United States Department of Agriculture
Forest Service

Wildcat Fuels Reduction and Vegetation Management Project

Environmental Assessment

Mt. Hough Ranger District, Plumas National Forest, Plumas County, California

November 2015

Thompson Peak as seen from Wildcat Ridge with the Wildcat Project in the foreground (photo taken by Kelby Gardiner, 2009).

For More Information Contact:

Daniel Lovato, Acting Forest Supervisor

c/o: Maurice Huynh, Project Leader
Plumas National Forest
Mt. Hough Ranger District
39696 Highway 70
Quincy, California 95971
Phone: (530) 283-7653
Email: mlhuynh@fs.fed.us
Project specific website: http://www.fs.usda.gov/project/?project=43435

Contents

List of Tables

List of Figures

Introduction

The Forest Service has prepared this Environmental Assessment (EA) for the Wildcat Fuels Reduction and Vegetation Management Project (hereafter Wildcat Project) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This EA discloses the analyses conducted by the Forest Service, used to assess the nature and importance of the physical, biological, social, and economic effects of the proposed action and the no-action alternative. The Wildcat Project was developed in accordance with the Pacific Southwest Region, Ecological Restoration Regional Leadership Intent (USDA 2011a; FSH Chapter 2020), in alignment with the Moonlight Restoration Strategy Version 1.0 (USDA 2013), and in compliance with the 1988 Plumas National Forest Land and Resource Management Plan (PNF LRMP)(USDA 1988a,b), as amended by the 2004 Sierra Nevada Forest Plan Amendment (SNFPA) Final Supplemental EIS (FSEIS) and Record of Decision (ROD)(USDA 2004a, b).

The Wildcat Project area encompasses approximately 11,556 acres of National Forest System (NFS) lands administered by the Mt. Hough Ranger District of the Plumas National Forest. The project area is just north of Antelope Lake, three miles southwest of Janesville, ten miles south of Susanville and approximately 25 to 30 miles northeast of Quincy, California in Plumas County, California (Figure 1). The Wildcat Project area lies within the ecological landscape considered for the Moonlight Fire Restoration Strategy (USDA 2013), deemed the appropriate scale to determine post-fire alterations affecting ecological values and services, while providing for strategic and effective restoration both inside and outside of the Moonlight Fire perimeter.

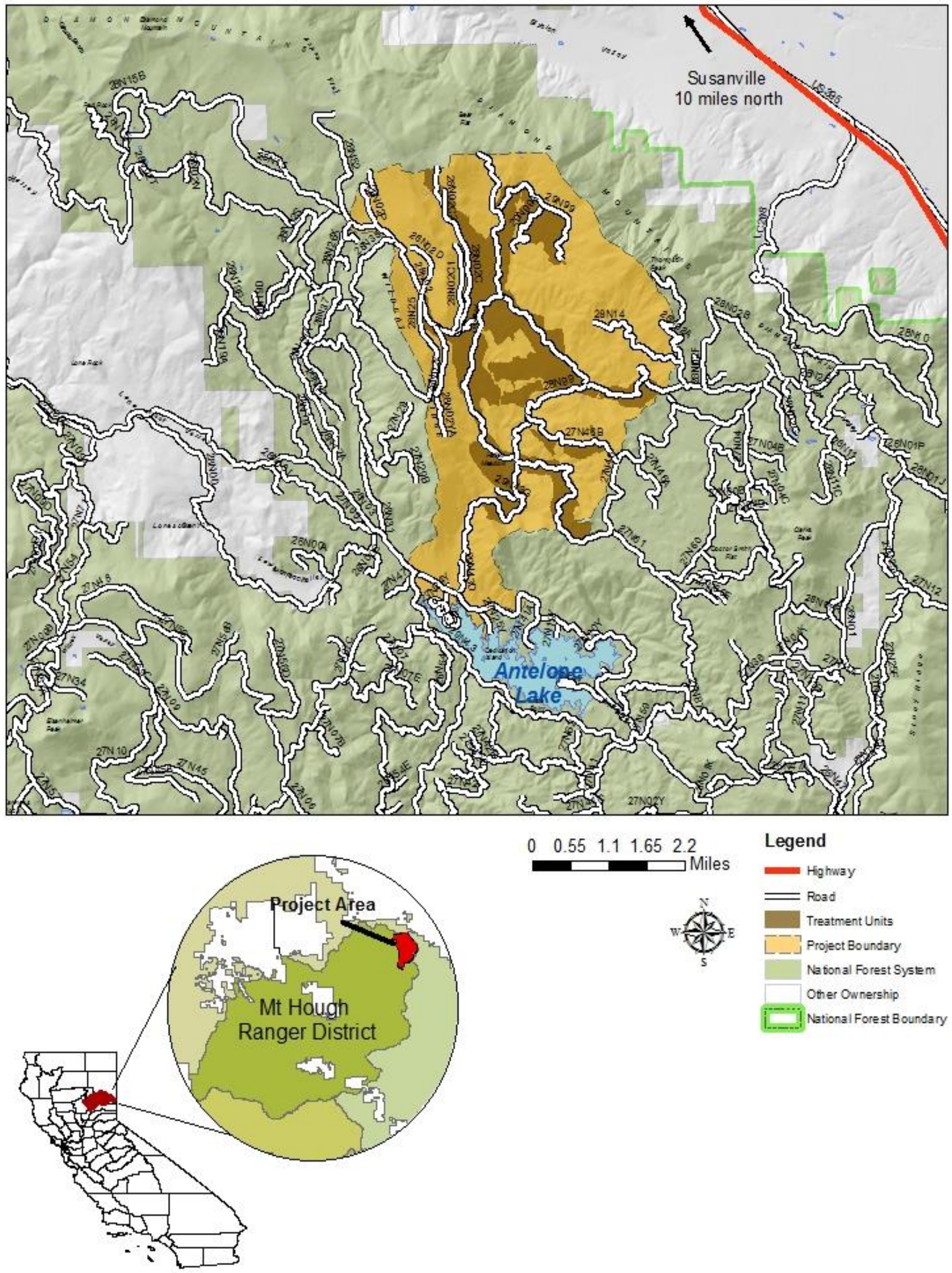


Figure 1. Vicinity map illustrating California, the Plumas National Forest, the Mt. Hough Ranger District, and the Wildcat Project area in relation to one another.

The Wildcat Project area lies between 5,000 and 7,800 feet in elevation above sea level and includes all or portions of T27N R12E Sections 1-3, 10-12, 14 and 15; T27N R13E Section 6; T28N R12E Sections 13-16, 21-24, 25, 28, 34-36; and T28N R13E Sections 30 and 31; Mount Diablo Base Meridian (MDBM). The Lassen National Forest and Lassen County are north, Thompson Peak and the Beckwourth Ranger District administrative boundary are east, and Wildcat Ridge is west of the Wildcat Project area. The southern portion of the Wildcat Project area lies within the Antelope Lake Recreation Area administered by the Forest Service, and is adjacent to Antelope Lake, a popular destination for forest visitors. The Diamond Mountain Motorway (National Forest System road 28N02), a major roadway from the eastern portion of the Plumas National Forest onto the Lassen National Forest, bisects the Wildcat Project area and proposed units.

Background

On September 3, 2007, the Moonlight Fire ignited to the west of the project area burning approximately 65,000 acres of National Forest System (NFS) and private lands. Over half of these acres burned at high severity as illustrated in Figure 3. To the south of the project area, the 2007 Antelope Complex, 2006 Boulder Fire, and the 2001 Stream Fire (Figure 2), have collectively impacted riparian and mid and late seral forest vegetation across an uncharacteristically large landscape within a relatively short time period (2001-2007). The development of mid to late seral forests upslope and within riparian corridors scorched by these recent wildfires will take a century, if not more.

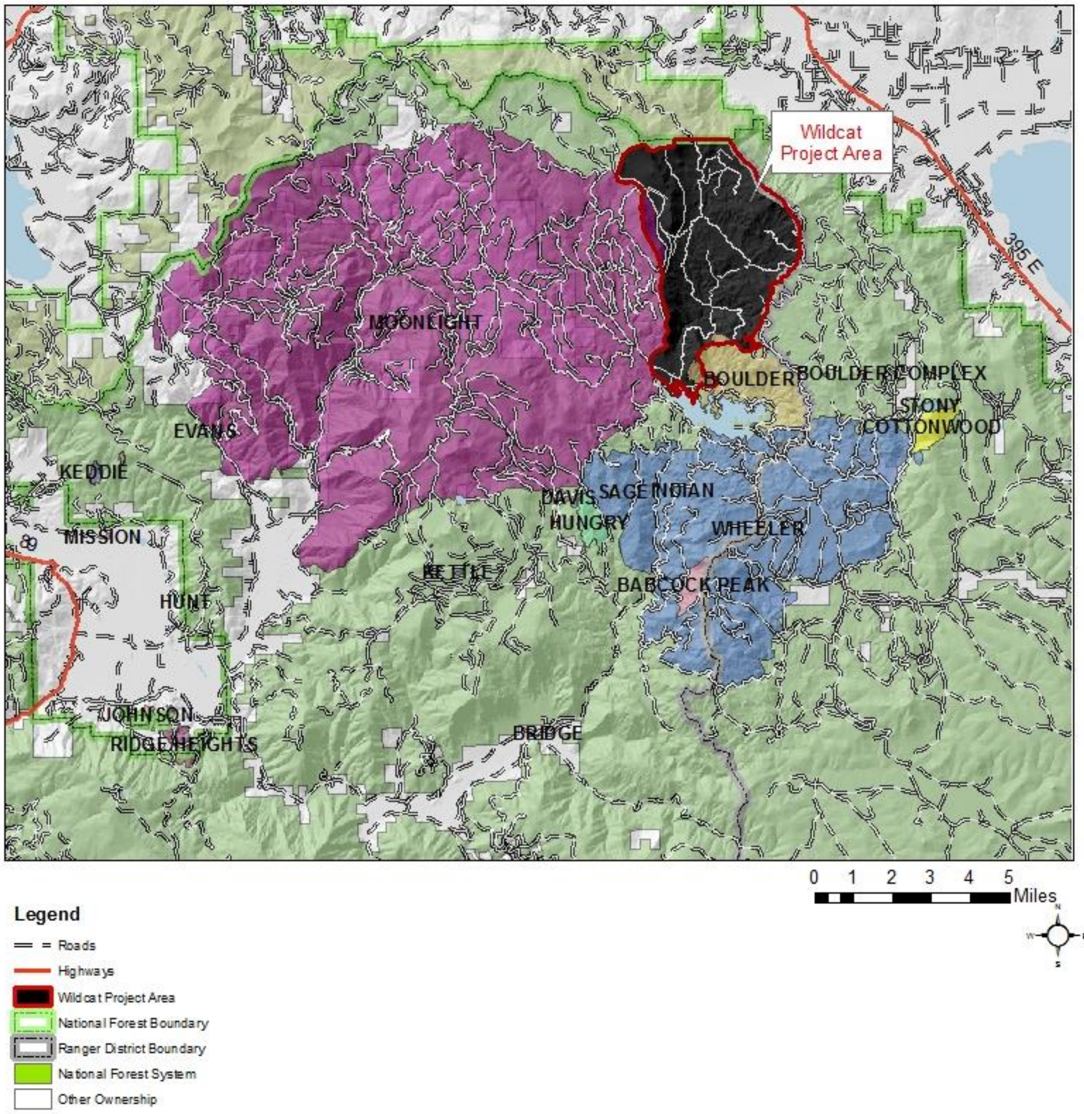


Figure 2. Wildfires occurring between 2001 – 2007 west and south of the Wildcat Project area (highlighted in red), located at the upper stream reaches of Antelope and Antelope Lake watersheds, illustrates areas across the landscape where forest vegetation has been altered.

Just outside these fire perimeters, the project area features intact (unburned) riparian and mid and late seral forest vegetative conditions affording interim habitat refugia for wildlife such as spotted owls, goshawks and Sierra Nevada yellow-legged frogs, currently at-risk to high severity wildfire impacts as depicted in Figure 3.

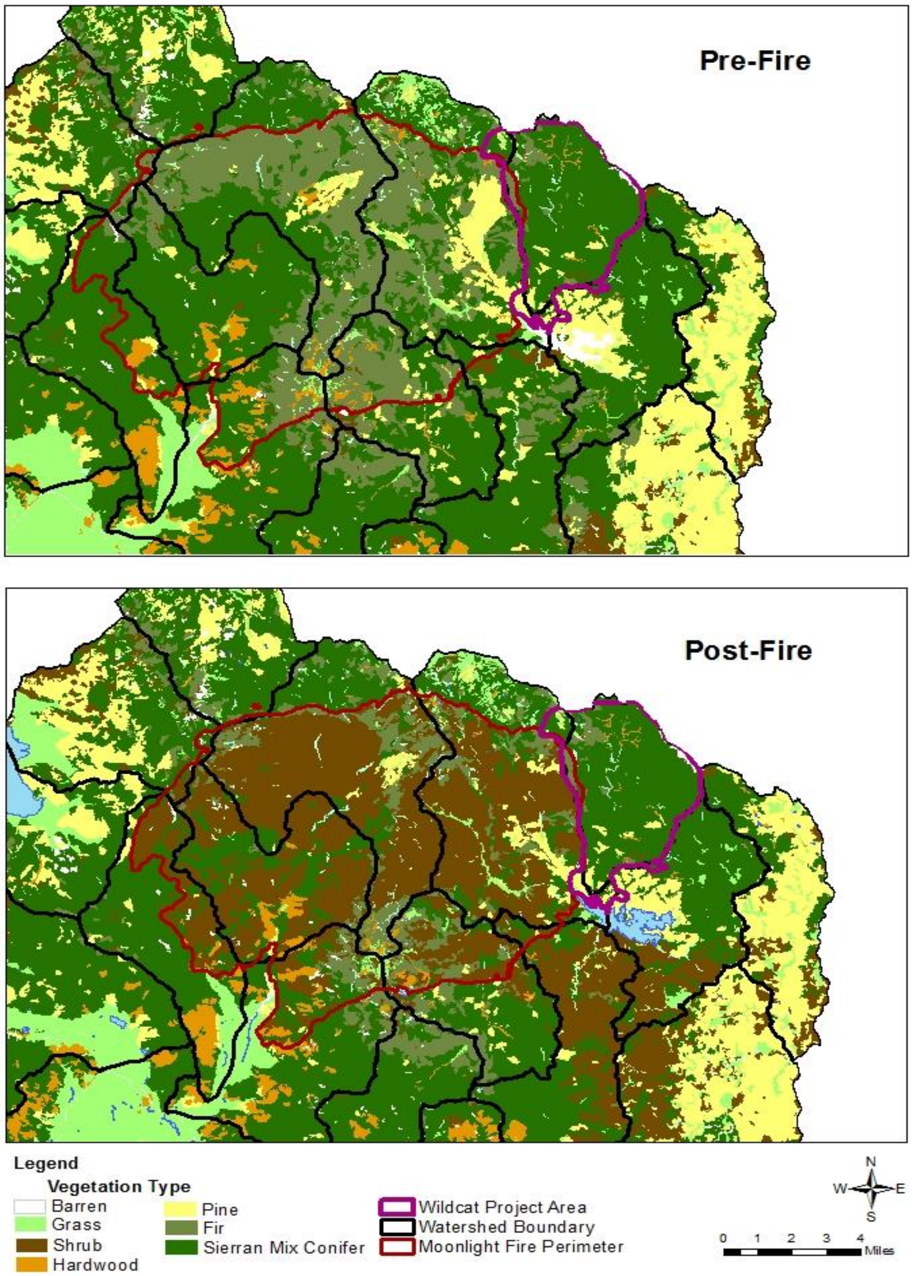


Figure 3. Vegetation types pre- and post-Moonlight Fire of 2007 in relation to the Wildcat Project area.

The Forest Service interdisciplinary team (IDT) employed an offsite restoration strategy during the development of the Wildcat Project, whereby proposed and ongoing restoration activities consider the effects of the Moonlight Fire in the context of the broader affected landscape.

The importance of taking immediate action as proposed by the Wildcat Project is further heightened in light of alterations to landscape scale hydrologic features, increased threats of invasive plants spreading to uninfested areas within and adjacent to the fires perimeters, and proximity of combustible woody fuels, capable of torching to ignite spot fires for many miles.

Purpose and Need for the Proposal

It is Forest Service policy to retain and restore ecological resilience of the National Forest System (NFS) lands to preserve ecological values and a broad range of services to humans and other organisms. According to the Leadership Intent, “from this point forward, ecological restoration will be the central driver of wildland and forest stewardship in the Pacific Southwest Region” (USDA 2011a).

Ecological resiliency as it applies to the Wildcat Project refers to the ecosystem’s ability to not only absorb small perturbations (disturbances) and prevent them from amplifying into large disturbances, but also its capacity to recover following landscape, high-severity fire disturbances; particularly in light of probable shifts in ecological features influenced by climate change and uncertain future environmental conditions (USDA 2004a, p. 34).

The Moonlight Fire Restoration Strategy (USDA 2013) and the amended Diamond Landscape Assessment (USDA 2012) provide current and desired conditions for areas affected by wildfire, including those relevant to the Wildcat Project area. These broader landscape restoration objectives, in combination with land management direction in the PNF LRMP (USDA 1988a,b), as amended by the 2004 SNFPA ROD (USDA 2004a, 2004b), underlie the following purpose and needs for the Wildcat Project.

Purpose

The purpose of the Wildcat Project is to reduce threats to communities and wildlife habitat from severe wildfires and re-introduce fire to fire-adapted ecosystems (USDA 2004a, Appendix A, p. 34). This project would preserve wildlife protected activity centers (PAC) and home range core areas (HRCA), mid and late seral forest habitats, one critical habitat refuge (CAR), proposed critical habitat for the Sierra Nevada yellow-legged frog and native herbaceous vegetation, while improving forest health and tree species diversity, soil productivity and localized water quality supporting proper hydrologic function; key to serving organisms and beneficial human uses.

Needs

Reduce hazardous fuel accumulations

There is a need for treating fuels in a manner that substantially reduces wildland fire intensity and rate of spread, thereby contributing to more effective fire management. Within the Wildcat Project area there are six PACs, three HRCAs, proposed critical habitat for the Sierra Nevada yellow-legged frog, and one CAR at risk of loss or degradation from wildfire.

Many of the forested areas in the Wildcat Project are above sustainable stocking levels exhibiting elevated levels of tree mortality caused by bark beetles during and after periods of drought. This mortality combined with high forest stand densities has resulted in heavy fuel loading in many areas and a corresponding increase in potential fire behavior.

The following needs have been identified for this proposal:

- Actively restore fire-adapted ecosystems by making demonstrated progress in moving acres out of unnaturally dense conditions (in other words, moving acres from condition class 2 or 3 to condition class 1).
- Strategically place treatment areas across the landscape to interrupt potential fire spread. The Wildcat Project will provide connectivity to past wildfires including the 2001 Stream Fire, 2006 Bolder Fire, and 2007 Moonlight Fire. In addition, this project will tie into the Diamond East Project (in planning) a fuels reduction project on the Lassen National Forest to the north.
- Remove sufficient material in treatment areas to cause a fire to burn at lower intensities and slower rates of spread compared to untreated areas.

Measurement Indicators: Flame length (feet), canopy base height (feet), probability of crown fire initiation, and predicted basal area mortality under 90th percentile weather conditions. Reduced fire behavior will be particularly important within ¼ mile of spotted owl and goshawk PACs, spotted owl HRCA, and proposed critical habitat for the Sierra Nevada yellow-legged frog and Critical Aquatic Refuge (CAR).

Improve Forest Health

There is a need for reducing tree densities in overstocked mid and late seral forests to achieve desired tree vigor and enhanced resistance to insect and diseases, particularly in light of drought conditions and predicted warming trends, while establishing complex heterogeneity of forest structure and widespread distribution of shade intolerant tree species such as Jeffrey pine, ponderosa pine, sugar pine, and aspen.

> The importance of forest heterogeneity- historical studies of the Sierra Nevada forests suggest mixed conifer forests, under an active fire regime, had a naturally clumped distribution containing a variety of size and age classes (North et al. 2009).

Approximately two-thirds of the forest stands in the Wildcat Project area are comprised of homogenous mid- seral overstocked forests dominated by unhealthy small to medium sized trees (mostly shade-tolerant true fir); with scattered pine in the overstory coupled by sparse regeneration.

