinyon juniper/ mountain shrub zones for invasive species increases. Mitigation measures will lessen the chance of invasive species outbreaks. If new populations of invasive plants are detected, treatment strategies will be initiated using control options identified in the Invasive Species Action Plan (2011).

The overall low abundance of invasive weeds in the project area should reduce the invasion of weeds into thinned and burned areas. Many studies have found similarly low levels of weedy plant invasion following thinning and burning treatments (Wayman and North 2007; Dodson et at. 2008; Nelson et al. 2008). Wayman and North (2007) reported no exotic plant

invasion following thinning and burning treatment in a mixed-conifer California forest that contained only a single-known exotic plant species.

Existing, but currently unknown weed populations would likely be discovered and documented throughout the project. These populations could currently exist in scattered locations or could establish following disturbances associated with the proposed action. Once discovered, these populations could then be treated using a range of control options identified in the Invasive Species Action Plan (2011). The overall result of discovery, documentation and treatment of these populations could be an overall reduction in the potential for new invasive plant populations.

Treatments of the sort proposed have been demonstrated as capable of reducing extreme wildfire behavior and overall fire severity (Graham et. al. 2004) and reducing the possibility of associated invasive plant infestations (Zouhar et al. 2008). As such, wildfires burning throughout the project area following application of treatments and mitigation measures would likely result in a lower overall risk of invasive weed spread throughout the project area as compared to an uncontrolled moderate to high-severity wildfire (Griffis et al 2000).

Cumulative effects

Land use activities such as motorized and non-motorized recreation, travel, road maintenance and/or grazing could potentially serve as vectors for invasive weed propagules into the project area. Unknown or uncontrolled invasive plant populations in areas adjacent to the project area (i.e. private land or BLM lands) could also serve as a source for invasive species propagules.

Monitoring and treatment of invasive plant design critera should limit invasive plant spread as a side effect of forest restoration and perhaps to mitigate weed problems generally. Post treatment monitoring should focus primarily upon skid trails, obliterated temporary road beds and roadsides (Birdsdall et. al. 2012).

Some of these activities could also provide additional areas of bare soil conducive for invasive plant establishment, in addition to those caused by the proposed treatments. Again, once populations of this sort are discovered, these populations could then be treated using a range of control options identified in the Invasive Species Action Plan (2011).

The combination of proposed treatments, revegetation activities and time would be expected to increase overall plant species diversity in affected stands. A proportion of this species diversity could be composed of invasive or exotic plants, but it is likely that the majority of plant diversity would be composed of native species present on-site prior to treatment (Griffis 2001; Fulé et al. 2005). Another study describing an increase in invasive species following controlled mechanical and prescribed fire treatments indicates that the ecological impacts of these species may not be severe. In this study, natives outnumbered non-native invasive plants following treatment by an almost 13:1 ratio (Dodson 2004). In the long-term, as areas are revegetated with native understory cover, there will be fewer available areas of light and growing space where invasive plant species are able to establish.

Soil and Watershed Resources

Affected Environment

Overview

The EFSR area lies on the eastern flank of the Uncompahgre Plateau which is an arid portion of the Grand Mesa Uncompahgre Gunnison National Forest. Annual precipitation ranges from approximately 15 to 34 inches (PRISM, 2002). The analysis area includes the upper portion of eleven 6th level watersheds that are tributary to the Gunnison River (Figure 4). The extent of Forest Service lands in those watersheds ranges from nearly all, to as little as ≤ 10% (Table 7.). A minor portion of the analysis area (2.5 %) along the Divide road drains west into the San Miguel River. The watersheds are characterized by a strongly expressed parallel drainage pattern both on the gently sloping uplands or mesa tops, and the steeper intervening canyons. Perennial streams are confined to the narrow canyon bottoms with fairly limited road access. Some small isolated ponds, springs and wetlands do occur, as well as surface stock ponds and small irrigation supply reservoirs. Aquatic values include common cold water fisheries and associated riparian areas and habitats. No aquatic or botanical TES are known to occur and no public drinking water sources are present in the analysis area.

Table 7: 6th Level Watershed Acreages and Condition Classes.

Name	Total Acres	FS Acres	Percent FS	Condition Class
Upper Roubideau Creek	33,346	32,856	99	Good
Potter Creek	36,584	20,516	56	Good
Middle Roubideau Creek	27,986	18,116	65	Good
Cottonwood Creek	29,988	9,652	32	Fair
Middle Fork Escalante Creek	21,508	20,804	97	Good
East Fork Escalante Creek	20,443	19,023	93	Good
Dry Fork Escalante Creek	30,933	15,795	51	Fair
Headwaters Dry Creek	33,992	10,980	32	Good
Upper Dry Creek	24,462	1,812	7	Good
Middle Dry Creek	21,162	2,367	11	Good
Lower Dry Creek	20,693	1,876	9	Good