White fir engraver beetle (*Scolytus ventralis*) is causing high levels of tree mortality throughout the Wildcat Project area. *Heterobasidion* root disease in white fir appears widespread in the project area, predisposing trees to bark beetle-caused mortality. Western dwarf mistletoe is causing severe stress to individual Jeffrey pines in several stands, most prominent in the north end of the project area, also predisposing them to bark and woodboring beetle attacks.

Conifer encroachment into aspen communities has resulted in increased canopy cover (ground shade), heavy build-up of forest litter underneath tree canopies (composed of needles, bark and broken branches shed over time) and increased absorption of surface and ground water (lowering water tables), which suppress aspen vigor and regeneration. Cumulatively, these micro-site alterations to ecosystem function have contributed to decline in aspen tree vigor, population size and their distribution across the Wildcat Project area.

Trends in climate change indicate environmental stressors will increase influencing tree vigor in the region over the coming century. This is of particular concern to land managers, as precipitation levels within the Wildcat Project area are characteristic of drier eastside pine forest types; presently at risk to high intensity fire disturbance (refer to Reduce hazardous fuel accumulations section above).

The following needs have been identified for this proposal:

- Reduce inter-tree competition in overstocked mid- and late seral forest stands experiencing elevated levels of diseases and tree mortality associated with insects, pathogens and drought to achieve desired forest health. Post-relative stand densities should be below the zone of imminent mortality for at least 20 years. (USDA 2004a, p. 51; USDA 2004 Blackwell letter July).
- Improve species composition by promoting the retention and regeneration of shade intolerant species, particularly large, fire-adapted Jeffrey pine and ponderosa pine (USDA 2004a, p. 52).
- Restore forest structure to be more characteristic and resilient to an active fire regime. Establish open forest canopies and gaps to improve stand structure, complexity, and landscape heterogeneity. Stand structure would vary according to topographic location, such as aspect, slope position, and site quality, creating high levels of horizontal and vertical diversity at the stand and landscape-scale. Desired forest attributes include uneven-aged, multi-storied stands dominated by legacy structures composed of large, fire-adapted trees. (USDA 2004a, p. 4; North et al. 2009; North et al. 2012).
- Enhance forest stand structure complexity and scenic integrity (quality and stability) in the Thompson Peak Semi-Primitive Non-Motorized Area, while removing diseased hazard trees and improving forest health (USDA 1988a pp. 4-88 – 4-90).
- Reduce conifer populations in aspen stands, along with reintroducing low and moderate intensity fire to restore ecology function to achieve desired enhanced tree growth, vigor and regeneration of aspen sprouts, while suppressing conifer regeneration. (USDA 2004a, p. 64).

Measurement Indicators: Stand Density (Relative stand density, Basal area, and Trees per acre), Species composition (relative abundance of shade intolerant species), Landscape heterogeneity (CWHR distribution and canopy cover), and Aspen Health (tree density by species).

Control invasive plants

Fire suppression activities during the Moonlight Fire likely increased the number of invasive species both within and adjacent to the fire perimeter. Invasive plants found in the Wildcat Project area include Canada thistle (*Cirsium arvense*), medusahead (*Elymus caput-medusae*), and jointed goatgrass (*Aegilops cylindrica*). Infestations of these species range from 10 square feet to about 7.6 acres in size and are capable of migrating, establishing, and spreading rapidly and unpredictably.

The following needs have been identified for this proposal:

- Eradicate localized invasive plant infestations where possible, control and contain extensive infestations, and prevent spread and new introductions, to preserve desired native and Forest Service listed Sensitive plants (USDA 2004a, pp. 54-55).

Measurement Indicators: Acres of established invasive plant infestations treated and risk of introduction and spread of invasive species within the project area.

Enhance watershed conditions including water quality and habitat for riparian and aquatic species

There is a need for improving transportation infrastructure to reduce road-related soil erosion and associated sedimentation rates, and for restoring soil productivity affecting infiltration, storage and release of storm runoff impacting localized water quality and riparian and aquatic habitats. The Sierra Nevada Forest Plan Amendment (SNFPA) Record of Decision (ROD) (USDA 2004a) describes management direction and management strategies aimed at preserving aquatic, riparian, and meadow ecosystems and associated species (USDA 2004a, pp. 32–34 and 42–44).

Currently, Boulder and Thompson Creeks exhibit elevated suspended soil particulates with heightened in-stream sedimentation, most prominent at road-stream crossings. The National Forest System (NFS) roads constructed near and through these stream reaches and their tributaries for administration have contributed to increased peak runoff rates by two prominent mechanisms: lower infiltration rates and capacities on compacted road surfaces and interception of shallow subsurface flow along road cutbanks.

Sedimentation refers to soil particles displaced and transported downslope by high velocity storm runoff, deposited along bottom streambeds.

Within the Wildcat Project area, Sierra Nevada yellow-legged frogs (SNYLF) occupy Boulder Creek and its tributaries. All vital life history activities for SNYLF such as breeding, foraging, dispersal, and over-wintering occur in these aquatic stream systems and adjacent riparian overstocked forest habitats; also compromised by road construction and motor vehicle use. A telemetry study conducted on a tributary of Spanish Creek on the PNF indicate SNYLF stayed within 10 m (33 ft) of the edge of the stream during the summer tracking session and within 25m (82 ft) of the edge of the stream during the winter tracking session (Wengert et al. 2006).

The following needs have been identified for this proposal:

- Upgrade water drafting sites to reduce sedimentation and protect aquatic habitat while providing sustainable access to water sources.
- Prioritize rehabilitating road-related non-point source pollution (near stream erosion) by improving road drainage features within the existing road prism, decommissioning classified NFS roads, and obliterating unclassified roads inside Riparian Conservation Areas (RCAs) to achieve desired Riparian Conservation Objectives (USDA 2004a, pp. 33-34).
- Improve road drainage within the existing road prism where non-point source pollution (sediment) is occurring along NFS roads.
- Enhance aquatic wildlife species habitat quality by increasing forest stand structure heterogeneity (small clearings for basking), decreasing dense understory vegetation to promote free movement and reducing hazardous fuels to preserve habitats from high intensity wildfire impacts.

Measurement Indicators: Near stream road density (miles of road per square mile within RCA, Number of road-channel crossings (per mile of stream), Water sources (of those identified) brought up to best management standards, miles of road reconstructed, and miles of stream enhanced.

Principle Laws and Regulations That Influence the Scope of This EA

This section describes land management direction and regulations relevant to the Wildcat Project area, which provided the legal framework for opportunities and constraints to achieving desired conditions during the development of the Wildcat Project. It also provides the foundation for assessing the environmental effects to the human environment being analyzed in this Draft EA.

Forest Plans

Plumas National Forest Land and Resource Management Plan (PNF LRMP) (USDA 1988a) as amended by the Sierra Nevada Forest Plan Amendment (SNFPA) Final Supplemental Environmental Impact Statement (FSEIS) and Record of Decision (ROD) (USDA 2004a, 2004b).

Direction for the Plumas National Forest is based on the 1988 Plumas National Forest Land and Resource Management Plan (commonly referred to as the “Forest Plan”) and a major Forest Plan amendment.

In August 1988, the Regional Forester signed the Record of Decision for the Forest Plan. In January 2004, the Regional Forester signed the Sierra Nevada Forest Plan Amendment (SNFPA) Final Supplemental EIS Record of Decision (USDA 2004a), which replaced the 2001 SNFPA Record of Decision. The 2001 SNFPA final EIS and Record of Decision are incorporated by reference in the 2004 Record of Decision on the SNFPA Final Supplemental EIS (FSEIS).

The Plumas National Forest Land and Resource Management Plan 1988 (PNF LRMP) (USDA 1988a) and the Sierra Nevada Forest Plan Amendment (SNFPA), FSEIS and the Record of Decision, (ROD) (USDA 2004a, 2004b) identify land allocations which divide the National Forest System lands into Management Areas, each with a unique resource goal or emphasis. Each Management Area prescribes a set of standards and guidelines which provide direction to achieve the future desired conditions. Many of these allocations overlap. Certain allocations (called *prescriptions*) in the original 1988 LRMP are still applicable in whole or in part, because they were not superseded by the 2004 SNFP amendment, including those under Antelope Management Area #29 (USDA 1988a, pp. 4-284 – 4-291). The proposed action was designed to meet applicable standards and guidelines for land allocations displayed in Table 1 as well as those that apply Forest-wide (SNFPA ROD pp. 49-66).

Table 1. Land allocations within the Wildcat Project area

Land Allocation Prescriptions	Standards and Guidelines	Approximate Acres within the Project area
Rx-5 Recreation Area (PNF LRMP)	Management treatments are designed to maintain or enhance recreation values associated with the Antelope Lake Recreation Area, limited to treating introduced invasive plants.	
Rx-8 Semi-Primitive (PNF LRMP)	Management treatments are designed to meet the standard VQO of Retention, while adequately reducing fuels likely to promote a catastrophic (high intensity) wildfire event, managing vegetation to lower hazards that could threat fire suppression personnel, while enhancing visual experiences.	2,049
Rx-10 Visual Quality Objectives (VQOs) (PNF LRMP)	Management treatments are designed to appear natural by retaining variable forest structure mimicking healthy forest conditions that would not be visually evident and would remain visually subordinate within the Retention and Partial Retention VQOs classes.	Retention -2,611 Partial Retention - 982 Modification - 10,378 Maximum Modification - 641
Wildland Urban Interface Threat Zone (SNFPA)	The wildland urban interface (WUI) zone is an area where human habitation is mixed with areas of flammable wildland vegetation. It extends out from the edge of developed private land into Federal, private, and State jurisdictions. The WUI Threat zone boundaries generally extend approximately 1¼ miles out from the defense zone boundary; however, actual extents of threat zones are based on fire history, local fuel conditions, weather, topography, existing and proposed fuel treatments, and natural barriers to fire. Fuels treatments in these zones are spatially placed to reduce wildfire intensity and interrupt spread, designed to link to the larger fuelbreak network to the north and south and other features, such as roads and rocky areas; effective as anchor areas to contain wildfire.	1,107
Rx-11 Bald Eagle Habitat (PNF LRMP)	Bald Eagles are nesting, roosting and foraging near Antelope Lake. Provide suitable nesting, roosting and foraging habitat to benefit bald eagles.	
Old Forest Emphasis Areas (SNFPA)	Management treatments are designed to achieve high level of horizontal and vertical diversity with reduced fuel levels.	
California spotted owl and Northern Goshawk Protection Activity Centers (SNFPA)	Management treatments are designed to avoid California spotted owl protected activity centers (PACs) and northern goshawk PACs, while strategically applying low intensity understory hand thinning and prescribed fire around the perimeters to protect wildlife from high intensity fire behavior and effects.	900
California spotted owl home range core areas (SNFPA)	A home range core area (HRCA) is established surrounding each territorial spotted owl activity center detected after 1986. Management treatments are designed reduce surface and ladder fuels up to 8 inches DBH only (hand thinning) to retain: (1) two tree canopy layers; (2) all dominant and co-dominant trees at least 24 inches DBH; (3) all very large (greater than 45 inches DBH) old trees; (4) at least 50 to 70 percent canopy cover; and (5) all snags and higher than average down woody material.	1,347
Critical Aquatic Refuge (SNFPA)	Critical Aquatic Refuges (CAR) include subwatersheds containing known locations of threatened, endangered, or sensitive species, highly vulnerable populations of native plant or animal species or	11,539

Land Allocation Prescriptions	Standards and Guidelines	Approximate Acres within the Project area
	localized populations of rare native aquatic- or riparian dependent plant or animal species. Management treatments are designed to be consistent with standards and guidelines associated with CAR and riparian conservation objectives (RCOs) in the 2004 Record of Decision on the SNFPA Final Supplemental EIS (FSEIS) (p.62-66) are designed to meet Clean Water Act and CA State water quality standards.	
Rx-9 Riparian (PNF LRMP)	Management treatments within riparian areas are designed to modify fuels and vegetation to enhance and reduce threats to riparian resources at risk to insects, diseases, encroachment of invasive plants and wildfire. Watershed treatments are designed to minimize the impact of roads on water quality, aquatic habitats and fish passage, providing provisions to improve drainage, decommission, adjust road design and close segments.	4,366
Riparian Conservation Areas (SNFPA)	Management treatments are designed to enhance habitat supporting viable populations of native and desired non-native plant, invertebrate and vertebrate riparian and aquatic dependent species, including the Sierra Nevada yellow-legged frog. The spatial placement of treatments is designed to preserve connectivity for riparian and aquatic dependent species within and between watersheds. Design criteria ensure new introductions of invasive species are prevented. The standards and guidelines for Riparian Conservation Area (RCA) widths described below per the SNFPA ROD (page 42-43) were assessed to determine if boundaries should be adjusted for the Wildcat Project. The interdisciplinary team (IDT) reviewed the Diamond Landscape Assessment and the Moonlight Fire Restoration Strategy, and conducted an additional project-specific analysis of Riparian Conservation Objectives (RCOs). There were no resource benefits identified to warrant modification of standard RCA widths. The following standard RCA widths apply to the Wildcat Project: • Perennial Streams: 300 feet on each side of the stream, measured from the bank full edge of the stream • Seasonally Flowing Streams (includes intermittent and ephemeral streams): 150 feet on each side of the stream, measured from the bank full edge of the stream • Streams in Inner Gorge: top of inner gorge • Special Aquatic Features or Perennial Streams with Riparian Conditions extending more than 150 feet from edge of streambank or Seasonally Flowing streams with riparian conditions extending more than 50 feet from edge of streambank: 300 feet from edge of feature or riparian vegetation, whichever width is greater • Other hydrological or topographic depressions without a defined channel: RCA width and protection measures determined through project level analysis. (SNFPA ROD).	4,366

Travel Management

2005 Travel Management Rule (36 CFR 212, 251, 261 and 295)

The Wildcat Project is designed to comply with the provisions of the 2005 Travel Management Rule 36 CFR 212, Subpart B to end cross-country travel and associated route proliferation, per the Plumas National Forests Public Motorized Travel Management Environmental Impact Statement Record of Decision (USDA 2010). The minor changes to the National Forest System (NFS) road network proposed in the Wildcat Project falls within the scope of this environmental analysis and comply with the criteria in the rule and decision.

Forest Service Manual Chapter 7710

Forest Service Manual Chapter 7710 provides direction to conduct transportation system planning and analysis using the best available science at the appropriate scale and in conjunction with other analyses to inform transportation management decisions. Ensure that road construction, reconstruction, and maintenance standards or criteria are guided by a roads analysis.

Other Relevant Assessments

This section describes documented assessments, the Moonlight Fire Restoration Strategy and the amended Diamond Landscape Assessment, that are pertinent to the development of the Proposed Action and the No-Action Alternatives being analyzed in this Draft EA.

Moonlight Fire Restoration Strategy (USDA 2013, version 1.0; August 17, 2013)

This fire restoration strategy outlines current and desired conditions to provide both a framework and target for restoration efforts; it also defines specific goals and objectives to focus restoration activities on resources affected by the Moonlight Fire, involving those within the Wildcat Project area. The Moonlight Fire had both direct and indirect impacts on a broad suite of ecological and cultural resources. As a result, the restoration goals, objectives, and activities proposed in this strategy are equally as broad; proposals range from maintaining and enhancing late seral forest habitat conditions for wildlife to restoring degraded stream conditions and engaging local communities in fire restoration.

Restoration strategies for many of the resources focus on areas or values directly impacted by the Moonlight Fire; for others it is necessary to consider the effects of the Moonlight Fire in the context of the broader landscape. The spatial and temporal effects of the Moonlight Fire provide the appropriate ecological context to assess the direct, indirect, and cumulative impacts on ecological values and services. The process to restore lost resources is proposed, as are measures to preserve the nearest adjacent values as a surrogate until the original area is restored.

Fire restoration opportunities carried forward in the environmental analysis for the Wildcat Project include:

- Assist the recovery of ecosystems that were degraded, damaged or destroyed by the Moonlight Fire;
- Result in more sustainable, resilient, and healthy ecosystems, with a focus on probable future conditions and climates in the restoration area;
- Consider the spatial and temporal relationship of fires on the landscape;

- ♦ Adopt an interdisciplinary landscape approach to accelerate the scale and pace of ecosystem restoration;
- ♦ Engage local communities to increase awareness and understanding of ecological restoration and fire-adapted ecosystems;
- ♦ Ensure the strategy and any subsequent proposed actions are linked to the restoration objectives laid out in the PNF LRMP (USDA 1988a) as amended by SNFPA ROD (USDA 2004a);
- ♦ Ensure alignment of the strategy and proposed actions with the Forest Service Ecological Restoration Framework; Region 5 Ecological Restoration Leadership Intent (USDA 2011a); and Forest Service Handbook (FSH) Chapter 2020 (Ecological Restoration, in prep.);
- ♦ Utilize current scientific knowledge for landscape restoration, including – where appropriate – information synthesized in PSW-GTR-220, An Ecosystem Strategy for Mixed Conifer Forests (North et al. 2009), and PSW-GTR-237, Managing Sierra Nevada Forests (North et al. 2012);
- ♦ Coordinate with the Lassen National Forest, which was also affected by the Moonlight Fire, to develop landscape-scale restoration activities; and
- ♦ Monitor the success of restoration efforts in the Moonlight Fire landscape and adapt the strategy when appropriate.

Diamond Landscape Assessment (USDA 2012)

The amended Diamond Landscape Assessment (USDA 2012) is incorporated by reference as pertinent to this environmental analysis, as the Wildcat Project area lies within the Antelope Lake (HUC6) watershed assessment boundary. This watershed scale was determined appropriate to compare existing and desired condition and identify opportunities and constraints for fuels-treatment and vegetation-management projects needed to implement the SNFPA fire and fuels strategy. The landscape assessment also identifies opportunities for other resource management needs in the watershed(s) for achieving desired conditions specified in PNF LRMP that might concurrently be met during implementation. The intent of landscape assessment is not to impose a rigid prescription for management actions, but to serve as a continuously-improved guide for adaptive management of the watershed(s) within the framework of land management direction per the 2004 SNPFA ROD, Appendix A, pp. 31-43 and 44-48, in addition to the PNF LRMP.

Decision Framework

The Plumas National Forest Supervisor is the Responsible Official and will use their discretion to decide whether to implement the Wildcat Project as proposed, or to not implement the project at this time.

Public Involvement and Tribal Consultation

The proposal was listed in the Plumas National Forest Schedule of Proposed Actions April 1, 2014.As part of the public involvement process, the agency held a public meeting to review preliminary project plans, discuss proposals, and answer questions prior to the start of project planning. A public meeting was held November 20, 2013 at the Mt. Hough Ranger District.

On January 23 and 24, 2013, a letter describing the proposed action (the "scoping" letter) was mailed to approximately 110 individuals and organizations, including local residents, federally recognized tribes and other Native American entities, and federal, state, and local agencies.

The 30-day Scoping period was initiated on January 29, 2014 and ended on March 14, 2014. On February 20, 2014 a Tribal meeting was held at Mt. Hough Ranger District and eight individuals representing tribal governments were present. Five comments were received during the scoping period.

On April 28, 2015, the Forest Service mailed a letter to 19 individuals and/or organizations announcing the thirty day comment period (April 22, 2015-May 22, 2015). A legal ad was published in the *Feather River Bulletin* on April 22, 2015. Five comments were received during the thirty day comment period.

Issues

In response to public outreach and scoping, the Mt. Hough Ranger District received written and verbal comments from meeting participants or phone conservation from local residents, individuals, regulatory organizations and interested parties. Five comments were received during the scoping period. Comments received are located at the Mt. Hough Ranger District and available upon request. The Interdisciplinary Team (IDT) reviewed these comments for relationships with potential for, or unintended physical, biological and social effects of proposed treatments; used by the IDT to refine the proposed action and as the basis to explore alternatives (refer to Alternatives Considered in Detail and Alternatives Considered but Eliminated from Detailed Study sections below).

Other relevant issues represent minor and/or non-variable consequences, which would be avoided, partially or fully mitigated by design criteria and operating procedure applied under the proposed action (typically applied as Best Management Practices administered under contract "B and C" provisions). These design criteria and operating procedures are disclosed in Chapter 2 (Alternative A) and throughout Chapter 3of this draft EA.