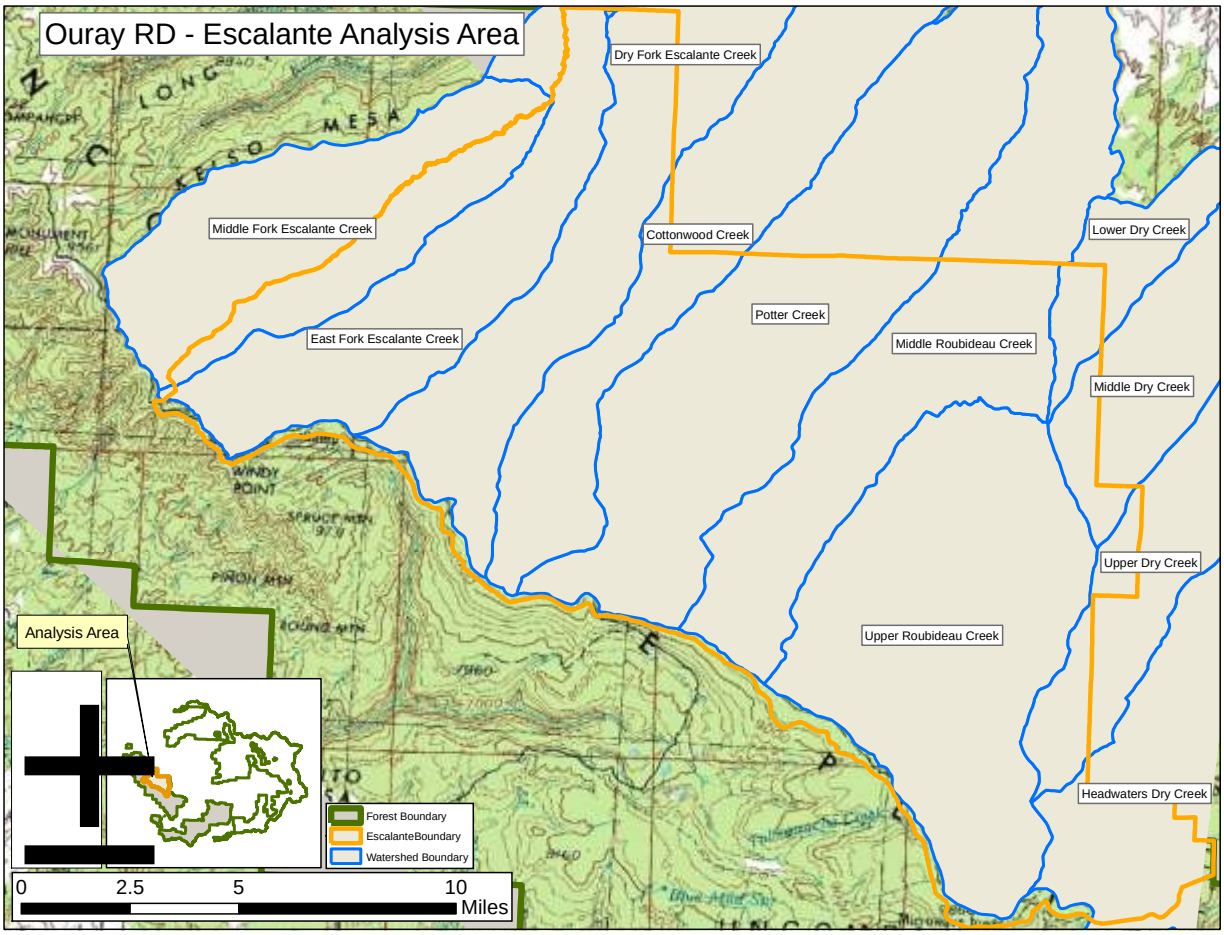

Figure 4: 6th level watersheds included within the Escalante analysis area

The GMUG NF recently completed two forest-wide watershed assessments. In 2011 overall watershed condition was rated for Forest Service lands according to a national protocol (USDA, 2011). In addition, the GMUG NF was one of eleven Forests from across the country to assess the vulnerability of water related values to climate change (Furniss et al., 2012). The watershed condition assessment rated all 6th level watersheds across the GMUG NF based upon their physical and biological characteristics. A standard set of twelve individual aquatic and terrestrial indicators characterizing current conditions and past management activities were evaluated. The twelve indicators were combined to categorize each watershed into one of three classes in terms of over-all integrity (good = 1, poor = 3). The watersheds within the Escalante analysis area were rated as being in either good or fair condition (Table 7.). These results were consistent with an earlier, more detailed forest-wide assessment prepared for a forest plan revision (USDA, 2005).

The climate change vulnerability assessment focused on six broad geo-climatic landscapes across the GMUG NF. The future climate projections used in the analysis suggest a continued warming trend across all seasons, and total annual precipitation remaining the same or decreasing slightly. Although completed at a coarse scale, that climatic combination suggests an increasing level of aridity (expressed as the ratio of: total precipitation/evapotranspiration demand). The hydrologic consequences are for earlier peak

flows, reduced average annual water yields, and diminished summer and fall low flows. Vegetative communities and wildfire activity would also change in response to the increased aridity. Already a relatively arid landscape, the Uncompahgre Plateau had the highest level of climatic exposure risk of the six landscapes examined on the GMUG NF.

Soil Resources

The analysis area lies within the Uncompahgre National Forest Soil Survey Area (CO676) published by the Natural Resource Conservation Service in 1995 (USDA-NRCS, 1995). Because it is a 3rd order survey and given the inherent variability of soils; specific project proposals generally need to be reviewed to confirm slope, depth, drainage, and other soil and site characteristics that may affect a particular use.

Site and soil conditions were examined during the 2011 and 2012 field seasons. In general, the soils are typically well drained, with loamy textured surface layers. Charcoal fragments were frequently present in the surface mineral layer of the forested sites examined, indicative of periodic fire events in the past. The soil properties and site conditions observed in the field are consistent with the soil survey's characterization and mapping of soils in the area.

Currently the forested portion of the Escalante area is free of active erosion, largely due to the subdued terrain and or the presence of a protective litter layer. General erosion hazard ratings are available and can be used to characterize the potential risk of soil loss after a disturbance that exposes bare soil. A combined 85% of the analysis area has a slight or moderate risk, with the remaining area of severe and very severe erosion risk confined to the steep canyon slopes. The greatest risk occurs on the side-slopes at lower elevations and those with south aspects that generally have only sparse surface litter cover.