Non-substantive issues were defined by the IDT as those: (1) outside the scope of the proposed action; (2) already decided by law, regulation, Forest Plan, or other higher level decision; (3) irrelevant to the decision to be made; (4) conjectural and not supported by scientific or factual evidence; or (5) the comment could not be phrased as a cause-effect relationship. The Council on Environmental Quality (CEQ) NEPA regulations explain this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review… (Sec. 1506.3)." Non-substantive issues are disclosed in the project record at the Mt. Hough Ranger District in Quincy, California.

Alternatives Considered in Detail

Two alternatives were analyzed in detail: the Proposed Action and (Alternative A) and the No-Action (Alternative B).

Alternative A - Proposed Action

The Mt. Hough Ranger District of the Plumas National Forest (PNF) is proposing to apply prescribed burning in fire-adapted ecosystems along with strategically placed area mechanical and hand fuels reduction and vegetation management treatments, totaling approximately 3,053 acres; control of invasive plants totaling up to 30 acres; and watershed condition restoration treatments of 18 sites along National Forest System roads; and decommissioning a total of 6.1 miles of existing non- system and 0.72 miles of NFS roads, as displayed in Figure 4, Figure 5, 0, and Figure 7.

Fuels Reduction and Forest Health Treatments

Under the proposed action, concepts from PSW-GTR-220, *An Ecosystem Strategy for Mixed Conifer Forests* (North et al. 2009), and PSW-GTR-237, *Managing Sierra Nevada Forests* (North et al. 2012) would be applied as a step toward achieving an ecologically resilient landscape, recognizing the uncertainty of climate change and risk of future disturbances. Fuels reduction treatments aimed at reducing fire behavior were designed to complement forest health treatments, whereby residual forest stand tree species, stand densities and structure are within ecological limitations and variation.

Effective hazardous fuels treatments targeting the reduction of surface, ladder and crown fuels and creation of forest gaps (small scattered open areas also beneficial to promoting regeneration of shade intolerant tree species) would be applied strategically around critical wildlife habitats and avoid direct impacts to suitable aquatic and terrestrial habitats within reserves [Protected Activity Centers (PACs) and Riparian Conservation Areas (RCAs) along Boulder and Thompson Creeks.

Management treatments aim to retain important habitat characteristics within California spotted owl Home Range Core Areas (HRCAs) and RCAs with occupied aquatic species such as the Sierra Nevada yellow-legged frog, while reducing fuel hazards.

Within the Thompson Peak Semi-Primitive Area (USDA 1988a; pp. 4-88 – 4-90) and along scenic corridors, management treatments would enhance scenic integrity (quality and stability) achieving visual quality objectives (VQO) of Retention or Partial Retention. Coupled by reducing fuels likely to promote a catastrophic (high intensity) wildfire and managing forest vegetation to remove hazard trees, control insect and disease, and modify forest stand structure.

As aspen reproduce primarily by means of root suckering, a clone can occupy over 200 acres and have up to 50,000 genetically identical stems tracing back to a common heritage to a single aspen seedling germinated millennia ago (Barnes 1975). Because of this, once lost from the site, aspen is not easily re-established, in part, because successful reproduction from seed is rare due to the strict germination requirements of bare mineral soil, full sunlight, and constant moisture during the first year of growth. Management treatments target removing encroaching shade-tolerant tree species (conifers) from aspen forests surrounding meadow communities to perpetuate root suckering and tree vigor.

Prescribed fire would be applied where and when necessary to further reduce existing fuel accumulations and activity created slash aimed at restoring ecosystem processes; key to preserving healthy forests and habitats.

Treatment Descriptions

Dense forest canopies and ladder and surface fuels buildup would be reduced and re-distributed using ground-based equipment and mechanical thinning allowing for timber and biomass removal. Temporary road construction (2 miles) and use of approximately18 existing and 81 new landings are needed. . Use of 11 miles of existing temporary roads is needed to access proposed treatment areas. All temporary roads constructed as part of this project would be closed and rehabilitated after use.

Existing landings would be used when feasible to expedite operations to minimize soil disturbances associated with new landing construction. Prescriptions designating targeting residual basal area, canopy cover and tree densities to alter forest structure and composition would vary depending upon various site conditions including stand type, aspect and slope position, and land allocation. Activities proposed appropriate for timber sales and/or stewardship contracts include:

- Mechanical thinning treatments (approximately 2,571 acres) including approximately 177 acres within the Semi-primitive Non-motorized land allocation
- Aspen stand enhancement (approximately 336 acres)
- Biomass removal (includes chip and haul) (approximately 2,571 acres)

Surface and ladder fuels treatments spatially overlapping mechanically treated areas would be implemented as needed, to achieve prescription objectives. More than one method may be applied to the same area or one method may be reapplied until desired conditions are reached. For example, hand thin, pile and burn may be required as a pre-treatment to a subsequent prescribed burn, due to scattered heavy fuel concentrations. Activities proposed appropriate for service contracts, force account, and/or agreement include:

- Machine (grapple) pile (up to 1,751 acres)
- Spot planting of eastside pine (up to 1,700 acres)
- Hand thin, pile, and burn (from 213 acres to 2862 acres)
- Prescribed fire (102 - 2862 acres)

Mechanical and Hand (chainsaw) Thinning – Sawlog and Biomass Treatments

Mechanical thinning is a harvest activity that utilizes ground-based logging equipment to remove identified trees. Ladder and canopy fuels on approximately 2,571 acres would be removed. Trees too large to be harvested by mechanical equipment may be hand felled and bucked using chainsaw prior to moving them to the landing. Conifers ranging from 10.0 to 29.9 inches in diameter at breast height (DBH) would be removed and processed as sawlogs. All trees 30 inches DBH or larger would be retained, unless removal is required for safety or operability (e.g., new skid trails, landings, or temporary roads).

Biomass includes limbs and foliage, as well as smaller diameter material that can be cut; collected; chipped or ground; piled and burned; exported from the forest; used for power production or wood fiber products, and/or made available for firewood collection. Conifers ranging from 3.0 to 9.9 inches DBH may be removed as a biomass product. Biomass includes existing down wood where levels are above desired condition. Biomass will be mechanically thinned, rearranged and manipulated, piled and burned on approximately 292 acres. If biomass cannot be removed potentially 2,862 acres would be treated by hand thinning, pile and burn as a secondary treatment.   Biomass size conifers may also be treated on site through various mechanism including hand thin (using chainsaws), pile and burn; lop and scatter; mechanical pile and burn; or chip and haul.

Stumps in thinning units without annosus root rot present may be treated with the chemical borax to minimize spread of the disease; however thinning units with the disease already present may not have stumps treated. All stumps within developed recreation sites would be treated for annosus root rot.

Hand Thin, Pile, and Burn

Hand thinning is an activity that utilizes crews operating chainsaws to reduce ladder fuels by cutting understory vegetation that is greater than two feet in height and less than 9.9 inches DBH. Hand thinning is generally restricted to areas not feasible for mechanical treatment due to difficult access, sensitive resources, excessive slope, or type/size of vegetation being removed. Hand thinning, piling, burning, and/or chipping conifers are proposed on approximately 213 acres. Some hand thin treatments are proposed on 11 acres within the Semi- Primitive Non-motorized land allocation.   Piles within 100 feet of streams maybe constructed, but not burned, for yellow-legged frog habitat.

Table 2. Design Criteria and Mitigations by Forest Stand Type

Criterion	Actions
Eastside Pine	Thin trees to retain 30 percent of the existing basal area generally comprised in the largest trees. Retain all live conifers 30 inches DBHDBH or larger; exceptions may be allowed to meet needs for operability on a specific case basis. Preferably retain shade intolerant species where present, red fir over white fir, and vigorous disease- and insect-free individuals over declining individuals. Individuals showing signs of heavy root disease infection, dwarf mistletoe, or insect attack will usually be targeted for removal. Incorporate topography and aspect when determining leave trees. Generally, stands on ridge tops or higher in slope position would have fewer retained trees as compared to stand in lower slope position and/or drainage bottoms. In addition, stands with a more southerly aspect would have lower residual basal area as compared to stands with a more northerly aspect. Increase horizontal heterogeneity by retaining patches of large trees among the thinning matrix, with occasional openings to allow for small gap regeneration and recruitment. Patches will have higher densities and canopy covers than surrounding areas, while openings will have lower densities and more open canopies. Patches may range from a few to several larger individuals. Openings will resemble small scale disturbances such as individual large tree mortality and disease centers where a few individuals die, and where possible will be targeted in areas where shade intolerant species are present. Stand densities would generally be low, characteristic of active-fire ecosystems, especially on south-facing slopes and near ridge tops. Pine type stands would be primarily shade intolerant species with open canopy. Desired forest attributes include uneven-aged, multi-storied stands dominated by legacy structures composed of large, fire-adapted trees. Pine type stands would have open pockets of sparse canopy cover that promote the establishment and growth of fire-adapted and shade-intolerant species including ponderosa and Jeffrey pine, sugar pine, and aspen which would contribute to landscape heterogeneity and native plant species diversity. Young pine regeneration in the understory is desirable to increase structural diversity and create uneven-aged conditions. Tree densities and canopy cover would generally have been lower than in Sierran mixed conifer forests due to the lower precipitation levels and poorer site productivity, but would still have varied according to aspect. Basal area should generally range from 40 to 100 on average within eastside pine stands. Tree densities should generally range from 30-80 trees per acre. Low density stands reduce the amount of inter-tree competition which leads to the growth and development of larger trees that are healthier and more resilient to insects, disease, drought and fire. Disease and insect infection centers would be reduced to endemic levels and the creation of new centers would be prevented.
Dry Stands Mixed Conifer	On denser stands (4/5 M/D), thin trees to retain at least 40 percent of the existing basal area generally comprised of the largest trees. Thin trees to retain an average of 40 percent canopy cover, ranging from 30 to 50 percent, across the stands. On sparser stands (S/P density), thin trees to retain 30 percent of the existing basal area generally comprised in the largest trees Retain all live conifers 30 inches DBH or larger; exceptions may be allowed to meet needs for operability on a specific case basis. Preferably retain shade intolerant species where present, red fir over white fir, and vigorous disease- and insect-free individuals over declining individuals. Individuals showing signs of heavy root disease infection, dwarf mistletoe, or insect attack will be targeted for removal. Incorporate topography and aspect when determining leave trees. Generally, stands on ridge tops or higher in slope position would have fewer retained trees as compared to stand in lower slope position and/or drainage bottoms. In addition, stands with a more southerly aspect would have lower residual basal area as compared to stands with a more northerly aspect. Increase horizontal heterogeneity by retaining patches of large trees among the thinning matrix, with occasional openings to allow for small gap regeneration and

Criterion	Actions
	recruitment. Patches will have higher densities and canopy covers than surrounding areas, while openings will have lower densities and more open canopies. Patches may range from a few to several larger individuals. Openings will resemble small scale disturbances such as individual large tree mortality and disease centers where a few individuals die, and where possible will be targeted in areas where shade intolerant species are present. A heterogeneous landscape comprised of different seral stages and tree species in various ranges of density and canopy cover would be resilient to disturbance. Desired stand structure would vary according to topographic location, such as aspect, slope position, and site quality, creating high levels of horizontal and vertical diversity at the stand and landscape-scale. North facing slopes, true fir and dry mixed conifer stands would contain more shade tolerant species and higher canopy cover. Desired forest attributes include uneven-aged, multi-storied stands dominated by legacy structures composed of large, fire-adapted trees. Basal area should generally range from 100 to 140 on average with mixed conifer and true fir stands.
True Fir Stands	True fir stands would generally have similiar tree density as dry stand mixed conifer. More northerly facing aspects would contain higher densities of trees with more shade-tolerant species compared to open-canopied, south-facing slopes. Species preference would be different than dry mixed conifer stands. The emphasis is to enhance and restore true fir stands where red fir and white fir will be retained. However, minor species such as incense cedar or western white may also receive preference. On denser stands (4/5 M/D), thin trees to retain at least 40 percent of the existing basal area generally comprised of the largest trees. Thin trees to retain an average of 40 percent canopy cover, ranging from 30 to 50 percent, across stands. On sparser stands (S/P density) thin trees to retain 30 percent of the existing basal area generally comprised in the largest trees Retain all live conifers 30 inches DBH or larger; exceptions may be allowed to meet needs for operability on a specific case basis.
Aspen	Remove all conifers through a combination of mechanized equipment and chainsaw, up to 30.0” DBH (29.9” DBH or less). Large shade intolerant trees with desireable structurally characteristics that are less than 30.0 inches DBH may be retained on a specific case by case basis (See Structure Trees). Remove conifers around aspen stand to allow for maximum sunlight. Treat up to 150 feet within the aspen stand on the south and west facing aspects and up to 75 feet on the north and east facing aspects. No canopy cover or spacing guidelines would restrict removal of conifers. Temporary fencing may be placed to protect new shoots from browsing if needed. Within SNYLF 100 foot buffers: Remove all conifers up to 12” dbh with chainsaw methods. Conifers between 12” and 30” dbh may be felled or girdled, depending on site conditions. Trees felled would have the boles retained and the limbs and tops removed and piled for later burning. Piles to be burned would be built outside of the 100 foot SNYLF riparian buffer. Piles for wildlife retention inside of the 100 foot riparian buffer would be built with wildlife pile prescriptions and would not be burned. Follow up treatment for ground fuels may include prescribed fire; if conditions do not allow for prescribed fire to be conducted safely, fuels may be piled for burning. The District Archaeologist would be consulted when arborglyph sites are identified within aspen stands. Sites would be flagged and avoided following the Standard Protection Measures outlined in the Region 5 Programmatic Agreement (USDA 2013).

Table 3. Design Criteria and Mitigations Common to Mechanical Thin Operations

Criterion	Actions
Ground-based Harvesting and	Mechanical harvesting would be used to remove commercial sawlog and biomass trees. Tops and limbs would be yarded to the landing and removed as a product.

Criterion	Actions
Yarding	Ground-based equipment would be restricted to slopes less than 35 percent. Exceptions may be made for short pitches (100 feet) within the interior of units where slopes exceed these limits. When units have inaccessibly steep inclusions of steeper ground, sawlog and biomass products may be end-lined.
Landings	Landings would be utilized to remove sawlog and biomass products. The Wildcat Project is planned to accommodate product removal with one landing per 40 acres. Landings may exceed more than one per 40 acres when there is a need for more landings to limit resource protection problems. Existing landings shall be reconstructed and utilized considering the location and protect resources. Would construct new landings where existing landings are not present or are inadequate due to the location and protection of resources. For existing landings supporting cull decks, identify and relocate individual hollow log structures prior to cull deck construction. Relocate hollow logs to forest stand outside of landing disturbance area. Removal of green trees would occur to allow for temporary non-system road and landing construction.
Road closures and logging traffic	Sign all haul routes to alert drivers of hauling and logging activities around the Antelope Lake Recreation Area, particularly the intersection of campgrounds, the boat launch, and trailheads. A key location for a logging traffic alert sign is at the intersection of Plumas County roads 112 and 207 in Taylorsville near the rodeo grounds. Alternate routes may be required due to season events or road restrictions and/or closures.
Residual species preference	Retain the largest, most vigorous dominant and codominant trees to create a residual stand that would be comprised of larger fire-resilient trees. Species preference would be determined by forest type. In general, prefer to retain shade-intolerant species including rust-resistant sugar pine, Western white pine, black oak, ponderosa and Jeffery pine, and Douglas-fir.
Residual surface fuels	Maintain adequate cover of surface fuels, litter, duff, and large woody debris to maintain habitat values, reduce potential erosion, and meet soil standards for woody debris and ground cover. Retain surface fuels (less than 12 inches diameter) at a level that would result in projected flame lengths of less than 4 feet under 90th percentile weather conditions. This generally corresponds to approximately 5 tons or less of surface fuels per acre depending on the forest type. In mixed conifer stands, retain large woody debris (greater than 12 inches diameter), of the largest down logs at six logs per acre. Where needed, jackpot burn, or machine pile and burn extensive areas of deadfall, where feasible, in terms of equipment operability and reduced chance of excessive scorch-related mortality upon burning of these piles. In pine stands,retain three of the largest down logs per acre. Based on post treatment evaluations, underburn, jackpot burn, machine pile and burn, and/or hand thin, pile, and burn to treat natural and activity-generated fuels.
Snag retention	Retain the number of snags per acre appropriate for each forest type unless removal is required to allow for operability. In Sierra mixed conifer types and ponderosa pine forest types, retain four of the largest snags per acre. Snags larger than 15 inches DBH and 20 feet in height would be used to meet this guideline.
Treatment of Stumps	In fuel treatment areas, conifer stumps 14 inches and greater in diameter would be treated with borax within one day of cutting, to prevent the introduction and spread of Heterobasidion root disease.
Structure Trees	Retain and protect high value wildlife habitat trees (trees with multiple tops, broken tops, rot, cavities, and other formations) that create structure for nests and dens.
Spotted Owl Habitat Protection	Limited Operating Periods (LOPs) would be implemented within 0.25 mile of an active nest from March 1 to August 31. No heavy equipment operations or tree felling will be allowed during the LOP. The LOPs are expected to eliminate effects from increased human activity and equipment noise.

Criterion	Actions
Goshawk Habitat Protection	Limited Operating Periods (LOPs) would be implemented to prevent disturbance within 0.25 mile of active nest sites from February 15 to September 15. No heavy equipment operations or tree felling will be allowed during the LOP. The LOPs are expected to eliminate effects from increased human activity and equipment noise.
Semi-Primitive Non-Motorized Land Allocation	Post operations after operations completed obliterate landings by subsoiling, recontouring and replanting. Temporary roads will be obliterated by subsoiling, recontouring, replanting and closure with barrier. Any damage from vehicles and other disturbances resulting from the removal of vegetation would be repaired. Landings will be screened from the road or whenever possible placed outside of the semi-primitive area. Skid trails will not be visible from roads in or adjacent to semi-primitive areas. Use special cutting methods such as flush cutting stumps and tree spacing that promotes a park-like look. Special cutting methods will be used along roads adjacent or in Semi-Primitive area using an 80-foot buffer along the roads. Coordinate with recreation staff on district prior to marking semi-primitive area.
Antelope Lake Recreation Area	Restrict hauling to weekdays only within Antelope Lake Recreation Area, on NFS road 28N03 to NFS road 29N43 and Antelope Lake Dam. No hauling on holidays from Memorial Day thru Labor Day weekend.
Yellow legged Frog Habitat Protection	No heavy equipment allowed within 100 feet of streams that have frogs (includes harvest equipment, road building equipment, mastication equipment, etc.) Chainsaw thinning allowed within the inner RCA, but no piling of material within 100 feet of stream (to prevent frogs choosing to hibernate in piles and then getting burned up). Wildlife piles that will not be burned may be constructed within 100 feet of occupied streams. Chainsaw thinning would be restricted to summer season when frogs are in streams, and not in uplands. All aspen treatments with same Rx as mech thin (i.e. no mechanical treatment within 100 feet of streams and wet meadows). No prescribed fire within 100 feet of occupied streams. No pile burning within 100 feet of occupied streams. End-lining will be allowed within aspen stands where excess logs greater than 10” DBH need to be removed to achieve resource objectives. End lining from 33 to 100 feet of the stream will only be allowed during the summer season (April 16 – Oct 31) when frogs are restricted to within 10 meters of streams. No end lining will be allowed within 10 meters (33 feet) of live streams.

Prescribed Fire

Prescribed fire is an underburn under an existing canopy of trees designed to reduce excessive live and dead vegetation. Prescribed fire is proposed on approximately 102 acres, as well as a potential follow-up treatment on approximately 2,862 acres. Prescribed burning would be initiated based on carefully designed prescribed burn plans and in accordance with State Air Quality Control Board burn restrictions. Existing roads, natural fire breaks, snow, or hand constructed firelines would be used around prescribed fire units.

Occasional broadcast burning may occur along with the potential follow-up treatments of prescribed fire. Firelines would be constructed using hand crews or mechanical equipment around areas to be underburned, machine piles or hand piles, as needed. Existing roads, landings, skid trails, rock fields, bare areas, and other features would be used as containment lines, where logical and feasible.

Invasive Plant Species Treatments

The following site-specific treatments of invasive plant species are targeted at eradicating or controlling known invasive plant infestations in order to preserve native plant species, including Forest Service Special Interest species. These treatments will be implemented primarily through service contract starting in 2016. Two herbicides are proposed for use (aminopyralid and imazapyr) on identified invasive plant infestations (up to 30 acres) with supplemental manual treatments proposed.