Riparian and Wetland Resources

Riparian areas and wetlands fill varied needs for many aquatic as well as terrestrial species. The streams, adjacent riparian areas, and wetlands within the analysis area are part of Management Area 9a in the current Forest Plan (USDA FS 1991). The emphasis is on the provision of upper, mid-seral, self-perpetuating plant communities and attainment of established water quality standards. Riparian areas (Management Area 9a) are not mapped in the Forest Plan; rather they are characterized as inclusions within other larger contiguous Management Areas with variable widths that usually extend 100 feet from the aquatic feature.

A forest-wide GIS riparian layer was assembled from a variety of sources in 2005. The majority of the Escalante analysis area was mapped by the Colorado Division of Wildlife, and the remainder by the Forest Service. The arid nature of the Plateau and general lack of alluvial channels limits riverine associated riparian to narrow linear stringers along the perennial stream courses. Approximately 45% of the riparian communities in the analysis area are described as forested, and the remainder evenly split between shrub and herbaceous dominated plant communities. Spruce-willow types dominate in the upper reaches which transition to narrow-leaf cottonwood and willow along wider bottoms at lower elevations near the forest boundary.

Riparian areas and wetlands associated with small sag ponds and reservoirs are also present in the analysis area. These features are concentrated at or below the geologic contact between the Dakota sandstone and Brushy Basin shale, a distinctive zone of prominent benches and basins. Most have no direct connection to perennial streams and occur within the pinyon-juniper and mountain shrub vegetation zones. Small isolated seeps or springs and even open water do occur on the mesa tops at higher elevations sustained by near surface groundwater, most likely perched on competent un-fractured sections of the Dakota sandstone (Darling Lake, Columbine gravel pit ponds). These features or perimeters around them also support wetland or riparian communities, as do developed springs and stock ponds.

Water Quality

The state's "Integrated Water Quality Monitoring and Assessment Report" provides the water quality and use attainment status for all waters in the state (Colorado Department of Public Health and Environment (CDPHE), 2012). The report utilizes all readily available and credible data collected from governmental, municipal, and private entities across Colorado. Waterbodies are assessed and placed into one of five reporting categories. Streams in the Roubideau & Escalante systems on NF lands met the category 1 criteria for full use support and no uses threatened. The main-stem segments of Escalante, Monitor, and Roubideau Creeks downstream of the forest boundary are also in category 1.

The Dry Creek tributaries are in a category 4. The cause of the impairment is a high concentration of Selenium (Se) due to the wide-spread presence of Se rich Mancos shale and large extent of irrigated agricultural development at lower elevations in the valley. A corrective plan (TMDL) has been developed to address the impairment. Although included in the impaired group, the stream reaches on the National Forest do not contribute to the Se loading since no significant Mancos shale occurs above the forest boundary. Although no data is available, it is likely that the streams on the National Forest fully support the classified uses.
The analysis area includes some lands draining to the San Miguel River however, no defined channels (waterbodies) occur within the analysis area.

Hydrologic Runoff

Water yield increases in Colorado forests are generally proportional to the degree of canopy removal as well as mean annual precipitation (McDonald and Stednick 2003). The majority of the annual yield increase occurs during the spring snow melt period with greater increases occurring in wet versus dry years. In the snowmelt driven systems of Colorado, the greatest yield increase occurs in subalpine settings and is the result of reduced winter interception losses caused by sublimation of snow captured on live tree crowns (Troendle and King 1987). Although no annual yield increases have been observed, no increases in peak flow or increases to summer low flows have been demonstrated after canopy removal. In the sub-alpine zone canopy removal of 15% to 25% or more over a short time period is thought to be necessary before measureable yield increases are observed (Ibid, R2-FSH 2509.25, 2006).

In drier climatic zones greater removal is required because reduced canopy interception and sublimation of winter snow is not the principal mechanism in operation. Runoff increases are

due to diminished transpirational losses following canopy removal. However, in the drier zones (ponderosa pine and mixed-conifer) much of the potential gain from canopy removal is lost via direct evaporation from the soil surface or increased transpiration by remaining stand or understory components. In Ponderosa pine stands of Arizona canopy removal of 30% to 35% produced small water yield increases (Baker 1986) and McDonald and Stednick (2003) suggest that 25% to 30% may need to be removed in the Black Hills of South Dakota.

Historically fire played a prominent role in the nature and extent of canopy cover in the surface fire-adapted vegetation types (i.e. ponderosa pine and mixed-conifer) within the Escalante analysis area. The exclusion of fire over the last 130 or so years has caused an increase in tree density, overall crown cover, and continuity. And as a result, openings created and maintained by periodic fire are fewer and smaller today than in the past. The ponderosa pine-oak-aspen forests are believed to exhibit a moderate to high departure from historical composition & structural patterns and the mixed-conifer a moderate departure.

Recently the hydrologic runoff effects of roads have received increasing interest. Potential effects include direct interception of precipitation, cutbank interception of near surface throughflow, flow concentration, and an increase in drainage density (efficiency) when ditch lines directly connect to existing channels. Most runoff studies have included the combined effect of harvest treatments and roads which confounds the results. Few studies focus explicitly on the influence of roads alone and they suggest a lack of an effect on annual yield and mixed results regarding the timing and magnitude of peak flows (Gucinski et. al. 2001). They suggest that the runoff effects of roads are smaller than those of canopy removal.

Because of the many deep SW-NE trending canyons, few perennial stream crossings exist and a limited amount cutbank created by cut and fill road construction occurs. By far the most road mileage occurs on the level uplands or mesa tops with few and mostly intermittent crossings needed. In contrast to cut and fill construction no cutbanks occur as the roads are prominently crowned with ditches and periodic turnouts.

Soil Resource Environmental Consequences

No Action Alternative

The No Action alternative will have no foreseeable direct effect on watershed resources as no mechanical treatments or prescribed burning would occur. Existing uses would continue at current levels. Future wildfire starts would be evaluated on a case by case basis and be suppressed or managed for resource benefit(s).