Treatment Description

Three invasive plant species of high management concern would be contained, controlled, or eradicated primarily through herbicide treatments, with a small amount of manual treatment. Herbicide treatment would include aminopyralid (e.g. Milestone) for Canada thistle and imazapyr (e.g. Arsenal) for the annual grasses medusahead and jointed goatgrass. To improve herbicide efficacy (i.e., help the herbicide stick to and penetrate the plant tissues), a modified vegetable oil surfactant will be added at label rates. To improve application efficiency and minimize over-treatment, a water soluble marker dye will be added at label rates. Herbicide would be applied using directed spray techniques with backpack-type sprayers or select application techniques, such as wicking or low pressure hand sprayers, within designated buffer areas to protect aquatic and wildlife resources. No aerial application of herbicide is being proposed for this project.

Manual treatment techniques would include digging and hand pulling and would be directed at medusahead and jointed goatgrass as a supplement to herbicide use.

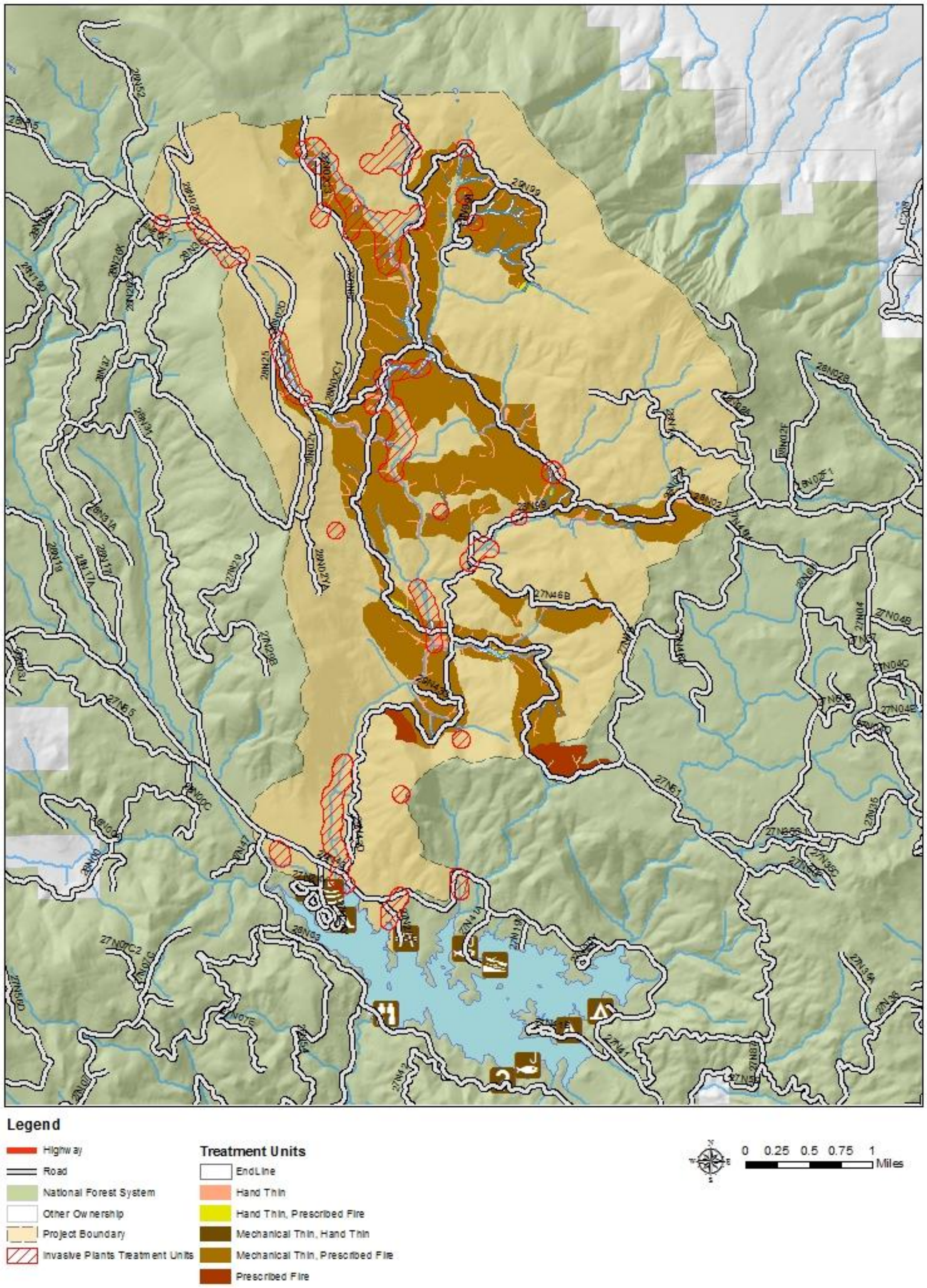


Figure 4. Locations of proposed invasive plant treatment units.

Table 4. Design criteria and Mitigations for Invasive Plants

Criterion	Actions
Prevent spread of invasive species with equipment	Clean vehicles and equipment prior to entering project area. Use Forest Service approved vehicle and equipment cleaning requirements and or standards prior to using on National Forest System roads or lands.
Prevent introductions due to infested materials	Use weed free mulches and seed sources. Avoid seeding in areas where re-vegetation will occur naturally, unless invasive plant species are a concern. Save topsoil from disturbances and put it back to use onsite unless contaminated with invasive weed species.
Staging areas	Do not stage crews, materials, or equipment in areas infested with invasive plant species, including landings.
Sierra Nevada yellow-legged frog (SNYLF) habitat protection	Treatment of invasive plants with herbicides would be restricted within 500 feet of occupied streams. Direct spray may would be allowed between 107 feet and 500 feet from occupied sites where site specific treatment is analyzed and determined to have no or negligible risk. Treatment of invasive species with herbicides would be limited to select methods within 107 feet of stream reaches designated as suitable SNYLF habitat. Select treatment methods, such as wicking herbicide directly onto plant leaves or use of low pressure hand sprayers, would be required where overspray may enter water bodies and when amphibians may be present. Select methods would be required where and when direct spray of frogs is possible. Herbicide methods, restrictions and LOPs would be incorporated into site specific invasive plant treatment cards.
Western bumblebee protection	Invasive species would be treated prior to flowering to minimize the risk that Western bumblebees are not present on plants during herbicide application.
Protection of botanical resources	No backpack spraying within 25 feet of Sensitive or Special Interest plant species. This buffer may be reduced if the Sensitive or Special Interest plants are covered/shielded during spraying, or if select application is used, or in consultation with a staff botanist.
Adjuvants for improved herbicide efficacy	To improve efficacy, a modified vegetable oil surfactant will be added to herbicide mixtures at label rates. To improve efficiency of application, a water soluble marker dye will be added to herbicide mixtures at label rates.
Timing and Frequency of Herbicide Application	Each site will be treated 1-2 times per year for 2-5 years. Canada thistle will be treated with aminopyralid in early to late summer, prior to flowering. Medusahead and jointed goatgrass will be treated in late summer to fall with aminopyralid as a pre-emergent herbicide, and in spring to summer with imazapyr, during active growth and prior to seed set.
Protection of human health	No herbicides will be applied on weekends or holidays to minimize impacts to recreation. To ensure members of the public do not enter treated areas during label reentry intervals, applicators will remain in or near treated areas until the application solution is fully dry. (This is the reentry interval for all herbicides and adjuvants proposed for use in this project.)
Location of Herbicide Application: Spread of Invasive Species	Due to the ability of invasive species to spread rapidly, each mapped invasive species treatment location is buffered to accommodate for spread in the years between survey and implementation. Any spread of the infestation within this area will be treated as described in the Proposed Action and Project Design Features.
Location of Herbicide Application: Aquatic Buffers	When not within SNYLF suitable habitat, the following herbicide application buffers will apply for backpack sprayers: Aminopyralid: 25 ft. for perennial streams or Special Aquatic Features; 10 ft.

Criterion	Actions
	for intermittent/ephemeral streams and wetlands. Imazapyr: 25 ft. for perennial streams, Special Aquatic Features, and intermittent/ephemeral streams and wetlands. When not within SNYLF suitable habitat, the following herbicide application buffers will apply for select application: Aminopyralid: 10 ft for perennial streams or Special Aquatic Features; no buffer required for intermittent/ephemeral streams and wetlands when surface water is not present. Imazapyr: 25 ft for perennial streams and Special Aquatic Features; no buffer required for intermittent/ephemeral streams and wetlands when surface water is not present. No buffer required for manual treatment such as hand-pulling.

Watershed Enhancement Treatments

The following improvements and minor changes to PNF transportation system target areas of non-point source pollution (sedimentation) into streams degrading water quality and habitats, which would be implemented concurrent with fuels reduction and vegetation management activities (stewardship and/or service contracts):

- Close and decommission a NFS, maintenance level 1 road (0.72 miles)
- Obliterate unclassified road segments (6.1 miles)
- Reconstruct four water drafting sites
- Construct or reconstruct 29 dips to improve drainage
- Construct three armored stream crossing

Road Treatments-Improvement and Reconstruction

A common activity is the installation of road dips to better disperse runoff from road surfaces and to frequently relieve roadway ditches to reduce the total length of ditches that flow to stream channels. The placement of 2-3 inch diameter rock armor (or larger, as needed to extend the functioning life of the armoring) may be necessary at the outlet of the dip to dissipate erosive potential where erosion hazard is high. Additional improvements may include outsloping road segments or replacing culverts.

National Forest System (NFS) roads 29N43, 27N46, 28N02, 28N02C, and 29N99, (project area contains approximately 30 miles of road) would be treated by addressing priority locations and segments where road-generated sediment is delivered to stream channels.

Road Treatments, Decommission

Decommissioning will block the ends of the roads to traffic and may include culvert removal, narrowing the road prism by sub-soiling, re-vegetation, and removing fill from stream crossings.

One NFS road segment within the project area has been identified as unneeded for management and are impacting resources. The southern 0.72 mile section of NFS road 28N99 is proposed for decommissioning but not to be obliterated as it is a heritage resource.

Road Treatments-Unclassified and Temporary road Obliteration

Obliteration would include, at the least blocking the ends of the roads to traffic, but may include culvert removal, sub-soiling, re-contouring, re-vegetation, and removing fill from stream crossings. Some of these routes may first be used during the project activities. Temporary roads constructed as part of this project would be closed with a constructed barrier after use. Temporary road surfaces would be subsoiled to a depth of 18 inches to restore hydrologic function and the road area would be re-contoured to match slopes of the surrounding natural landscape.

Road Treatments-Water Drafting Sites

Four water drafting sites in the project area would be reconstructed and brought up to best management practice standards. This may include installing permanent, underground, vault water containers or constructing ponds located off of active stream channels, installing bump logs, and surfacing and outsloping parking pads and access routes.

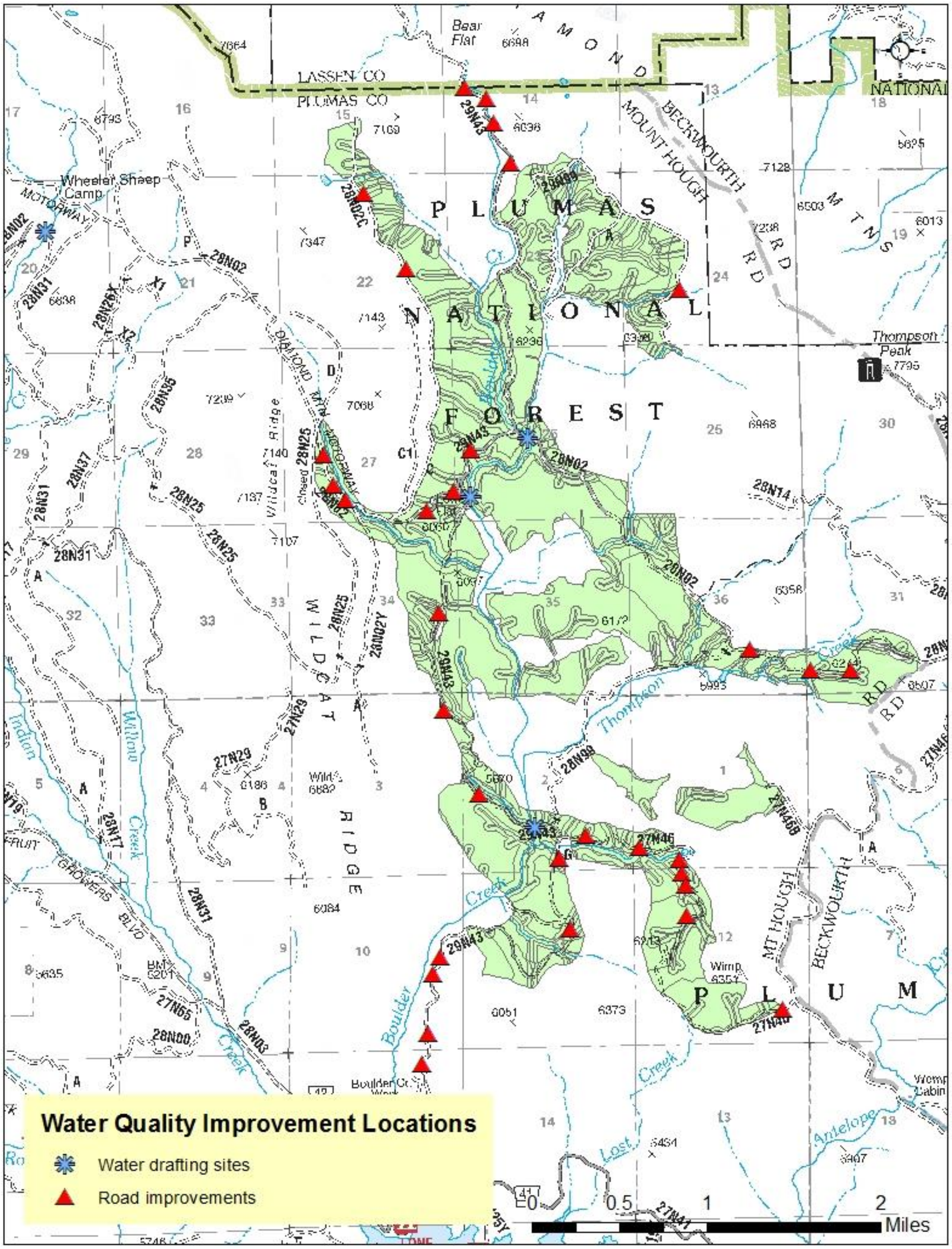


Figure 5. Watershed Enhancement Treatment locations including water drafting sites and road improvements.

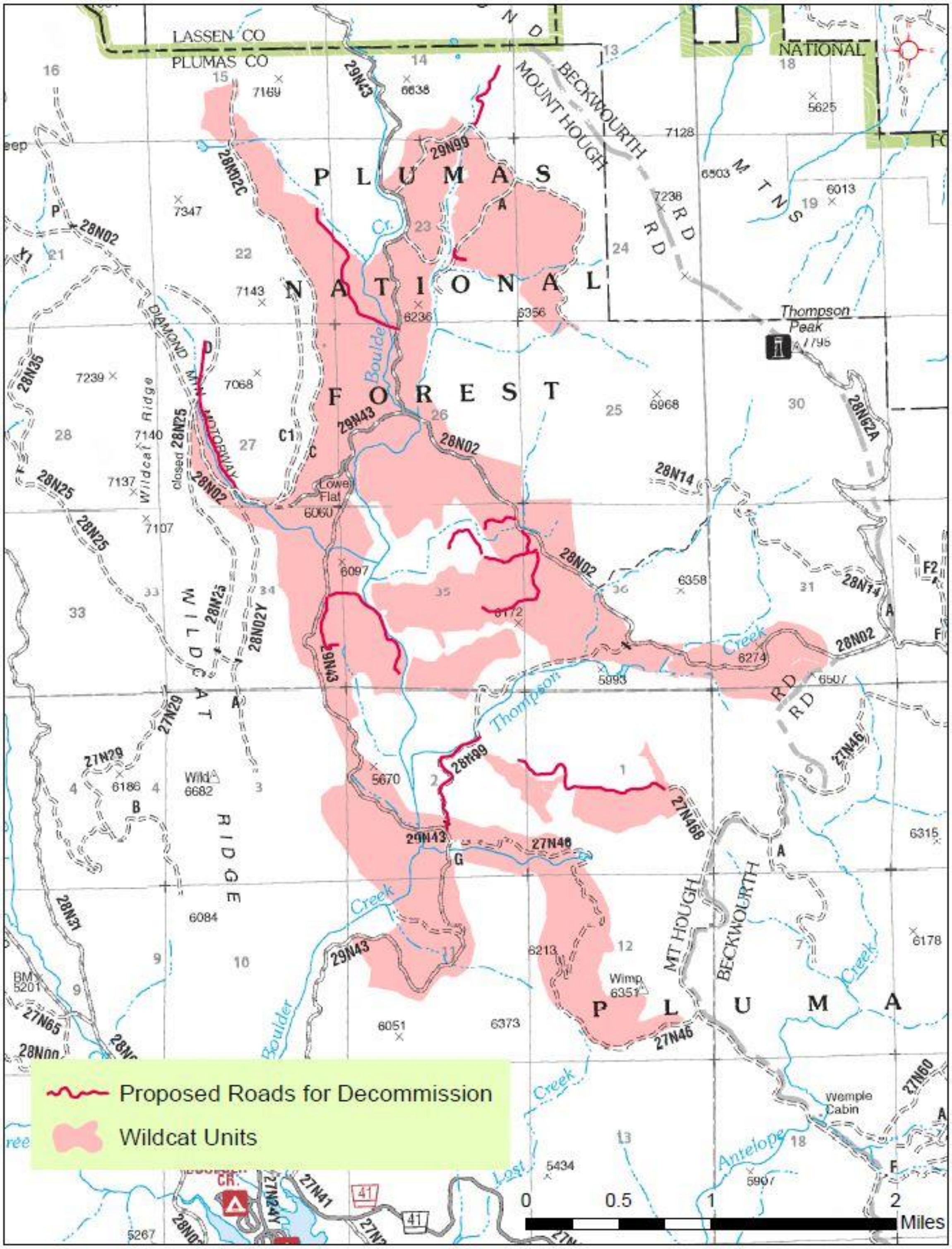


Figure 6. Watershed enhancement treatment locations including road decomissioning.

Within Riparian Conservation Areas (RCAs)

The RCA widths listed below would be the maximum buffer width identified for each stream type. Table 5 also displays an additional buffer (inner buffer or equipment exclusion zone) within the RCA guideline buffer.

For example, there is a perennial fish bearing stream within a treatment unit-a 300 foot buffer is applied. Within that 300 foot buffer, approximately 70 feet from the edge of the active channel, the slope is 22 percent; a 100 foot inner buffer is applied. From the edge of the active channel no equipment can enter the RCA for 100 feet. Equipment can enter the remaining 200 feet of the 300 foot total buffer. When the slope within the RCA guideline buffer is greater than 35 percent, no mechanical equipment is allowed to enter the RCA. For example, there is a perennial stream within a treatment unit- a 300 foot buffer is applied. Within that 300 foot buffer, approximately 100 feet from the edge of the active channel, the slope is 38 percent; no equipment is allowed within any portion of the 300 foot buffer that exceeds 35 percent slope. 37

Table 5. Riparian Conservation Area Treatment Design Criteria by Stream Type

Stream Type	Riparian Conservation Area (RCA) widths	Minimum distance to burn pile	Equipment Exclusion Zone	
			Slope <35%	Slope >35%
Perennial, frog bearing, streams	300 feet	100 feet	100 feet	Excluded
Intermittent, frog bearing, stream	150 feet	100 feet	100 feet	Excluded
Intermittent stream	150 feet	25 feet	50 feet	Excluded
Ephemeral stream	100 feet	15 feet	25 feet	Excluded
Special Aquatic Features (Reservoirs, wetlands, fens, and springs)	300 feet	25 feet	50 feet	Excluded

Table 6. Riparian Conservation Area Treatment Design Criteria Mitigation Measures

Criterion	Actions
RCA Equipment constraints	No mechanical equipment operations on slopes steeper than 35 percent. Establish equipment exclusion zones adjacent to stream channels according to Table 5 below. Allow equipment to travel into the outer RCA zone to harvest trees and bring them to skid trails. Locate skid trails at angles to stream channels that minimize erosion into the channel, and allow skidders to back in to the outer RCA on these skid trails. To minimize soil displacement, no equipment would be permitted to turn around while off a skid trail in RCAs. Endlining may be allowed, depending upon site conditions. Excessive soil displacement i.e. "furrowing" caused by endlining will be mitigated or repaired by the operator. Allow endlining of merchantable material, hand thinning and hand piling, and/or lop and scatter treatments in areas where equipment is excluded.
Diameter constraints	Within mechanical harvest areas, implement a 30-inch upper diameter limit, except where needed for operability.
Residual species preference	Where present, retain all hardwood and riparian species. Retain the largest, most vigorous dominant and codominant trees to create a residual stand that would be comprised of larger fire-resilient trees. Species preference would be determined by forest type. In general, prefer to retain shade-intolerant species including rust-resistant sugar pine, black oak, ponderosa and Jefferey pine, and Douglas-fir.
Snag retention	Retain the number of snags per acre appropriate for each forest type unless removal is required to allow for operability. In Sierra mixed conifer types and ponderosa pine forest types, retain four of the largest snags per acre. Snags larger than 15 inches DBH and 20 feet in height would be used to meet this guideline.
Fireline	Construct firelines using hand crews around areas to be underburned or around handpiles burned, as needed. Incorporate existing roads, landings, skid trails, rock fields, bare areas, and other features into containment lines where logical and feasible.
Residual surface fuels	Based on post treatment evaluations, underburn, broadcast burn, machine pile and burn, and/or hand pile and burn to treat natural and activity-generated fuels within the equipment restriction zone.