The indirect effect of the No Action alternative is an increased risk of a large high severity wildfire with potentially damaging watershed effects. Lacking treatment, canopy and ladder fuels will continue to accumulate in the fire adapted cover types which will increase the risk of a high severity crown fire. Critical weather conditions or thresholds may be met more easily as fuel loads continue to increase over time. Because the current crown structure is uncharacteristically continuous, the No Action Alternative also increases the risk for a larger more widespread wildfire event.

The impacts of any wildfire are dictated by its size, severity, the physical environment in which it occurs, and post fire weather. The effects are generally only of significance when large fires (several thousand acres or larger) occur that include extensive areas of high burn severity. Many of the effects are associated with the loss of canopy and litter cover. There is potential for alteration of physical and chemical soil characteristics, which may enhance runoff by causing water repellency and reducing soil aggregate stability. Extensive loss of canopy and litter cover causes a reduction in canopy interception, transpiration, and infiltration rates and removes the protective surface cover which can lead to increased runoff and accelerated erosion.

Increased delivery of sediment to stream channels may effect aquatic habitat and channel morphology. Fine sediments tend to be damaging to aquatic resources, while coarse sediments may be beneficial in the long run by creating spawning habitat and providing deposition on floodplains that are necessary for some riparian species reproduction. Live canopy and surface cover losses contribute to large peak flow events that may occur which are typically associated with high intensity convective storms. Increases in peak flows can produce dramatic changes to channel morphology, e.g., channel incision, channel migration and material deposition, and has the potential to damage downstream property values.

Release of nutrients stored in live vegetation, down wood, and forest floor materials consumed during a fire can also be expected. Some loss will occur through direct volatilization into the atmosphere; ash laden runoff entering into receiving waters; or leaching through surface soils into the groundwater. The loss of vegetative cover can also result in changes to micro-site climate that may affect vegetative recovery and/or increases in stream temperatures due to loss of shade.

Roads, livestock grazing, and timber harvest are management activities that have been and continue to be important uses within the watersheds included in the proposed action. Because they involve manipulation of vegetation and/or soil disturbance, these activities have had effects upon soil, water, and riparian resources. Soil effects are largely related to the complete productivity losses associated with the permanent travel network and the intermediate to long term losses associated with temporary road, landing, and skid trail compaction. No new travel routes will be added by implementing the proposed action. Temporary road, landing, and skid trail effects can be minimized but not eliminated by application of design criteria. The modest nature of the terrain limits the extent of surface soil erosion and the potential for the delivery of sediment to the channel network. The controlled nature of conditions required to initiate prescribed burning should limit the extent of high soil burn severity, especially in comparison to the potenial soil effects of a wildfire.

Water quality effects as a result of past activites occur in localized areas. Poorly maintained and/or located travel routes have been a contributor, as has livestock grazing in some cases. These increases are still considerably less than the natural levels of sediment producted by the native sedimentary geology. Any cumulative increase of sediment as a result of the propsed action is not sufficient to degrade the designated uses of water or harm the distribution and diversity of aquatic species. It is expected that live ground cover and litter will increase relatively quickly on treated sites. The extent of stand initiation canopy removal activities across the analysis area is not expected to produce significant changes to the hydrologic runoff regime. Mechanical treatments in riparian areas are not being proposed,

and although the use of prescribed fire may have a direct effect it is expected to be incidental and of limited extent.

In conclusion, the proposed activities in addition to those of the past represent a low risk of adverse cummulative effect to soils, water quality & runoff characteristics, or riparian function. Because these watersheds are in relatively good condition and resistent to disturbances they should be able to withstand any short-term effects, without degradation to watershed function and health, or impacts to downstream values.

Action Alternative

Proposed mechanical treatments are focused across the fire adapted pine and mixed-conifer cover types. The treatments represent roughly 30% to 70% of the total acreage that occur in each type within the analysis area. While approximately 5% to 20% of the total acreage in spruce-fir/aspen and pinyon-juniper mountain shrub cover types are proposed for treatment. Commercial material will be removed during operations while smaller non-commercial ladder fuels will generally be felled and left in place.

The direct soil effects due to ground disturbance are expected to be minimal and of short duration (3 to 7 years for recovery) within general treatment areas. Visible ground disturbance caused by mechanical equipment is a direct effect that is inevitable in the treatments units of the project. However, visible soil disturbance is not necessarily detrimental. Longer term detrimental soil impacts caused by equipment operations (compaction, surface soil displacement, and rutting) or post-harvest erosion typically occurs on a much smaller portion of treatment units or areas. Disturbance and detrimental impacts can be minimized by application of the guidelines described in the Rocky Mountain Region Forest Service Handbook 2509.25 “Watershed Conservation Practices Handbook” (USFS 2006) in order to limit the combined area of all detrimental soil impacts to the Regional standard of 15% or less of any treatment area (excludes permanent road system).

The actual extent of detrimental soil impact that occurs during activities depends not only on inherent soil and site characteristics, but also the weather conditions during operations, as well as timber sale contract administration. Recent soil monitoring in the project area found that detrimental soil impacts ranged from 2% to 11% of the three separate treatment areas sampled. This potential for detrimental impact within treatment areas is greatest when the soil is wet, or when exposed on steep slopes. The operable area utilized to develop the proposed action, limits mechanical treatments to areas with prevailing slopes of 35% or less. Approximately 75% of that operable area has a slight erosion risk (slopes of ≤ 15%) and largely occurs on soils derived from the Dakota sandstone. The remainder has a moderate erosion risk (16%-35% slopes) and occurs on soils that have developed in the Brushy Basin shale.

The risk for compaction is also slight to moderate, given the notable quantity of gravel and larger sized material commonly found at or near the surface which reduces but does not eliminate compaction potential. Small ladder fuels, tops, logging slash and cull logs created during harvest will provide an additional layer of material that will buffer potential machine

impacts during treatment. In moist mixed-conifer and spruce-fir stands, the pre-existing cover of forest floor material and down logs will further limit potential erosion and compaction. Soil impacts related to log landings and temporary road construction will be of longer duration than the impacts within general treatment areas given the typical blading and or heavy traffic use that they receive. Design criteria have been recommended to minimize the impacts to soil and water resources and facilitate reclamation.

The mechanical grinding or shredding of woody material during mastication operations will add a concentration of coarse wood fragments or chips to the existing forest floor. The total addition depends on the standing biomass to be treated. Employing operational and experimental scale trials, Battaglia et al (2009) examined the effects of mastication of fuels across four cover types in Colorado (pinyon-juniper, ponderosa pine, mixed-conifer & lodgepole pine). They demonstrated few short term effects on soil conditions, although depths greater than 3” depressed soil N concentrations at the lodgepole pine and pinyon-juniper sites. The deeper and more continuous the layer of material produced by mastication, the greater the risk of reduced plant available N, poor seed bed conditions, and cooler growing season soil temperatures following treatment. However, given the patchy surface distribution typical of these operations, no soil effect is expected.

Prescribed fire is focused on the fire adapted forest types to address the activity fuels created by mechanical treatment, as well as suitable untreated areas on adjacent operable ground when developing logical burn units. Mechanical pre-treatment of fuels will produce more homogenous fuel loading, and create conditions where the objective is to reduce the hazard posed by the slash generated by treatment. Given the modest slopes and controlled burning conditions; a low to moderate soil burn severity is expected although untreated pockets or inclusions with heavy fuel loads may burn at high severity. A mixed severity mosaic is expected in adjacent untreated areas that are incorporated in a logical burn unit because of the more heterogeneous fuel characteristics especially in the mixed-conifer type.

Severely burned soil is characterized by complete consumption of the forest floor or duff layers with charring of fine roots in the upper half inch of mineral soil. Because of the controlled conditions under which prescribed burning will occur and the focus for its use on the modestly sloping operable ground, the potential for large contiguous areas of high burn severity is low. Localized areas of high soil burn severity will occur where heavy accumulations of slash are consumed due to the intensity and duration of burning. Overall, the use of prescribed fire proposed is not expected to have a detrimental impact on soil resources.

Riparian Areas and Wetlands— Environmental Consequences

No mechanical or prescribed burning is proposed in riparian areas. In addition, they have largely been eliminated from the operable area for mechanized equipment by exclusion of a 100 foot buffer along 2nd order and larger streams and adjacent side slopes exceeding 35%. The operable area results are generally consistent with the location and size of riparian areas in the forest-wide GIS layer. The exceptions are several 1st order perennial streams in the upper reaches of Criswell Creek and small isolated seeps and ponds. Other small riparian stringers or surface seeps also likely occur as inclusions within the broader operable areas

on the mesa tops. Design criteria have been recommended to protect all previously unrecognized perennial water features. As a result, direct mechanical effects to riparian related resources are not expected.

Intermittent stream channels upstream of many riparian systems are included within the defined operable area for mechanized treatment. Although lacking riparian vegetation or perennial flow, these areas concentrate and retain moisture longer than adjacent uplands and seasonally convey flow downstream as evidenced by defined banks and scoured channel bottoms. The greatest risk near these areas is for soil compaction or rutting damage caused by operations when soils are wet and alteration of existing flow paths due to rutting or logging slash left in channels. Design criteria have recommended to avoid or minimize negative effects in these areas.

Prescribed burning impacts may occur given the presence of riparian inclusions within mechanically treated stands which will serve as focal areas in the development of prescribed burn plans. Design criteria have been recommended with the goal of maintaining live canopy as well as the protective cover provided by the forest floor and duff layers. Over all, the riparian impacts of prescribed fire are expected to be incidental short term, and of limited extent.

Water Quality—Environmental Consequences

Adverse water quality impacts would be avoided or minimized through the measures outlined in the Rocky Mountain Region Watershed Conservation Practices Handbook (WCPH R2-FSH 2509.25, 2006) and the supplemental design criteria of this document. The WCPH includes measures that are recognized as effective and are considered to be Best Management Practices (BMP's) for silvicultural operations by the State of Colorado. The principal purpose is to protect classified uses by disconnecting ground disturbances from the channel network and maintaining vegetative buffers adjacent to water related features.

There may be some short-term increase in soil movement within treatment units, but given the operable area's modest relief, the limited drainage density, and application of design criteria to minimize exposure of bare soil, delivery of sediment to perennial stream segments is unlikely.. However, temporary roads and landings will expose bare soil and be potential short term sediment sources. Because they will only be needed within operable areas, sediment delivery potential, as noted above, is low. In addition, effective design criteria are available to provide adequate drainage and prevent or minimize sediment production. Reestablishment of vegetation and obliteration after use will reduce the production of sediment to background levels, so that long term impacts are not expected.

Intermittent stream channels are present within the defined operable area for mechanized treatment. Although lacking riparian vegetation or perennial flow, these areas concentrate and retain moisture longer than adjacent uplands and seasonally convey flow downstream as evidenced by defined banks and scoured channel bottoms. The greatest risk near these areas is for soil compaction or rutting damage caused by operations when soils are wet and alteration of existing flow paths due to in-channel debris or rutting.