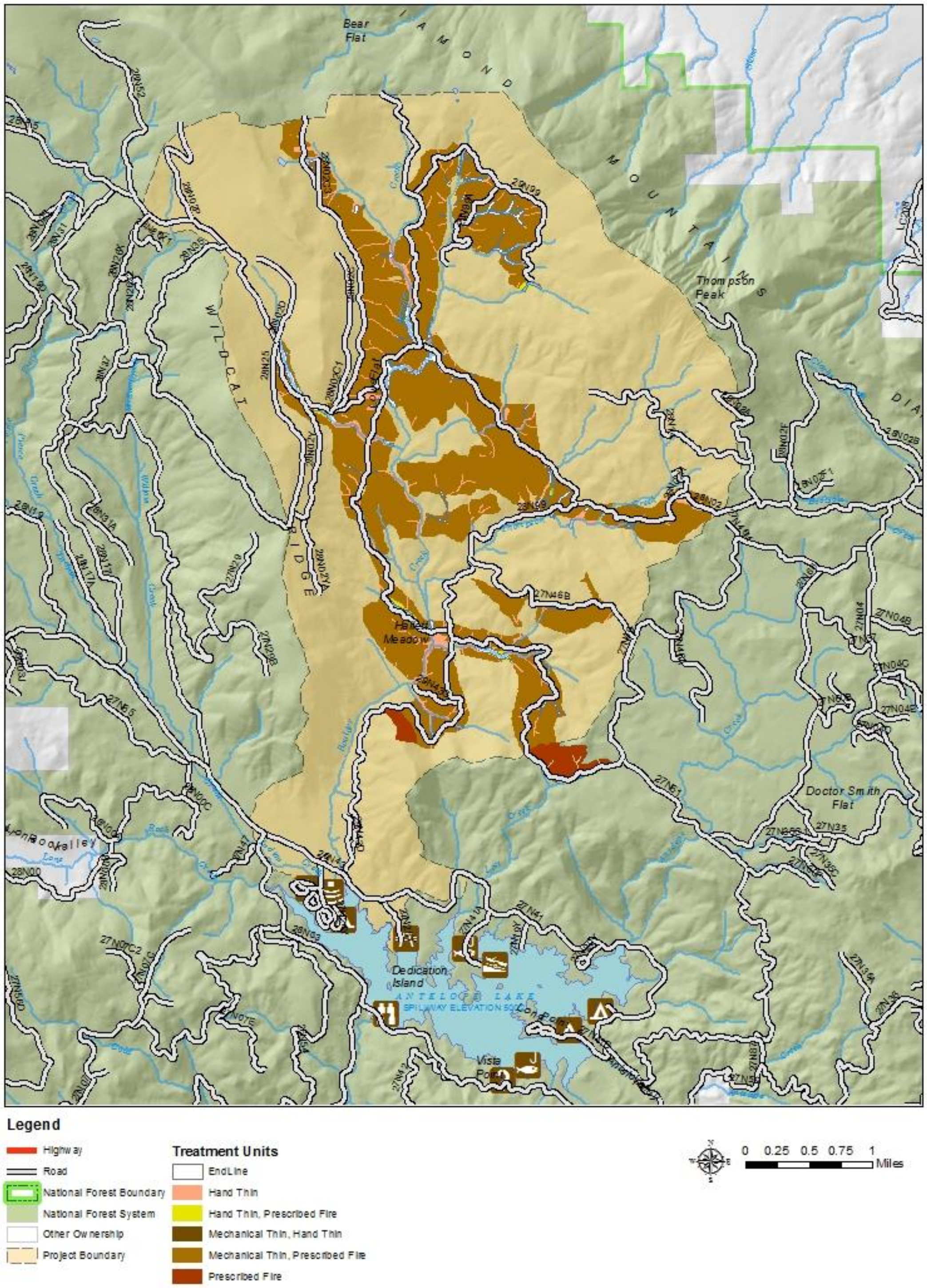


Figure 7. Alternative A. Proposed Action Treatment

Alternative B: No-Action

The No-Action Alternative provides a baseline for comparing the proposed action. Under the No-Action Alternative, proposed fuels reduction, vegetation management, treatment of invasive plants and road improvements would not occur. The Moonlight Strategy and associated ecological restoration goals emphasized by Ecological Restoration Regional Leaderships Intent would not be realized in the Wildcat Project area at this time.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14).

Enhance Outdoor Recreation

On November 20, 2013, a public comment was provided requesting the Forest Service to consider adding motorized trails to the Off-Highway Vehicle (OHV) trail system, which would supplement the present network authorized by the Plumas National Forests Public Motorized Travel Management Environmental Impact Statement and Record of Decision (USDA 2010) (per 2005 Travel Management Rule 36 CFR 212, Subpart B). This commenter suggested converting the 6.1 miles of unclassified road segments proposed for obliteration and the 0.72 miles National Forest System (NFS) road 28N99 (maintenance level 1) planned for closure and decommission under the Wildcat Project, to OHV motorized trails instead. The commenter also recommended adding two roads to the OHV trail system, used to access dispersed camping around Hallett Meadow.

On March 5, 2014 (during the scoping period), another public comment supporting improvements to the OHV motorized trail system was submitted, recommending adding NFS roads 28N99 and 27N46B to the OHV motorized trail system along with mitigating soil erosion impacts to water quality, rather than being rehabilitated by decommissioning as proposed under the Wildcat Project. Also, the commenter requested the Forest Service analyze all the very popular dispersed campsites along NFS road 28N03 directly west of Antelope Lake and of the horse camp road near the intersection of NFS roads 28N03 and 28N31; used for generations by the Indian Valley Riding and Roping Club as well as other equestrians. The commenter indicated Antelope Lake area is a very popular recreation area and their interest in preserving as many roads and trails as possible for public use.

An alternative to enhance outdoor recreation was considered by the Forest Service, but eliminated from detailed study as further development of OHV motorized trails system was deemed outside the scope of the purpose and need for the Wildcat Project. Rather, the purpose and needs targets reducing hazardous fuels accumulations, improving forest health, controlling invasive plants and enhancing watershed conditions.

The IDTs review of the commenters suggested motorized use of roads were found to be within or have segments that lie with Riparian Conservation Areas (RCAs), some occupied by sensitive wildlife species. The SNFPA goal is to protect and restore desired conditions of aquatic, riparian and meadow ecosystems and provide for the viability of species associated with those ecosystems (USDA 2004a, p. 10). For this reason, environmental impacts such as increased engine noise, near stream erosion from tire ruts, increased risk of human fire ignition was considered inconsistent with Riparian Conservation Objectives (RCOs) designed to meet Clean Water Act and CA State water quality standards in the 2004 Record of Decision (ROD) to the Sierra Nevada Forest Plan Amendment (SNFPA) Final Supplemental EIS (FSEIS) (p.62-66)..

Riparian conservation objective (RCO) 103 states, "Prevent disturbance to streambanks and natural lake and pond shorelines caused by resource activities (for example, livestock, off-highway vehicles, and dispersed recreation) from exceeding 20 percent of the stream reach … Disturbance includes bank sloughing, chiseling, trampling, and other means of exposing bare soil or cutting plant roots" (USDA 2014a, p. 63).

The Forest Service review of NFS road 28N99 to determine feasibility of converting it to an OHV motorized vehicle trail, revealed this road is designated as an historic wagon road per Section 106 of the National Historic Preservation Act (NHPA) of 1966, with several intact segments. In response to public interest and concern for mitigation impacts to historic features, the proposed action plans to close, rather than decommission this road segment, allowing for a separate comprehensive environmental analysis of effects linked to OHV use in this area.

Environmental Impacts of the Proposed Action and No-Action Alternative

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 alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in the chart above.

Affected environment sections have been divided by resource areas, where as environmental consequence sections have been divided by resource areas and then by alternative, where is some cases, action alternatives are grouped. Further, effects analyses that are required by law are discussed per alternative.

This chapter describes aspects of the environment likely to be affected by the proposed action and alternatives. Also described are the environmental effects (direct, indirect, and cumulative) that would result from undertaking the proposed action or alternative. Together, these descriptions form the scientific and analytical basis for the comparison of effects in Chapter 2.

The following resource specialist analyses are incorporated by reference: A Cultural Resource Inventory of the Wildcat Fuels Reduction and Vegetation Management Resurvey Project Area, ARR# 02-12-2013 (Doug Baughman)(USDA 2013b); Wildcat Fuels Reduction and Vegetation Management Project Forest Vegetation Report (Maurice Huynh)(USDA 2014a); Biological Assessment/Biological Evaluation for Terrestrial and Aquatic Wildlife Species for Wildcat Fuels Reduction and Vegetation Management Project (Colin Dillingham)(USDA 2014b); Management Indicator Species Report for the Wildcat Fuels Reduction and Vegetation Management Project (Colin Dillingham)(USDA 2014c); Migratory Bird Species Report for Wildcat Fuels Reduction and Vegetation Management Project (Colin Dillingham)(USDA 2014d); Botanical Report on Special Interest Species for the Wildcat Fuels Reduction and Vegetation Management Project (Japhia Huhndorf)(USDA 2014e); Invasive Plant Species Risk Assessment for the Wildcat Fuels Reduction and Vegetation Management Project (Japhia Huhndorf)(USDA 2014f); Recreation, Lands, and Scenic Resources Report for the Wildcat Fuels Reduction and Vegetation Management Project (Erika Brenzovich)(USDA 2014g); and A Cultural Resource Inventory of the Wildcat Hazardous Fuels Reduction 2014 Resurvey Project Area ARR # 02-15-2014 / R2014051102015 An Addendum to A Cultural Resource Inventory of the Wildcat Fuels Reduction Resurvey Project Area (ARR# 02-12-2013 / R2013051102012)(USDA 2014h).

Resources that were not impacted and therefore not further analyzed include range resources.

Past, Present and Reasonably Foreseeable Actions

According to the Council on Environmental Quality (CEQ) National Environmental Policy Act (NEPA) regulations, “cumulative impact” is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions (40 CFR §1508.7).

In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects.

This cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for not taking this approach. First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions over the last century (and beyond), and trying to isolate the individual actions that continue to have residual impacts would be nearly impossible. Second, providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the proposed action or alternatives. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because there is limited information on the environmental impacts of individual past actions, and one cannot reasonably identify each and every action over the last century that has contributed to current conditions. Additionally, focusing on the impacts of past human actions risks ignoring the important residual effects of past natural events, which may contribute to cumulative effects just as much as human actions. By looking at current conditions, we are sure to capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects. Third, public scoping for this project did not identify any public interest or need for detailed information on individual past actions. Finally, the Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, “agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions.”

The cumulative effects analysis in this EA is also consistent with Forest Service National Environmental Policy Act (NEPA) Regulations (36 CFR §220.4(f)) (July 24, 2008), which state, in part:

> “CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonable

> foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making. (40 CFR §1508.7)"

In determining cumulative effects, the past, present, and future actions displayed in Appendix D were added to the direct and indirect effects of the proposed action and alternatives.

Fire and Fuels

Introduction

Dominant within the wildcat landscape are the impacts of recent high severity wildfires (Figure 8). Fuels reduction and forest restoration treatments proposed under the Wildcat project will be critical to maintaining healthy, productive, and sustainable resources within the area.

Effects Analysis Methodology

Potential fire behavior and effects of alternatives were modeled pre-treatment and post-treatment with the use of a variety of computer programs including:

ArcMap 10.1

ArcMap is a Geographic information System (GIS) and was used to describe many landscape conditions such as fire history and fire regimes.

FlamMap 5.0

FlamMap was used to predict landscape fire behavior utilizing data provided by the US Geological Survey under the program called Land Fire.

The Forest Vegetation Simulator

The Forest Vegetation Simulator (FVS) is a family of forest growth and yield simulation models. It is a system of highly integrated analytical tools that is based upon a body of scientific knowledge developed from decades of natural resources research and experience. This program utilizes Common Stand Exam data collected on live and dead trees, ground fuels, and assigned fuel models. The output data reflects fire modeling assumptions (weather, fuel model characteristics, and spatial variability) and variability within the common stand exam plots. The Fire and Fuels Extension (FFE) of the Forest Vegetation Simulator (FVS) were used to model predicted potential fire behavior.

Fire Family Plus

Fire Family Plus is a widely used software program for summarizing and analyzing historical daily fire weather observations and computing fire danger indices based on the National Fire Danger Rating System (NFDRS). For this analysis, the modeling of potential fire behavior was done under 90th percentile weather conditions meaning the most severe 10 percent of the historical fire weather conditions occurring during the fire season. These outputs are entered into FVS and FlamMap described above. For this exercise the Pierce Remote Automatic Weather Station (RAWS) was used. This weather station is 1.5 miles to the west of the project area at 5,811 feet in elevation.

Table 7. Ninetieth percentile fire weather fuel moistures and winds calculated for the Pierce weather station. Fire season used was from July 1 through October 1, 2004 through 2013.

1hr	10hr	100hr	1,000hr	Herbaceous	Woody	20 foot wind speed (MPH)	Direction (degrees)
2	4	7	11	34	103	18	225

Some important measurement indicators for fuels and potential fire behavior include; flame length, potential torching, crowning index, canopy base height, and percent basal area mortality. These indicators are described below:

Flame Length

The predicted length of flame measured in feet. Flame length is influenced in part by fuel type, fire type (surface or crown fire), and weather conditions. Together, flame length and fuel type influence the rates at which firelines can be safely and effectively constructed by different fire resources, including fire fighters, bull dozers, and aerially delivered fire retardant (Table 8). The 2004 SNFPA ROD provides direction that the desired condition for fuel treatments include flame lengths at the head of the fire less than 4 feet (USDA 2004b).

Table 8. Fire behavior Hauling chart; tactical interpretation for flame length.

Flame Length	Interpretation
Less than 4 feet	 Fires can generally be attacked at the head or flanks by firefighters using hand tools. Handline should hold fire.
4 to 8 feet	 Fires are too intense for direct attack on the head with hand tools. Handline cannot be relied on to hold the fire. Dozers, tractors-plows, engines and retardant drops can be effective.
8 to 11 feet	 Fires may present serious control problems: torching, crowning, and spotting. Control efforts at the head will probably be ineffective.
Over 11 feet	Crowning, spotting, and major fire runs are probable. Control efforts at the head of the fire are ineffective.

Potential Torching

The probability of torching occurring under 90th percentile weather conditions as predicted by FFE. This is the probability of finding an area of the stand where torching can occur. A torching situation is generally defined as one where tree crowns of large trees can be ignited by a surface fire or flames from burning crowns of small trees that reach the larger trees. Probability of torching is the proportion of areas where trees are present and torching is possible (Rebain et al. 2010).

Crowning index

The open wind speed at which an active crown fire is possible, given the stand's canopy bulk density and the fire weather conditions.

Canopy Base Height

Average height from the ground to the lowest level of the forest stand's canopy. Represents the lowest height in a stand at which there is a sufficient amount of forest canopy fuel to propagate fire vertically into the canopy.

Percent Basal Area Mortality

The potential tree mortality as measured by the percent of basal area that would be killed in a fire event occurring under 90th percentile weather conditions as predicted by FFE (Reinhardt and Crookston 2003, Rebain et al. 2010). "The probability of mortality is based on bark thickness and percent crown volume scorched, which are derived from scorch height, tree height, crown ratio, species, and tree diameter" (Carlton 2004) . The mortality calculation uses established calculation methods (Reinhardt and Crookston. 2003).

Affected Environment

Fire Regimes and Fire History

The dry forest types of the Sierra Nevada are some of the most fire-prone and fire adapted ecosystems in the Nation. Fire has long been recognized as a natural and predictable disturbance and a major ecological process shaping forest structure and function in the Sierra Nevada (Fites-Kaufman et al. 2007, Franklin and Fites-Kaufman 1996, McKelvey et al. 1996). Moody et al. (2006) estimated mean fire return intervals ranging from 6.1 to 14.8 years near the Wildcat project area (Figure 10). These past fire cycles periodically reduced fuel accumulations, and thinned conifer stands with the majority of mortality induced at the seedling and sapling stages. As fire interacted with weather, topography and fuels, a rich mosaic of forest conditions were created (North et al. 2009).

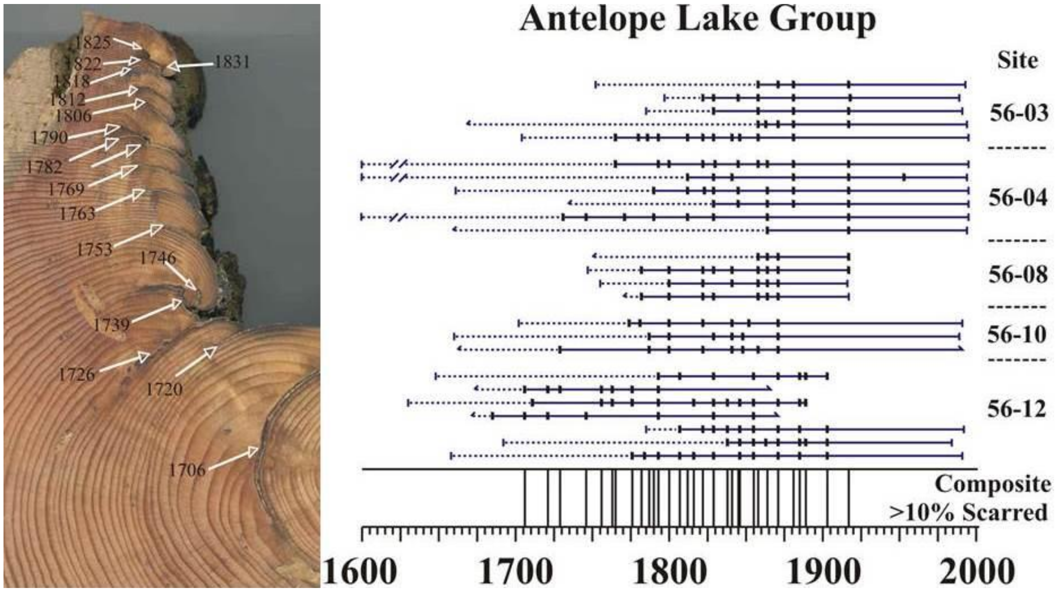


Figure 8. Fire scared tree samples found near the Wildcat Project. Left: example of a fire scared cross section from a Jeffrey pine. Right: Fire chronologies with horizontal lines representing individual tree samples found near Antelope Lake. Vertical tick marks are dated fire scars. Composite fire chronologies at bottom show only fires scarring >10 percent of samples in each group (minimum of two scars) (Moody et al. 2006).

Over the past century, historic management practices combined with an aggressive fire suppression program have altered fire regimes, forest structure and function. In the most basic terms, we have traded frequent low severity fire for infrequent high severity fire. As with many other National Forests in the west, the Plumas is experiencing larger and more intense fires. The Mt. Hough Ranger District experienced the greatest number of acres burned in recorded history in the past decade (Figure 9). However, fire size is not the major concern as we are only now beginning to approach fire areas that are within the pre-settlement natural range of variability (Collins and Stephens, 2010; Collins and Stephens, 2012). The patch size of high severity wildfire is the major concern as this has had a major impact on values such as timber and wildlife habitat (Skinner and Chang, 1996; Scholl and Taylor, 2010).