Elevated sediment loads following prescribed fire could occur, but only in areas that are directly connected or immediately adjacent to a stream course (riparian areas) which experience high burn severity losses of ground and litter cover. A short-term pulse of elevated nitrate and or total dissolved solids may also occur. Effects would be most likely immediately below burn units and quickly diminish downstream given the limited area burned relative to the size of the full watersheds. Vegetative recovery and nutrient uptake is expected to damper the duration of any observed effect. Incidental losses of riparian shade should not have an effect on stream water temperatures.

Water quality degradation as a result of prescribed burning would require large areas of high burn severity. Overall, the direct effects to water quality are expected to be of limited magnitude and short duration; and that classified uses will be maintained and supporting standards met within and downstream of the analysis area.

Hydrologic Runoff — Environmental Consequences

Direct, Indirect and Cumulative Effects

Results of analysis of the proposed action on hydrologic runoff indicate that only in the cool-moist mixed-conifer type, would achieving the upper historical level of stand initiation openings approach a threshold for annual yield increases. The remaining treatment acres in the proposed action will be partial canopy removals focused on maintaining or promoting other successional classes with limited risk for altering runoff.

McDonald and Stednick (2003) assert that fire suppression over the last century has promoted an increase in cover density which has actually reduced annual water yields as a result. No controlled studies have demonstrated that effect, although water yield models in the North Platte Basin suggest reduced flows due to increased forest cover density (Troendle and Nankervis, 2000). Similar increases in cover density as a result of fire suppression on the Uncompahgre plateau suggest an overall lowering of water yields. In which case, any water yield increases would actually be a step toward restoring the historic hydrologic regime.

No road related runoff effects are expected given the topographic nature of the analysis area, the need for only temporary road construction, and the design criteria available to minimize their short term effects and facilitate reclamation.

Recreation and Travel Management

Affected Environment

Developed Recreation

Several developed Recreation sites are included in the analysis area, these include Columbine campground, Columbine day use area (old campground), Ironsprings Campground, Silesca Guard Station (cabin rental), and multiple trailheads.

Dispersed recreation

A diverse array of dispersed recreation opportunities occur within the analysis area. These opportunities include but are not limited to: driving for pleasure, sight-seeing, hiking, hunting, fishing, horseback riding, picnicking, firewood gathering, snow shoeing, cross-country skiing, snowmobiling, use of all-terrain-vehicles (ATV) on roads and trails, mountain biking on roads and trails, and camping.

Recreation Opportunity Spectrum (ROS) Setting

The ROS Setting is a spectrum that varies from semi-primitive non-motorized to rural. The management emphases according to the Forest Plan Management Area Directions are Timber Management (7A) and Livestock Management (6B). The Livestock Management direction is to provide for semi-primitive non-motorized, semi-primitive motorized and roaded natural recreation opportunities. The Timber Management direction is to provide for semi-primitive non-motorized, semi-primitive motorized, roaded natural, and rural recreation opportunities.

System Trails/Trailheads

There are numerous trails and trailheads in the analysis area. These include hiking and horseback riding, mountain biking, single track motorized (motorcycle), ATV (less than 50 inches) trails, and full-size vehicle routes. Some of the trails in the analysis area have seasonal closures for motorized use to protect wildlife habitat. During the winter, groomed routes are maintained by special use permitees along the existing road system.

Recreation Special Uses

There are several commercial recreation permitee operating in the area. Most of the permitees provide day use activity services, however some do offer overnight trips on the forest. Project design criteria are being employed to minimize affects to these recreationists.

Travel Management

Forest travel regulations restrict motorized travel to designated roads and trails. Additionally, forest regulations allow vehicles to leave roads for a distance of 300 feet to access a suitable campsite or for gathering firewood, as long as no damage is caused to the resources.

Environmental Consequences

No Action Alternative

This alternative could have some impacts to recreationists if the widespread effects of dead trees scattered on the ground impeded visitor access and the ability to move around within the area and the safety aspect of many standing dead trees preclude the use of the area. Winter recreationists may not be able to access areas until the snow is deep enough for the same reasons.

Environmental Consequences

Action Alternative

This alternative would have temporary effects on recreation users and private land owners adjacent to the proposed treatment areas, especially during the active timber sales with heavy truck traffic on the roads leading into the sale areas. In absolute terms, there would be fewer opportunities for public firewood gathering than the No Action alternative, although free public use firewood collection associated with vegetation management could increase ease and accessibility of firewood collection for some members of the public.

Following harvest, some areas would be more open which could allow for unauthorized cross-country travel by motorized vehicles, which will be difficult to restrict without natural barriers. The openness of the area could also change winter use patterns as well by allowing snowmobiles access to areas they currently do not, due to heavy timber. Cross country travel by snowmobiles could impact tree regeneration, as machines may clip the tops of the trees that are minimally covered by snow.

Groomed snowmobile routes are along some of the proposed haul routes, which could be plowed in the winter. If winter hauling and snow plowing is approved, the Forest Service will facilitate a working agreement between the special use permittees and the contractor. It is expected that the grooming routes will not be impacted during the entire timeframe of the project, especially during the initial stages.

There may be opportunities to implement the travel management plan through vegetation management activities. For example, trails that are open to ATV but have a much wider profile could be reduced to proper ATV width through activities such as ripping and seeding, obstructions with logs or boulders, and installation of width restrictors. Unauthorized routes could be decommissioned, however the 300ft travel off designated routes for activities such as dispersed camping and forest product gathering will need to be taken into consideration.

Visual qualities will change in the short term, however they will return to current levels or possible improve through treatment. In the short-term visual qualities texture will remain on the landscape. Texture will be achieved through leaving live vegetation in harvest areas and retaining coarse woody debris loadings on the ground. Also low stump heights (6-12”), along visual corridors and adjacent to Developed rec sites will not detract significantly from visual quality.

The recreation/travel management Project Design Criteria are feasible because they would be incorporated into contracts to protect recreation infrastructure, warn visitors of hazards, and minimize impacts to forest users during periods of highest use. The Project Design Criteria have been used on other timber sales on the Forest, and in the Region, and should be an effective means of minimizing negative impacts to other forest users.

Economics

Non-commercial Mechanical Treatment and Prescribed Fire Costs

High variation in the estimation of non-commercial mechanical treatment costs is anticipated due to several factors:

- The most important factor affecting total costs is the variation due to the wide range of proposed treatments across the vegetation zones in the EFRS project. Since this range of acres is wide, it has a significant effect on the final cost of proposed treatments.
- Mechanical treatment will also likely vary with the scale of mechanical treatment contracts, with large acreage contracts having a lower per acre cost than smaller acreage contracts.
- Stewardship contracts will likely be used to complete the majority of non-commercial mechanical treatments associated with the EFRS projects. These contracts combine non-commercial mechanical treatment costs with timber related revenues in one government contract. Recent experience from the Uncompahgre Mesas Forest Restoration Demonstration project indicates that mechanical treatment costs appear to be influenced heavily by associated timber values. Contracts that are composed of a mix of commercial timber value and mechanical treatment costs, especially on the same acres, result in a lower overall cost to the non-commercial mechanical treatment cost to the government. Thus, the total cost of proposed non-commercial treatments, will be heavily dependent upon the amount, distribution and quality of included commercial forest products within each stewardship contract.
- Market related factors will heavily influence price. For instance, if broader regional demand for similar mechanical treatments increases (i.e.an increase in forest service timber contracting or demand for mechanized equipment due to wildfire, etc…), or the supply of available contractors diminishes (i.e. bankruptcy, relocation, etc…) overall treatment costs will increase.

Despite the wide-range of factors affecting non-commercial mechanical treatment costs, an estimate of mechanical treatment costs is essential to understand the overall viability of the EFRS project. To develop a reasonable range of treatment costs, the following assumptions were used:

- Prescribed-fire will be used to the greatest extent possible in accomplishing forest structure objectives consistent with the historical range of variability for each vegetation zone and where commercially viable timber volume per acre is not available. For these reasons, it is reasonable to assume prescribed fire will be used in

lieu of mechanical treatment, on anywhere from 1/3 to ½ of proposed mechanical treatment acres in both the Warm-Dry Mixed-Conifer and Ponderosa pine-oak zones.

- Contracts will be designed to keep the overall cost to the government at a minimum
- Within Warm-Dry Mixed-Conifer and Ponderosa pine-oak zones, non-commercial treatments will be designed to increase post-treatment stand diversity in spatial structure and age class. As such, treatments will not be applied homogenously throughout treatment areas, thereby reducing the overall cost of treatments to the contractor. This reduction in cost relative to the spatial variability of proposed treatments has been seen in the stewardship contracts associated with the Uncompahgre Mesas project.
- Prescribed fire will strive to use natural and pre-existing firelines and fuelbreaks to the greatest extent possible throughout the implementation. This ability is supported by the large number of roads and trails present throughout the project area. Further, the ability to design burn units with increasingly less constructed fireline has been a trend during the of the Uncompahgre Mesas project.
- Prescribed fire will ultimately not be applied homogenously throughout areas slated to be broadcast burned. Excluded areas, both within and adjacent to cut or mechanically treated areas, are a common and expected feature of prescribed fire within the project area.

Quantification of these non-commercial mechanical and prescribed fire treatment assumptions is shown in Table 8. Estimates contained in Table 8 are not intended to supersede acreage estimates shown in the proposed action (Table 1), but instead are a fine-scale estimate of actual contract within different vegetation zones of the project area.

Table 8: Acreage Assumptions for EFRS Non-commercial Mechanical Treatment and Prescribed Fire Activities (estimates shown here do not supersede acreage estimates shown in the proposed action Table 1, but instead are a fine-scale estimate of actual contract implementation acres)

Non-Commercial Mechanical Treatment Acreage Estmations	
Spruce-fir-aspen WUI and Cool-moist Mixed-conifer Non-Commercial Mechanical Treatments	One-third to two-thirds (49.5 % average) will require non-commercial mechanical treatment
Warm-dry Mixed-Conifer Mechanical Treatments	One-half to three-fourths (62.5 % average) will require non-commercial mechanical treatment
Ponderosa pine-oak Mechanical Treatments	One-half to three-fourths (62.5 % average) will require non-commercial mechanical treatment
Pinyon-Juniper/Mountain Shrub Mechanical Treamtents	Two-thirds (66%) will require non-commercial mechanical treatment
Prescribed Fire Acreage Estimations	

5% of Cool-Moist Mixed-Conifer and Spruce-fir-aspen commercial and non-commercial treatments will require pile burning
70% of Warm-dry Mixed-Conifer and 80% Ponderosa pine-oak (including plantations) will require broadcast burning
0-33% of Mechanically treated Pinyon-Juniper/Mountain shrub acres will require broadcast burning

Estimated total costs of non-commercial mechanical and prescribed fire treatment costs are estimated between 3 to 10.4 million dollars. This wide variation reflects the wide differences between the low and high acreage ranges in the proposed treatments and variability inherent in cost estimations for non-commercial mechanical treatments.

Non-commercial mechanical treatments costs range from 2.1 to over 7 million dollars. Treatments within the Ponderosa pine-oak and Warm-dry Mixed-conifer zones are responsible for approximately 2/3 of the total mechanical treatment costs for the entire project. In these zones, since costs are somewhat prohibitive and these areas are well-adapted to frequent fire, in some areas it is likely prescribed fire may be used in lieu-of mechanical treatments to accomplish project objectives. The average of the mechanical treatment cost range, approximately $4.8 million best represents the actual non-commercial mechanical treatment cost for the project.