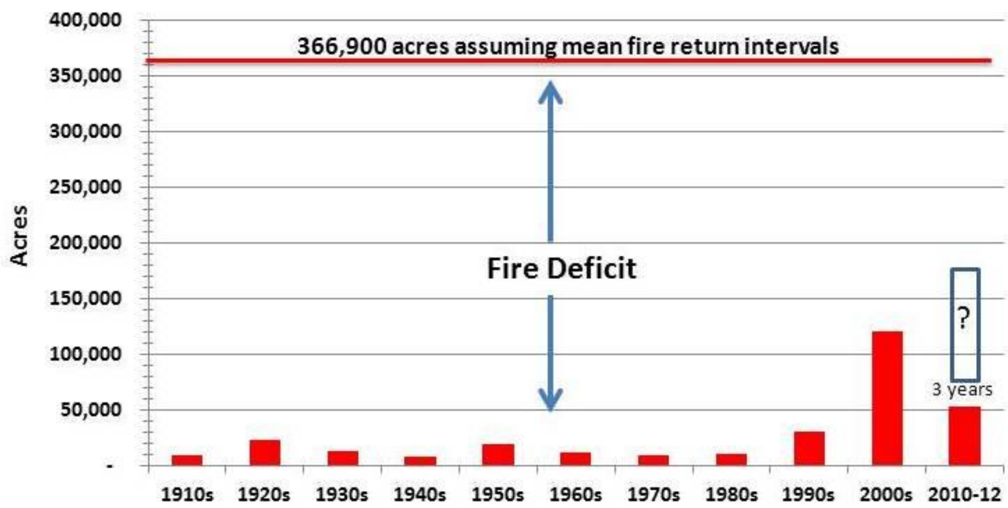


Figure 9. Cumulative acres burned by decade on the Mt. Hough Ranger District PNF. Last bar only includes the past 3 years and is largely represented by the 2012 Chips fire. Question mark above the last bar representing the uncertainty about cumulative fire over the rest of the current decade. Line above represents the number of acres that would be expected to burn prior to fire suppression.

The Wildcat analysis area has been impacted by a number of fires dating back to 1917. Of greatest concern is the amount of recent high severity fire that has occurred in the surrounding landscape. These fires have had a substantial impact on resources such as timber and wildlife habitat.

Table 9. Historic fires within the Wildcat analysis area.

FIRE_NAME	YEAR	CAUSE	Acres
Moonlight	2007	Equipment Use	1,004
Boulder Complex	2006	Lightning	5
Boulder	2006	Lightning	1,070
Stream	2001	Lightning	31
Cateyes	1996	Debris Burning	96
Un-named	1966	Lightning	851
Un-named	1938	Un-recorded	8
Un-named	1933	Un-recorded	94
Un-named	1919	Un-recorded	1,271
Un-named	1918	Un-recorded	2,299
Un-named	1917	Un-recorded	65

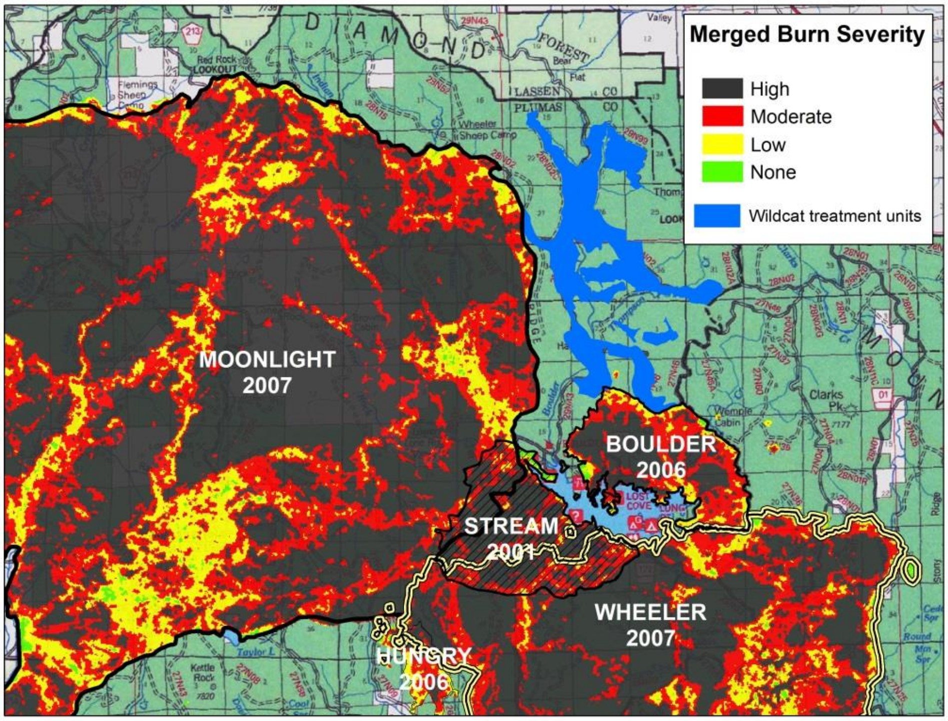


Figure 10. Merged burn severity for recent fires in the Wildcat area.

Future Fire Risk

As fire areas and severities increase, the risk of re-burns are presenting unique management challenges, particularly where stand replacing fires burn again at high severity (Figure 11). This was observed when the 2012 Chips fire re-burned the 2000 Storrie Fire area with an overlap of 44,240 acres. These re-burns are driven by a heavy shrub component and large accumulations of surface fuels and woody debris as snags decomposed and fall over time. This may be of particular concern for the Wildcat project area and emphasizes the need for protection.

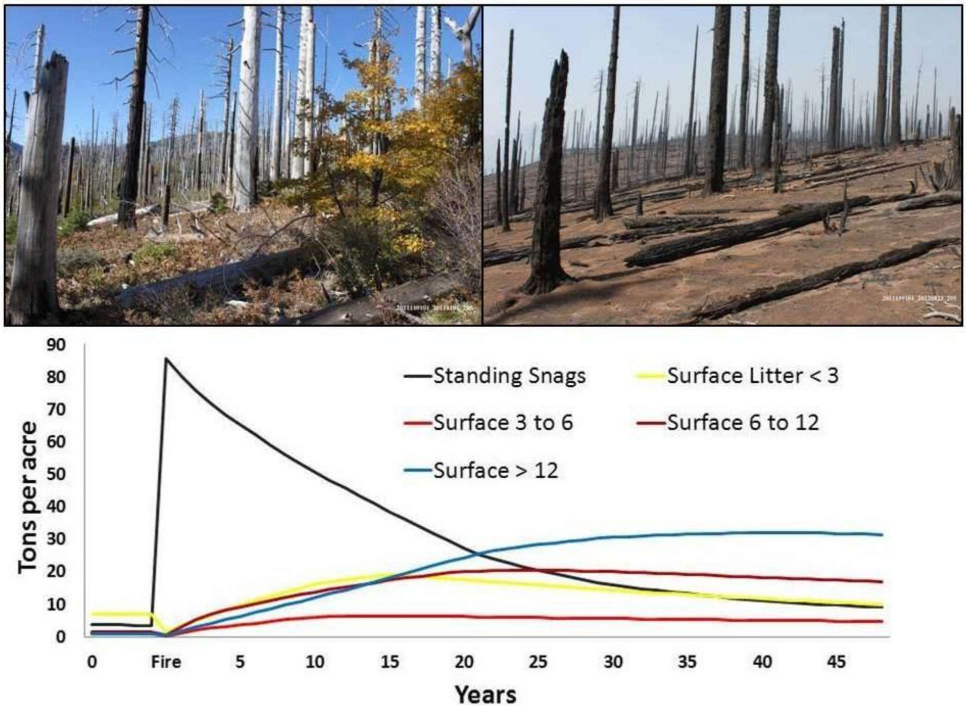
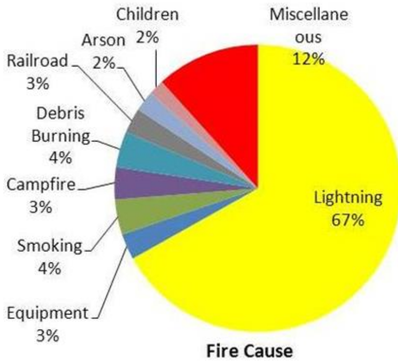


Figure 11. Top Left: Post 2000 Storrie Fire conditions captured 12 years after the fire. Top Right: Exact same frame taken 22 days after the Chips Fire passed through this site on August 1st 2012. Bottom: Fuel loading over time after stand replacing wildfire with no treatment modeled with the Forest Vegetation Simulator. Representative mixed conifer stand chosen for simulation was well to over stocked with a dense understory. Trees per acre = 450, basal area = 275, merchantable board feet = 30,000, quadratic mean diameter = 10.5.

Fire Starts

Lightning accounts for the majority of fire starts on the Mt. Hough Ranger District however the majority of acres burned has tended to be from human caused ignitions (Figure 12) Lightning is of particular concern near the Wildcat project as recent high severity fire has created receptive fuel beds in the form of snags and dead and down woody debris. In addition, lightning strike density is highest on the east side of the Plumas with an average of .81 strikes per square mile per year.



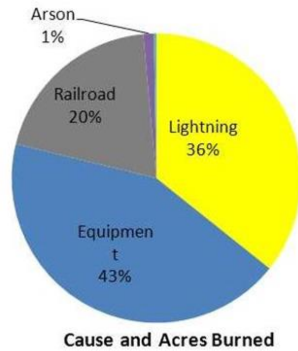


Figure 12. Left: historic fire starts from 1970 to 2009. Right: proportion of acres burned and their associated cause for large fires (>100 acres 1980 to 2011).

WUI

Janesville is about 5 miles to the northeast of the Wildcat project. Between the project area and Janesville, the rocky slopes of Thompson Ridge form a formidable barrier 3.3 miles long and ¼ to ½ mile wide. The nearest private property is about 1.5 miles to the north east and the nearest structures are 1.8 miles to the northeast outside of Janesville. Despite these distances and barriers, Janesville is alignment for smoke impacts from the project area.

Analysis Area

The geographic region defining the watershed analysis area encompasses nine Wildcat Project sub-watersheds, seven of which are contained by the Boulder Creek HUC 6 (Hydrologic Unit Code) watershed. The watershed analysis boundary follows Wildcat Ridge north from Antelope Lake up to Wheeler Sheep Camp, east through Bear Flat and southeast along Thompson Peak Ridge. The watershed boundary then follows the Mt. Hough Ranger District boundary south past Wimp Mountain and back to Antelope Lake. In addition, when larger data sets were needed to describe overall trends such as historic fire causes described above, the Mt. Hough Ranger District Boundary was used.

Environmental Consequences

No-Action Alternative

Direct and indirect effects

Surface, ladder, and canopy fuels would remain untreated under the no action alternative and as a result, potential fire behavior would remain unchanged (Figure 13). Currently potential torching is at 55 percent and expected basal area mortality is at 72 percent within stands proposed for treatment as modeled with the Forest Vegetation Simulator (Table 10). Continued high densities of ground, ladder, and canopy fuels and the associated increases in expected fire behavior would compromise fire management’s ability to safety manage fire in this area. As fire becomes more difficult to manage, other major negative effects may result, including increased suppression efforts and cost. For example, more resource damage and cost would be incurred with construction of dozer lines as opposed to hand lines. In addition, more intensive management would require higher rehabilitation costs after the fire is out. Overall, the existing forest and landscape structure and predicted fire behavior for this area could lead to a greater potential for large, high-severity fires. In addition, the No-Action alternative would not improve firefighter and public safety which could lead to potential future injuries or fatalities during wildfire events.

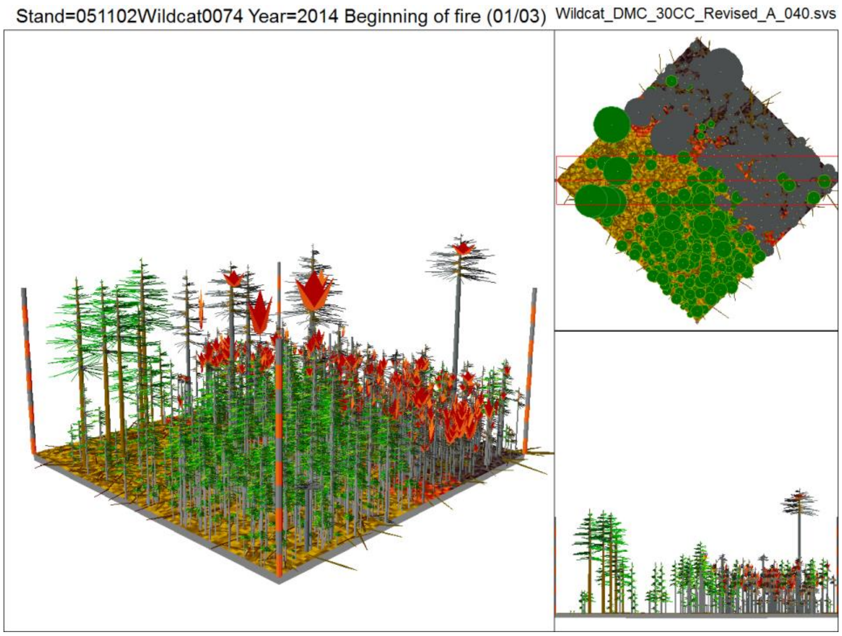


Figure 13. . Output from the Forest Vegetation Simulator of stand 74 burning largely at high severity under the No-Action Alternative.

Cumulative Effects

As discussed above, one of the greatest additive cumulative impacts has been the exclusion of low severity fire in the fire prone and fire adapted ecosystems of the Sierra Nevada. The No-Action alternative would cumulatively add to and exacerbate the ecological problems associated with missed fire cycles and altered fire regimes. The no action alternative would allow stands to continue to develop under the influence of the legacy of past management practices and fire suppression. Surrounded by recent high severity fire events (Figure 10), a future high severity fire in the area would continue to substantially compromise the ability of the Forest Service to provide for sustainable forest management.

In order to adapt to current management challenges, the Forest Service has recognized the need for increasing the pace and scale of restoration (USDA 2012). Maintaining about 20 percent of the landscape in a fire reliant treated condition appears to have the most consistent support by fire modelers in terms reducing fire size and fire behavior (Ager et al. 2007, Finney et al. 2007, Schmidt et al. 2008, Ager et al. 2010). If treatments are assumed to be effective for 10 to 20 years, an annual treatment rate of about 5,500 to 11,000 acres per year would represent the pace and scale required to achieve effective landscape fire management on the Mt. Hough RD. Proactive fuels management has been falling far short of this general goal (Figure 14), and the No-Action Alternative would cumulatively exacerbate these deficits.

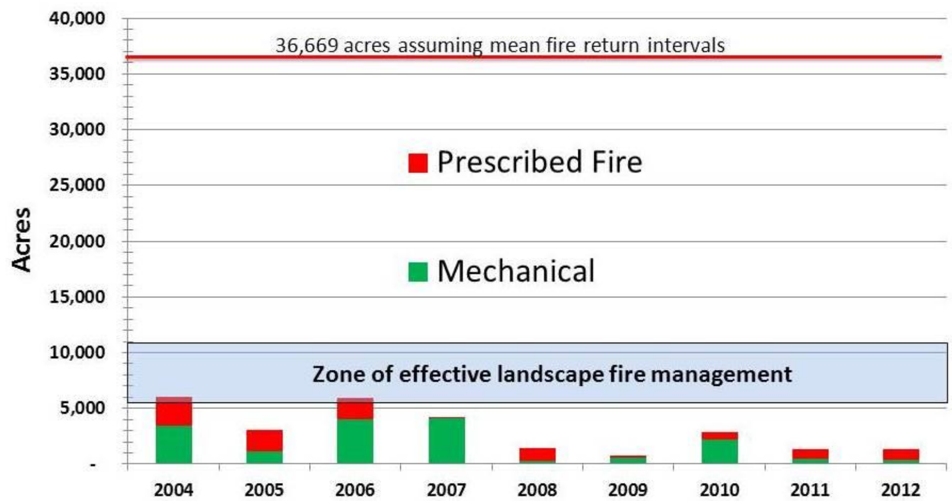


Figure 14. Mechanical and prescribed fire treatments from 2004 to 2012 on the Mt. Hough Ranger District. Red line above represents the benchmark of what would be expected to burn under pre-settlement fire regimes. Effective landscape fire management may be achieved by treating 5,500 to 11,000 acres per year according to landscape fire models.

Proposed Action Alternative

Comparison of Effects by Treatment

In order to give a clear and concise comparison of treatments, Table 10 displays some key fire behavior and expected fire effects modeled under 90th percentile fire weather conditions as modeled with the Fire and Fuels Extension of the Forest Vegetation Simulator (FVS). This model is based in measured stand characteristics and provides robust predictions of fire behavior at the stand level. The vast majority of acres (2,534) will employ mechanical thinning with follow up prescribed fire. Other treatments include hand thinning with no burning in riparian areas (331 acres), hand thinning and pile burning (9 acres), and stand-alone under burning (99 acres). Table 10 attempts to boil down some of complicating variables such as major vegetation types and variable density thinning prescriptions intended to maintain diversity on the landscape.

Table 10. Comparison of effects by vegetation type and treatment ranges. RX = prescribed fire.

Stand Type	Treatment Range	Flame Length (feet)	Potential Torching	Crowning Index (mph)	Canopy Base Height (feet)	Percent Basal Area Mortality	Approximate Acres
Mixed Conifer	No-Action	25.6	55	20	7.9	77	819
	30% Residual CC	9.8	12	21	17.4	33	
	30% Residual CC + RX	3.3	0	24	22.8	21	
	50% Residual CC	15.3	48	19	10.2	46	
	50% Residual CC + RX	3.2	0	24	11.3	23	
Eastside Pine	No-Action	25.6	55	20	7.9	77	1,659
	20% of existing BA	0.8	0	81	19.4	9	
	20% of existing BA + RX	0.8	0	102	20.3	7	
	40% of existing BA	3.9	17	56	14.5	22	
	40% of existing BA + RX	0.7	0	70	15.2	8	
True Fir	No-Action	25.6	55	20	7.9	77	56
	30% Residual CC	9.9	0	21	17.9	34	
	30% Residual CC + RX	3.2	0	24	18.4	24	
	50% Residual CC	15	9	19	10.2	46	
	50% Residual CC + RX	4.6	0	24	11.3	23	
Conifer Aspen	Hand Thinning	17.5	14	19	10.2	47	331
Eastside Pine	Prescribed Fire Only	4.7	0	24	10.2	26	99

Direct and Indirect Effects of Mechanical Thinning with Prescribed Fire

As mentioned above, the vast majority of acres (approximately 2,534) employ mechanical thinning followed by prescribed fire. These treatments are the most effective at mitigating wildfire hazards throughout all vegetation types and thinning prescription ranges (Table 10). For FVS modeling, baseline stand conditions were calculated for the year 2014, mechanical thinning was applied in 2015, prescribed fire was applied in 2020. Surface flame lengths would be reduced from 3.4 feet to .6 feet, potential torching would be reduced from 55 percent to 0 percent, and percent basal area mortality would be reduced from 72 percent to an average of 22 percent. It is important to note that the application of prescribed fire following mechanical treatment has a substantial effect on reducing fire behavior. With a large backlog of acres to be treated with fire on the Mt. Hough RD and a large number of technical constraints on its use such as smoke dispersion, applying fire is a bottleneck. However, the application of fire as a natural ecosystem process will be critical to maintaining healthy, resilient, and productive ecosystems.

Direct and Indirect Effects of Hand Thinning with no Burning

Hand thinning with no burning captures approximately 331 acres and this prescription is largely confined to narrow riparian areas. Excluding fires is primarily to protect the Sierra Nevada

Yellow Legged Frog. Thinning without the application of fire is not as effective as with the application of fire however a number of mitigating factors can be applied. Directional falling and dragging lighter fuels outside of these fire exclusion zones would be relatively easy and effective. This combined with the presence of riparian vegetation and aspen will yield better results than can be modeled in Table 10.

Direct and Indirect Effects of Prescribed Fire Only

Prescribed fire would be applied to approximately 99 acres. Prescribed fire would be effective at reducing flame lengths and many other fire behavior parameters (Table 10). This treatment is less effective at reducing crown density and height to live crown. Without a tree removal component, treatments would be less effective over time as ground and ladder fuels build up.