The same situation is true for estimation of prescribed fire costs, as the broadcast burn acreage range is the primary factor affecting overall treatment costs. Overall prescribed fire costs range from 0.8 to over 3 million dollars. Prescribed fire costs are known to vary dramatically with scale. Large extent prescribed fires accomplished in short time periods can have a much lower cost per acre than small extent fires or large fires requiring a long implementation period. Because of this reality, prescribed fire managers charged with implementing the project will have incentive, especially in a climate of limited economic resources, to manage prescribed fire at the broadest-scale given other resource and regulatory constraints. For this reason, prescribed fire cost estimates will likely be closer to the lower end of the cost estimate range.

A combination of Collaborative Forest Landscape Restoration Program grant funds, appropriated dollars and timber receipts will be used to fund non-commercial treatments and prescribed fire. Additional grant funding may be acquired to accomplish specific components of the proposed activities as opportunities become available throughout management.

Forest Product Outputs

As previously discussed, timber sale and stewardship contract activities will be designed to be economically efficient to provide attractive offerings to local forest industry and to maximize the value of funds spent. Silvicultural prescriptions and timber and stewardship contracts will be designed to provide an adequate volume of timber per acre, a mix of desirable tree species, and an adequate average sized saw log in order to minimize the cost of hazardous fuels mitigation and forest restoration work across the analysis area.

The trend from the last three stewardship contracts awarded on the Uncompahgre Plateau indicate that total contract costs to the government have been going down. This is a result of mixing economically attractive timber offerings with more expensive hazardous fuels mitigation and forest restoration activities. Mixing spruce-fir-aspen group selection and patch cuts in the same contracts as ponderosa pine-oak and warm-dry-mixed conifer HRV-based restoration commercial and non-commercial treatments has been a success in the recent past to provide projects that are economically attractive to local industry and a good value of tax dollars spent.

The demand for Engelmann spruce, blue spruce, and subalpine fir from local mills is currently high. The demand for Douglas-fir and aspen is from local mills is moderate, but tends to fluctuate with time. The demand for ponderosa pine is currently low to moderate, however Montrose Forest Products is evaluating their operations with regard to this species and demand may rise in the future. As demand for local forest products increases, the value for timber harvested in the Escalante project area will increase. An estimate of timber volumes and associated assumptions are shown in Table 10. It should be stressed that these numbers are best estimates and are subject to change based upon actual project accomplishments.

Table 10: Estimated Volume Associated with EFRS Commercial Harvest Activities

	Commercial Acreage Range		**Timber Volume Range (CCF)**	
	Low	**High**	**Low**	**High**
Spruce-Fir-Aspen*				
5%AF/10%AS/85%ES	1,232	2,563	22,176	46,134
Cool-moist Mixed-conifer*				
10%AF/35%BS/15%DF/35%ES	1,425	5,000	14,250	50,000
Warm-dry Mixed-conifer* **				
10%AF/45%BS/15%DF/10%ES/20%PP	2,090	4,357	12,135	17,873
Ponderosa pine-Oak* **				
75% PP/20%BS/5%DF	2,713	4,550	11,725	21,175
Totals	7,459	16,870	60,286	135,182

** Estimated commercial harvest species composition from Escalante Proposed Action Document (12/14/2012). Actual species distribution will differ somewhat from this estimated species composition; AF=Subalpine-fir, BS=Blue Spruce, DF=Douglas-fir, ES=Engelmann Spruce, PP=Ponderosa pine*

*** For revenue estimation purposes, 25% of proposed commercial and non-commercial mechanical treatment acres were assumed to be commercial acres.*

Changing timber market demand could strongly influence overall timber revenues. This situation, although possible especially in a strongly rebounding timber market, is also not highly likely given the extent of small diameter, low-value trees across the project landscape. Short to mid-term changes in timber market strength are extremely difficult to predict, and are

tied to many factors outside the scope of these estimates. Based on current market conditions, the proposed volume and mix of sawtimber associated with the proposed action could generate between 1.5 and 3.1 million dollars of revenue from timber receipts.

All cost and revenue estimates are based on the assumptions stated and are subject to change due to conditions on the ground. Commercial harvests will generate revenue to facilitate the proposed forest restoration activities designed to accomplish goals and objectives associated within each vegetation zone. Commercial and non-commercial treatments will occur over 10 years. Each year implementation will include a balance of commercial timber harvest and non-commercial mechanical treatments. Commercial activities will be balanced with non-commercial treatments necessary to meet objectives for each vegetation zone. Delay or postponement of specific areas of the proposed treatments could be an option if anticipated funds are not available to complete proposed activities.

Environmental Justice

The issue of environmental equity and justice in natural resource allocation and decision-making is receiving increasing political and social attention (Albrecht, 1995; Scott, 1996). Following President Clinton's Executive Order 12898 (Federal Register, February, 1994) all federal land management agencies have been mandated to address environmental justice in nonwhite and/or low-income populations, with the goal of achieving environmental protection for all communities regardless of their racial and economic composition.

The action and no action alternatives assessed in this analysis do not result in significant disproportionate impacts to minority populations.

CONSULTATION AND COORDINATION

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

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Federal, State and Local Agencies

US Fish and Wildlife Service
Colorado Division of Wildlife

Tribes

Others

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Colorado Forest Restoration Institute
Colorado Wild
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APPENDIX A: PROJECT AREA MAPS

Map 1: Project Area Overview

Map 2: Commercial and Non-commercial Treatment Priority Areas

Map 3: Prescribed Fire Prioritization

Map 4: Tentative Implementation Schedule

APPENDIX B: LANDFIRE SUCCESSION CLASS ANALYSIS