Cumulative Effects

The cumulative effects of past management practices, fire exclusion, and high-mortality fires as described in the Effected Environment above have largely shaped the forest that exists in the analysis area today. These factors have influenced vast areas of the Sierra Nevada mountain range and are well documented in the scientific literature. Past projects and events are reflected in the data layers used to characterize the existing conditions. Changes in vegetation structure as a result of recent fires and past projects since the baseline data were collected have been incorporated into the Wildcat project existing conditions.

On National Forest System lands and private lands, past harvest activities focused on selection and sanitation harvests resulting in overstory removal of dominant and codominant trees, and retention of midstory and understory trees. These harvest systems often used lop and scatter techniques for limb wood and tree tops. These practices resulted in promoting closed-canopy, high-density stands of small trees with relatively high fuel loads. Many of these stands continue to be conducive to high-mortality fire today.

Since the mid to late 1990’s, commercial and non-commercial thinning from below, with and without prescribed fire, has been the principal silvicultural treatment implemented on NFS and private lands in the analysis area. This silvicultural treatment has been used to establish several fuel treatments on NFS and private lands both within and adjacent to the analysis area. These treated areas currently meet desired conditions in terms of potential fire behavior and tree mortality.

Compliance with the Forest Plan and Other Direction

National Fire Plan

In August 2000, the President directed the Secretaries of Agriculture and the Interior to develop a response to severe wildland fires, reduce fire impacts on rural communities, and assure sufficient firefighting capacity in the future. Funding provided for fuel management and reduction to address dense forest vegetation resulting from decades of wildfire suppression and fire exclusion on Federal lands. Activities focus on wildland-urban interface areas to reduce risk to people and property.

Plumas National Forest Land Management Plan (1988)

General direction under fire and fuels includes managing fuels to reduce high risk hazard and/or to facilitate cost-efficient resource protection. Standards and Guidelines also include giving preference to fuel utilization. Where utilization will not be effective, employ broadcast burning or underburning, pile and burn, treatment, and/or fuel break system construction.

Sierra Nevada Forest Plan Amendment: Final Supplemental Environmental Impact Statement Record of Decision: Forest-wide Standards and Guidelines (2004)

Goals for fire and fuels management include reducing threats to communities and wildlife habitat from large, severe wildfires and re-introducing fire into fire-adapted ecosystems. Broad-scale goals include:

- treating fuels in a manner that significantly reduces wildland fire intensity and rate of spread, thereby contributing to more effective fire suppression and fewer acres burned;
- treating hazardous fuels in a cost-efficient manner to maximize program effectiveness; and
- actively restoring fire-adapted ecosystems by making demonstrated progress in moving acres out of unnaturally dense conditions (in other words, moving acres from condition class 2 or 3 to condition class 1).

The decision includes managing hazardous fuels in and around communities combined with strategic placement of fuels treatments across broad landscapes to modify wildland fire behavior. Goals for fuels treatments include:

- strategically placing treatment areas across landscapes to interrupt potential fire spread,
- removing sufficient material in treatment areas to cause a fire to burn at lower intensities and slower rates of spread compared to untreated areas, and
- considering cost-efficiency in designing treatments to maximize the number of acres that can be treated under a limited budget.

Air Quality

Introduction

This section will address the Clean Air Act, ambient air quality standards, and potential impacts of the Wildcat Project. The major focus will be on particulate matter generated when forest fuels are burned.

Effects Analysis Methodology

Air pollution is regulated by two types of standards: emission standards and ambient air quality standards. Emission standards are the levels of air pollutants a source is allowed to release into the air. Ambient air quality standards are levels of air pollutants that if exceeded are considered unhealthy to breathe. If there have been no violations of an ambient air quality standard, an area is said to be in attainment. If there have been violations of a standard, the state or federal government designates the area as being in nonattainment for that pollutant. A list of Federal and California State air quality standards can be found at http://www.arb.ca.gov/research/aaqs/aaqs2.pdf. A wide variety of standards are designated for such pollutants as ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, sulfates, hydrogen sulfide, vinyl chloride and particulate matter. One of the most important measures of air pollution, and most relevant to this project, is particulate matter. Particulate matter pollution consists of very small particles floating in the air. Of greatest concern to public health are the particles small enough to be inhaled into the deepest parts of the lung. These particles are less 1/7th the thickness of a human hair and are divided into two size classes for air quality standards and monitoring; particles that are less than 10 microns in diameter, (PM10), and those that are less than 2.5 microns in diameter, (PM2.5). These standard measures for air quality are important due to their impact to public health and the environment.

For compliance to air quality standards in California, PM10 must not exceed 20 $\mu g/m^3$ (micrograms per cubic meter of air), averaged over an annual year and must not exceed 50 $\mu g/m^3$ averaged over a 24 hour period (Table 1). In addition, PM2.5 must not exceed 12 $\mu g/m^3$ averaged over an annual year and must not exceed 35 $\mu g/m^3$ averaged over a 24 hour period.

Table 11 Relevant California and National ambient air quality standards measured in µg/m3 (micrograms per cubic meter of air).

Pollutant	Averaging Time	Standard
PM10	24 Hour mean	50 µg/m3
	Annual arithmetic mean	20 µg/m3
PM2.5	24 Hours	35 µg/m3
	Annual arithmetic mean	12 µg/m3

The Forest Vegetation Simulator (FVS) was used to estimate tons of particulate matter expected to be released into the atmosphere for each relevant treatment by alternative. As discussed in greater detail below, tons of particulates produced provides a relative measure of potential impacts. However, the most important dilution factors of air volume and time of exposure are difficult to quantify as they are entirely dependent on weather conditions. Thus, the relative measures provided here in tons of particulates produced per acre are not direct measures of air quality standards which are measured in terms of density, (micrograms per cubic meter of air), and duration of exposure (24 hour, and annual arithmetic mean standards). Direct impacts to air quality standards are difficult to predict as there are far too many variables to be accounted for (Joe Fish 2012 personal communication). As a substitute, the Northern Sierra Air Management

District recommends analyzing emissions in the context of smoke management and targeted weather conditions that provide for mixing, dispersion and transport of particulates such that air quality standards are met.

Affected Environment

According to the Northern Sierra Air Quality Management District, (2006), the town of Quincy had difficulties meeting ambient air quality standards in the late 1980 and early 1990s for PM10 and PM2.5 particulates. However, twelve years of monitoring data has shown dramatic improvements in air quality and this trend is expected to continue. Quincy consistently meets standards for PM2.5 particulates. Within the past 10 years, the PM10 annual arithmetic mean standard of 20 µg/m3 has been met about every other year and on average only 2 days out of the year exceed the 24 hour standard of 50 µg/m3. Overall, in their latest report in 2006, the Northern Sierra Air Quality Management District considered Quincy to be an air quality success story.

Seven communities are within 20 miles of the Wildcat project and are listed in Table 2. Major sources of particulates in the analysis area are thought to be largely locally generated and include woodstoves, open burning, and dust from traffic and wind. In addition, wildfires and agricultural burning in the Sacramento valley are also thought to be major contributors. In particular, woodstove smoke and strong wintertime inversions have had a major impact on particulate monitoring stations in local communities. As more efficient and EPA compliant stoves replace older models, improvements in air quality have been noticeable. Smoke from local and more distant USFS prescribed fires are also suspected as a contributor to periodic spikes in particulates.

Janesville to the northeast is most likely to be impacted by the project area and air quality form http://www.usa.com/janesville-ca-air-quality.htm are presented in Figure 15 below. These data suggest that meeting air quality standards has been difficult in a number years in this area however air quality has generally been better than the National or California State averages.

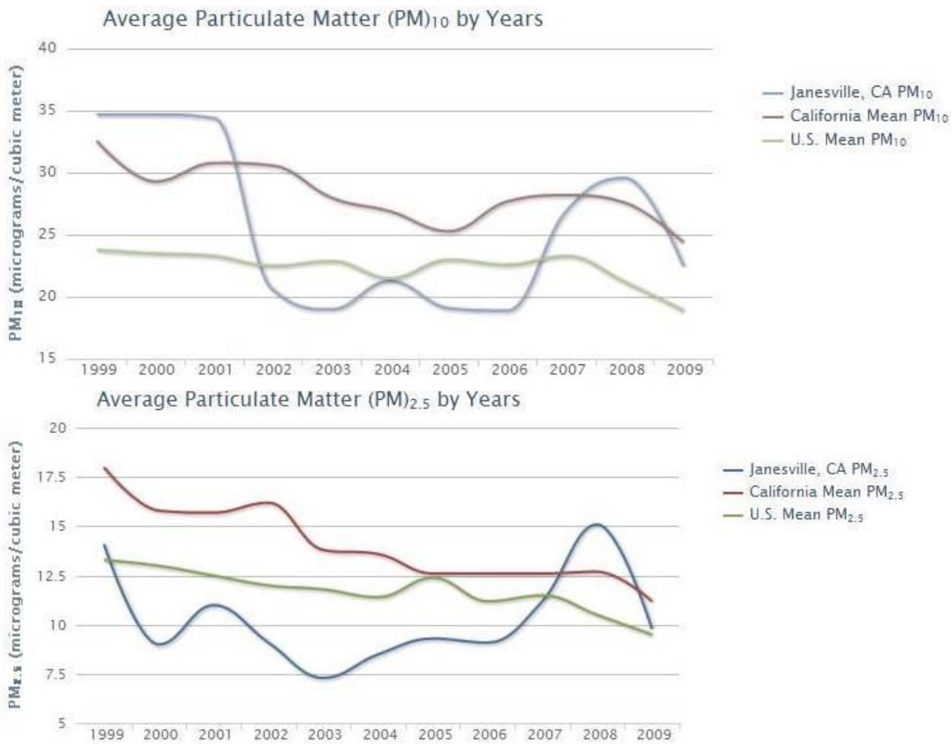


Figure 15. Particulate measurements estimated for Janesville CA.

Analysis Area

Communities within 20 miles of the Wildcat Project were considered (Table 12). In addition the watershed analysis area was used to evaluate potential future wildfire scenarios.

Table 12. Communities within 20 miles of the Wildcat Project.

Community	Bearing	Distance (miles)	Population
Janesville	40	5	1,408
Buntingville	60	6	< 100
Milford	120	12	167
Genesee	220	15	< 100
Taylorsville	240	17	150
Greenville	250	18	1,129
Susanville	340	15	17,974

Environmental Consequences

No-Action Alternative

Direct and Indirect Effects

Forest fuel accumulations will eventually burn in these dry forest types where decomposition by fungi and bacteria are unable to keep pace with the production of biomass. Under the No-Action alternative, no controlled burning would occur and particulate emissions would be produced under future wildfire scenarios where virtually no control can be exerted in terms of managing for air quality. This reality is supported by recent fire events such as the Moonlight fire of 2007 and Chips Fire of 2012. In contrast, emissions from controlled broadcast burning or pile burning on Forest Service system lands are managed on a day to day or even hour by hour basis. In addition, implementation of fuel treatments in the Wildcat Project could reduce emissions from future wildfires by reducing their ultimate size and/or intensity (Figure 15).

Cumulative Effects

Annual quality standards have been difficult to meet in a number of years for this area (Figure 15). It is not reasonable to assume that future wildfire scenarios would not impact this area given the recent fire history and current state of forest fuels. Under these scenarios with little to no controls over emissions, it is likely that cumulative impacts would result in nonattainment of air quality standards for many days during the burn period as well as for the yearly average.

Proposed Action

Direct and Indirect Effects

For the Proposed Action, a cool season prescribed fire was simulated for all mechanically thinned treatment acres. For comparison with the No-Action Alternative, it could be assumed that these acres may burn under a wildfire scenario in the future. For this exercise, a high severity wildfire was applied to these same units with no pre-treatment. To take the No-Action Alternative one step farther, smoke emission factors were applied to the entire watershed analysis area. This may seem speculative; however given the recent fire history in the area it is not at all unreasonable to assume future fire events of this scale. This is particularly true considering our compromised ability to manage fire in this area if no action is taken to reduce fuels.

Smoke emissions from wildfire scenarios about doubles for both PM10 and PM2.5 particulates compared to thinning followed by prescribed fire (Table 13). If the entire watershed were to burn at high severity, we could expect close to ten times the emissions compared the Action Alternative.

Table 13. Particulate emissions by alternative using FVS.

Alternative	Impacted Area	Fire Type	PM10 tons per acre	PM2.5 tons per acre	PM10 Total emissions (tons)	PM2.5 Total emissions (tons)
Proposed Action	Project Units 2,712	Prescribed Fire	.204	.173	553	469
No-Action	Project Units 2,712	High Severity	.402	.341	1,090	925
No-Action	Watershed 13,376	High Severity	.402	.341	5,377	4,561

As mentioned above, estimates in total tons of particulates released give us some relative measure of potential impacts, however direct correlations to air quality standards are difficult. This is because the most relevant measures for air quality are not in tons per acre but in density of particulates in the atmosphere over a given time period of exposure. Thus we are missing the most important dilution factors of volume of air in which particulates are dispersed, and how long they persist. These variables depend on current and predicted weather conditions at the time of release. A meaningful discussion of air quality impacts must be framed within the context of weather conditions.

Implementation of underburning and pile burning would occur over five to seven years as weather conditions and resource availability permit. It is also important to note that not all units designated for fire use would receive burning treatments. All mechanically treated units would be evaluated to determine post treatment surface fuel loads. Units meeting desired conditions may not be burned, thereby decreasing total burned acres and emissions. In addition prescribed burning units were generally created larger than what would actually burn in order to provide ample holding opportunities. During burning activities, smoke would likely be visible from many of the communities listed in Table 12. All burning would be completed under approved smoke management plans which set the number of acres or piles that can be burned over time and weather parameters under which burning can occur. These smoke management plans describe Northern Sierra Air Quality Management District regulations for burning activities in terms of smoke management, provide a detailed implementation schedule, and describe monitoring and reporting requirements. One of the most important factors determining burn days would be weather conditions and predicted impacts to air quality. Burn days would be dependent on current and predicted weather condition and take into account such factors as wind direction and the dispersion characteristics in the atmosphere. Typically, some degree of atmospheric instability is required to ensure appropriate mixing dispersal and transport of particulates. Smoke direction and dispersal would be continually monitored during burning operations and ignition would be halted if poor conditions develop. In addition, dust emissions from logging traffic would be spread out during the mechanical treatment implementation period of approximately five years. In addition, dust would be mitigated by road watering and other standard management practices described in contract specifications.

Due to the controls in place to manage the release of particulates, this project would have no significant effect to air quality.

Cumulative Effects

Other planned projects that include burning in the area include the Antelope Border project, the Keddie Ridge project and the Diamond project currently in planning on the Lessen NF. An extremely important point to make when addressing cumulative impacts and burning is that additional “shelf stock” in acres available for burning does not necessarily translate into more acres burned on an annual basis. Prescribed burning windows of opportunity are largely dependent on fuel conditions and atmospheric smoke dispersion characteristics as described above. In addition, burning resources such as skilled and qualified personnel, fire engines, equipment and crews are also limited. Taking these limitations into account, the Forest Service has been implementing treatments at or near our capacity with an annual average of 1,355 acres of prescribed and pile burning in recent years (Table 14). The Wildcat project may provide some expanded seasonal and geographical opportunities. In fact, more burning opportunities may help managers reduce smoke impacts to populated areas as current weather and transport wind direction are considered for a given burn day. Due to the limiting factors mentioned above, additional planned acres would not incrementally add to cumulative impacts to air quality. In addition, annual smoke production from burning activities wou1d result in particulate matter emissions less than the threshold of 100 tons per year for a general conformity analysis.

Table 14. Acres of under burning and pile burning from 2004 to 2012 accomplished for the Mt Hough Ranger District.

Year	Pile burn and under-burn acres
2004	2,574
2005	1,992
2006	1,863
2007	208
2008	607
2009	1,621
2010	709
2011	1,622
2012	996

Forest Vegetation

Introduction

This report summarizes the potential effects on forest vegetation resources from vegetation management activities proposed under the Wildcat Project of the Mt. Hough Ranger District of the Plumas National Forest. This analysis addresses how the different alternatives would impact the forest vegetation within the Wildcat Project. The report also addresses the scientific and analytical basis for the comparison of alternatives as presented in this report.

Analysis Framework: Statute, Regulatory Environment, Forest Plan and Other Direction

The Wildcat Project is designed to fulfill the management direction specified in the 1988 Plumas National Forest Land and Resource Management Plan (PNF LRMP) (USDA 1988a,b), as amended by the Sierra Nevada Forest Plan Amendment (SNFPA) FSEIS and ROD (USDA 2004a; b). Fuel and vegetation management activities are designed to comply with the standards and guidelines as described in the SNFPA FSEIS and ROD (USDA 2004a; b).

National Forest Management Act

The National Forest Management Act (NFMA) of 1976, including its amendments to the Forest and Rangeland Renewable Resources Planning Act of 1974 state that it is the policy of the Congress that all forested lands in the National Forest System be maintained in appropriate forest cover with species of trees, degree of stocking, rate of growth, and conditions of stand designed to secure the maximum benefits of multiple use sustained yield management in accordance with land management plans. Both acts also state "insure that timber will be harvested from National Forest System land only where – (ii) there is assurance that such lands can be adequately restocked within five years of harvest."

Sierra Nevada Forest Plan Amendment: Final Supplemental Environmental Impact Statement Record of Decision: Forest-wide Standards & Guidelines (2004)

The Plumas National Forest Land and Resource Management Plan (dated 1988) was amended in January, 2001 with the Sierra Nevada Forest Plan Amendment Record of Decision. In 2004, a Supplemental Final Environmental Impact Statement Record of Decision, known as the Sierra Nevada Forest Plan Amendment Record of Decision, 2004 (USDA 2004a) was signed by the

Pacific Southwest Region Regional Forester and replaced the 2001 decision in its entirety. The SNFPA ROD, 2004 adopted an integrated strategy for vegetation management that is aggressive enough to reduce the risk of wildfire to communities in the wildland user interface while modifying fire behavior over the broader landscape. Strategically placed DFPZ's are priority areas for fuels treatments, but the strategy was broadened to include other management objectives such as reducing stand density for forest health, restoring and maintaining ecosystem structure and composition (USDA 2004a).

Effects Analysis Methodology

A final Forest Vegetation Report has been completed by Maurice Huynh in November 2015. These reports are incorporated by reference and are available in the project record.

All GIS spatial data used in this analysis represent approximate location and size of treatment polygons and are meant to serve as a guide during field implementation. However, deviations from the polygon boundaries are typically minimal in nature and are reviewed and monitored for adverse impacts to resources. As such, all acre figures and values derived from GIS data are approximate in nature.

GIS data is being updated and improved continuously as new information is incorporated into the database.

Measurement Indicators

Stand Structure

In general, stand structure could be described as the physical form of a forested stand. Essentially, this includes the space and dimensionality of the stand, from how area is occupied and how the trees are dispersed within the stand. Oftentimes, more than one measurement indicator is required to capture the description of stand structure. While there are multiple indicators that can be used, the ones discussed in this report reflect current and desired conditions as well as the effects of the alternatives.

Relative stand density

Stand density, is a quantitative measure of the area occupied by trees. Stand density index (SDI) is calculated based on the number of trees per unit area and diameter at breast height of the tree of average basal area as developed by Reineke (1933). A desirable level of stand density is often considered that which maximizes stand health, growth and disturbance resiliency. The relative density (rSDI) concept describes a stand's density relative to the maximum possible density (based on observed stands). This can serve as a proxy for a stand density relative to its carrying capacity. In general, the concept of stand density as a measure has been further developed for forest management applications for both even-aged and uneven-aged stands (Curtis 1970; Drew and Flewelling 1977, 1979; Long 1985; Long and Daniel 1990; Helms and Tappeiner 1996; Jack and Long 1996; Oliver and Uzoh 1997; Powell 1999; Woodall et al. 2002).

It stands to reason that there are fewer resources available per individual tree on stands that have a higher density of trees as opposed to stands with a lower density, all else being equal. Limited resources for trees tend to lead to decreased individual tree and stand vigor. A relative density between 55 and 60 percent has been described as the lower limit of the "Zone of Imminent Competition Mortality" above which trees begin to die due to competition related stress (Drew and Flewelling 1977, 1979; Long 1985; Long and Daniel 1990; Smith et al. 1997; Powell 1999; Long and Shaw 2012 For the purpose of this analysis, 60 percent was used as a measure of the onset of competition-related mortality because stress induced by competition increases tree susceptibility to drought, insects, disease, and fire. This threshold serves as an appropriate measure for forest health because stands managed below this threshold are less likely to incur mortality due to the agents mentioned above. The use of 60 percent of maximum stand density also follows direction set forth by the Regional Office (USDA2004c,d).

Several studies in forests similar to the Wildcat Project have found relative stand density to have been historically low (approximately 20-30 percent) (Table 15). The desired relative densities immediately post-treatment are between 15 and 40 percent to allow for a variety of stand structures and densities, the lower bounds of which correspond with the onset of competition and crown closure. These levels are substantially below the threshold of imminent competition mortality, and treatments within the desired range would have a reasonable “lifetime” before reaching densities at which mortality is expected to occur. Desired relative densities within 20 to 30 years would be below the 60 percent threshold of imminent competition as this longer time frame would be representative of a reasonable cutting or entry cycle (USDAc,d).

Table 15 Estimates of forest structure for pine dominated and mixed conifer forests in California and northern Mexico adapted to an active fire disturbance regime

Study	Study Site	Forest Type	Time Period	TPA[1]	BA (ft^2/acre)[1]	Diameter (inches)[1]	Relative Density[2]
Taylor 2004, 2006 and 2007	N. Sierra: Lake Tahoe	JP-mixed conifer	Pre-fire suppression (ca. 1870-1900)	28 (12-46)	111 (55-156)	26.5 (21.5-33.6)	29%
Taylor (unpublished data) in Taylor 2008	Central Sierra: Yosemite Valley	Ponderosa pine-black oak	Pre-fire suppression (unknown)	36 (31-38)	95 (39-117)	21.9[A]	28%
North et . al 2007	S. Sierra: Teakettle Forest	JP-mixed conifer	Pre-fire suppression (ca. 1865)	27[B]	225[B]	19.5[B]	18%
Taylor and Scholl 2006 in Taylor 2008	Central Sierra: Yosemite NP	JP-mixed conifer	Pre-fire suppression (ca. 1899)	54 (4-210)	186 (21-452)	25.2[A]	53%
Scholl and Taylor 2010	Central Sierra: Yosemite NP	JP-mixed conifer	Pre-fire suppression (ca. 1899)	65 (16-263)	130 (1-387)	20.7 (3.2-43.6)	46%
Stephens and Gill 2005	N. Mexico: Sierra San Pedro Martir	JP-mixed conifer	Contemporary forest with unaltered disturbance regime	59 (12-130)	87 (25-221)	12.8 (1.0-44.1)	20%
Taylor 2001, Taylor 2010	S. Cascades: Ishi Wilderness	Ponderosa pine-black oak	Contemporary forest with unaltered disturbance regime[c]	47 (29-64)	108 (65-142)	20.6 (17.6-23.6)	33%

[1]Ranges are provided in paratheses
[2]Calculation of relative density is based upon maximum SDI from Long and Shaw's draft density management diagram for pine-dominated Sierran Mixed Conifer forests. Using a maximum SDI of 450 provides a very liberal estimate of density because relative density (current SDI/maximum SDI) would have even lower values if a higher maximum SDI was used.
Mean diameter was calculated using TPA and BA per acre
No range provided
Skinner and Taylor (2006) discuss the applicability of the Beavery Creek Pinery site in the Ishi Wilderness in sidebar 10.2 (pages 207-209).

Reinecke (1933) described a maximum stand density of 750 for mixed conifer stands in California. More recently, Oliver (1995 and 1996) suggested a maximum stand density of 365 for even-aged ponderosa-pine stands and a much higher density for red and white fir stands as their shade-tolerance allows for greater densities. Long and Shaw suggests a maximum of 550 for fir-dominated mixed conifer stands (2012) and a maximum of 450 for pine-dominated stands (2005, 2012); however, the calculation of this maximum stand density is largely dependent on the mix of species and management objectives. Because of this project's objective of creating a mosaic of low density, pine dominated stands and mixed conifer stands, maximum stand densities of 450 and 550 will be used for pine-dominated and mixed conifer stands, respectively.

Trees Per Acre

Trees per acre (TPA) and size class distribution are inter-related stand structure measurement indicators where trees of different diameters are grouped together in similar size classes. This distribution is useful in illustrating stand structure and development, regeneration and wildlife structure components. The number and distribution of TPA by diameter class is an important unit of measure because it shows the effect of treatments on different size trees. The diameter classes are shown in Table 16. According to various researchers, historical average trees per acre would have ranged from 28 to 65 TPA (Table 15).

Table 16. Diameter class and tree size by forest product

	Size Description				
	Seedlings	**Sapling to Pole Size Tree**	**Small-Sized Trees**	**Intermediate-Sized Trees**	**Medium to Large Size Trees**
Diameter Class	1-3 inches	3-10 inches	10-24 inches	24-30 inches	+30 inches
Forest Product	N/A	Biomass trees	Sawlog	Sawlog	Reserve trees

Basal Area

Basal area is another inter-related measure of stand density or stocking. Basal area is the cross section area of a tree stem in square feet measured at breast height (4.5 feet above ground). Although TPA is a very useful indicator of stocking, it doesn't describe the size of the trees. For example, a stand comprised of 100 six-inch TPA is very different than a stand of 100 16-inch trees. Conversely, two stands of the same basal area but with vastly different TPA varies greatly in structure. Stocking for an area, usually on a per-acre basis, is the sum of the basal area for all trees in an area.

Basal area can also be used determine whether a stand has reached a critical threshold. For example, Sartwell (1975), states that mountain pine beetle outbreaks appear to occur when basal area is in excess of 150 ft^2. Landram (USDA2004c) also uses basal area to develop forest health risk thinning guidelines for the Plumas National Forest. Basal area has been used to describe historical stand densities of similar dry, yellow pine dominated stands as low as 50 ft^2 (USDA

2007a). Furthermore, marking descriptions often use target basal area in guiding timber markers on how to designate trees in thinning projects.

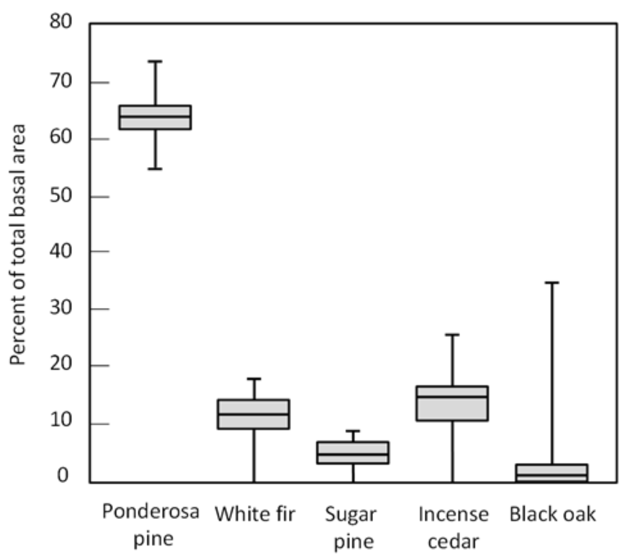
Species Composition

Species composition is measured by calculating the ratio of shade-tolerant vs. shade-intolerant species composition pre and post-treatment in terms of trees per acre and basal area. Species composition is analyzed because silvicultural prescriptions may have an effect at the stand level on differing species dependent on shade tolerance and species biology. Residual species composition post-treatment is an important measure because these trees represent the seed bank of the future, which is one factor that affects species diversity over time.

Much of the scientific literature has indicated that species composition in the northern Sierra Nevada mixed conifer forests has shifted from shade-intolerant species such as yellow pine (ponderosa and Jeffrey pine) and black oak to shade-tolerant species such as white fir (USDA 1992a; Skinner and Chang 1996; Ansley and Battles 1998).

This is especially true for the eastside zone in which much of the Wildcat Project resides. Forest types within this area historically have been dominated by drought and fire-resistant species such as yellow pine (Figure 16 and Figure 17), with shade-tolerant species being restricted to more mesic, north facing aspects (Safford 2013). Treatments that improve the percentage of pine species in mixed conifer forest would be beneficial and meet project objectives.

Figure 16. Reconstructed basal area distribution by species in eastside pine stands under an active frequent fire regime. Note: Horizontal lines within quartile boxes represent the median, the "error bars" represent upper and lower ranges for each species. (Safford 2013)



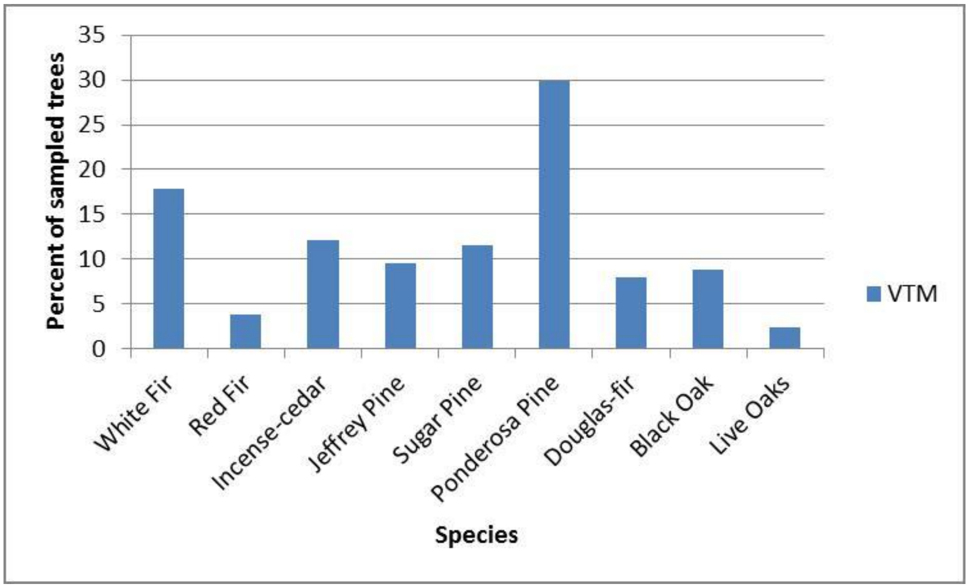


Figure 17. Relative densities of tree species in eastside pine and mixed conifer stands according to Weislander (1930's) (Safford 2013)

Landscape heterogeneity

Past management practices, including fire suppression has resulted in homogenized stands across the project area. The landscape across the Wildcat Project is lacking horizontal and vertical heterogeneity. Increased landscape heterogeneity is one of the components of the Purpose and Needs in the Proposed Action.

CWHR Distribution and Canopy Cover

California Wildlife Habitat Relationships (CWHR) vegetation typing (Mayer and Laudenslayer 1988) are used to measure cumulative effects of alternatives on landscape structure and diversity. CWHR vegetation type, size class and density is an effective proxy for seral stages and may be used to display the relative distribution of seral stages because it describes vegetation type, average tree size and canopy cover. This also allows for a congruent analysis of effects on forest vegetation and wildlife habitat. Size classes 0-3 are usually indicative of young, seral stages best described as dominated by seedlings, saplings and pole-sized stands with small trees (Table 17). Larger size classes are often interpreted as mid to later seral stages. Density of forest cover is often expressed in terms of canopy cover (Table 18). Stands consisting of size class 5 over a distinct layer of size class 4 or 3 trees with a minimum of 60 percent canopy cover are classified as CWHR 6D.

Table 17. CWHR size classes

	CWHR Size Classes					
	1	2	3	4	5	6

Diameter Range	<1” DBH	1-6” DBH	6-11” DBH	11-24”DBH	>24” DBH	>24” DBH
Description	Seedlings	Sapling	Pole tree	Small tree	Medium/large tree	Multilayered canopy with dense cover

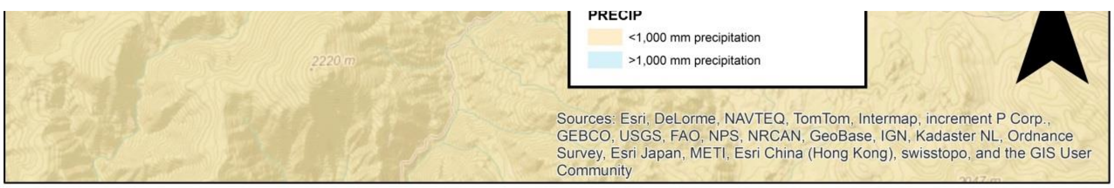
Table 18. CWHR density and canopy cover

	CWHR Density Classes				
	S	**P**	**M**	**D**	**“Blank”**
Canopy Cover	10-24%	25-39%	40-59%	>60%	<10%
Description	Sparse cover	Open cover	Moderate cover	Dense cover	No cover, but definitely forest

Because CWHR can serve as an effective proxy for seral stages, for the purposes of this analysis, landscape structure refers to the distribution of CWHR size and density on the landscape, and the relative distribution of closed-canopy and open-canopy stands. This is an important indicator because it may be used as a measure of landscape heterogeneity and diversity, and as a measure of cumulative effects to forest vegetation on the landscape scale. Landscape structure is measured by calculating the distribution of these seral stages within the vegetation analysis area. The relative distribution of seral stages within the landscape is measured by using CWHR size class as a proxy for seral stage.

Analysis Methodology

Field inventories were conducted to measure attributes of existing vegetation in the analysis area. Additional past field inventory data was also used to supplement and increase the current data set. These stands are representative of the analysis area and the areas to be treated in the action alternative. Data was collected on live and dead trees and fuels.



conditions discussed below. The FVS model output predicts average conditions and attributes by stand. The stand attributes analyzed include trees per acre, basal area, quadratic mean diameter, stand density index, canopy cover, and species composition. Model outputs were averaged by treatment type to examine the effects of treatment over the larger landscape scale. In order to simulate the diverse structures that variable density thinning would create, the stands were modeled under various scenarios designed to emulate high density clumps, low density gaps, and evenly spaced matrix. Resulting stand attributes were used to create ranges and averages to represent heterogeneous stand structure for analysis purposes.

It would be reminded that the model was used to quantify existing conditions and to predict the effect of alternative treatments on forest development. Model results are used to highlight relative differences, not absolute conditions. Considering this, model outputs such as stand density and basal area provide useful metrics for determining relative risk of these effects. This further underscores that interpretation of model outputs are best evaluated in a relative sense in conjunction with professional judgment, firsthand knowledge of stand conditions, forest health evaluations, and pertinent scientific research, studies, and literature. No future activities, fire or natural regeneration events are included in the growth simulation due to the variable and unpredictable nature of such events.

A Geographic Information System (GIS) was used to analyze forest vegetation on the landscape scale for the analysis area. Forest-wide vegetation typing into California Wildlife Habitat Relationships (CWHR) classifications (Mayer and Laudenslayer 1988) was done for the Plumas-Lassen Administrative Study in 2002 (Vestra 2002). The Land Management Unit ArcMap tool (Information Center for the Environment 2011) was used in conjunction with the Digital Elevation Model of the forest to classify the landscape into topographically distinct treatment areas based on aspect, slope, and slope position. These treatment areas were used to identify approximate areas where differing treatments would generally occur to facilitate spatial analysis. These data were combined in a GIS to provide a complete map of the existing vegetation within the analysis area. All vegetation information is displayed using CWHR vegetation typing and serves as the baseline acres for analysis. The distribution of CWHR size class and density was analyzed relative to the stand-level effects modeled by FVS. Other sources of information used in the assessment of effects were aerial photos, data generated from common stand exam plots, and field reconnaissance.

Affected Environment

The project and forest vegetation analysis area resides just north of Antelope Lake and southwest of Honey Lake and US Highway 395 (Figure 18). Ranging from approximately 5,000 to 7,000 feet, the Wildcat Project lies on the eastern edge of the Mt. Hough Ranger District, Plumas National Forest and south of the Lassen National Forest. The nearest community is Janesville, CA. Vegetation treatments may directly affect forest vegetation within treatment units and indirectly affect forest vegetation in nearby areas.

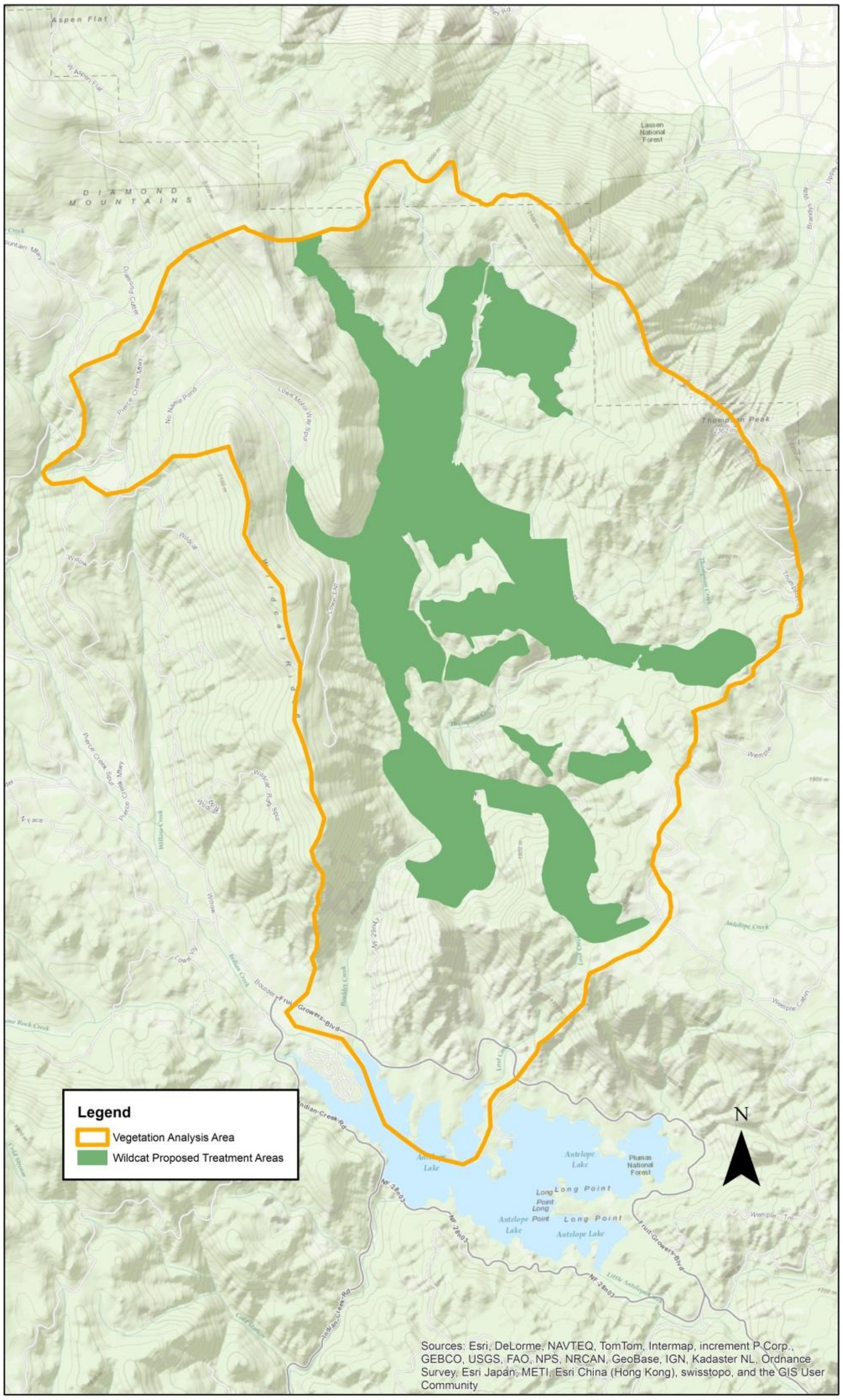


Figure 18. Spatial extent of Wildcat Project and forest vegetation analysis area

The project area lies east of the Sierra Nevada crest (USDA2013a, b). Based on recent analyses reflected in the DRAFT 2013 Moonlight Restoration Strategy using precipitation bands, Wieslanders' vegetation maps from the 1930s, and historic aerial photos, much of the project area can be inferred to have been historically yellow pine dominated forests (eastside pine types) along with dry mixed conifer forests. Precipitation, along with other factors, is considered as an indicator of forest vegetation type in the Sierra Nevada As a generality, the landscape in the Wildcat Project area lies entirely within the eastside precipitation range of under a 1,000 mm of annual precipitation (Figure 19).

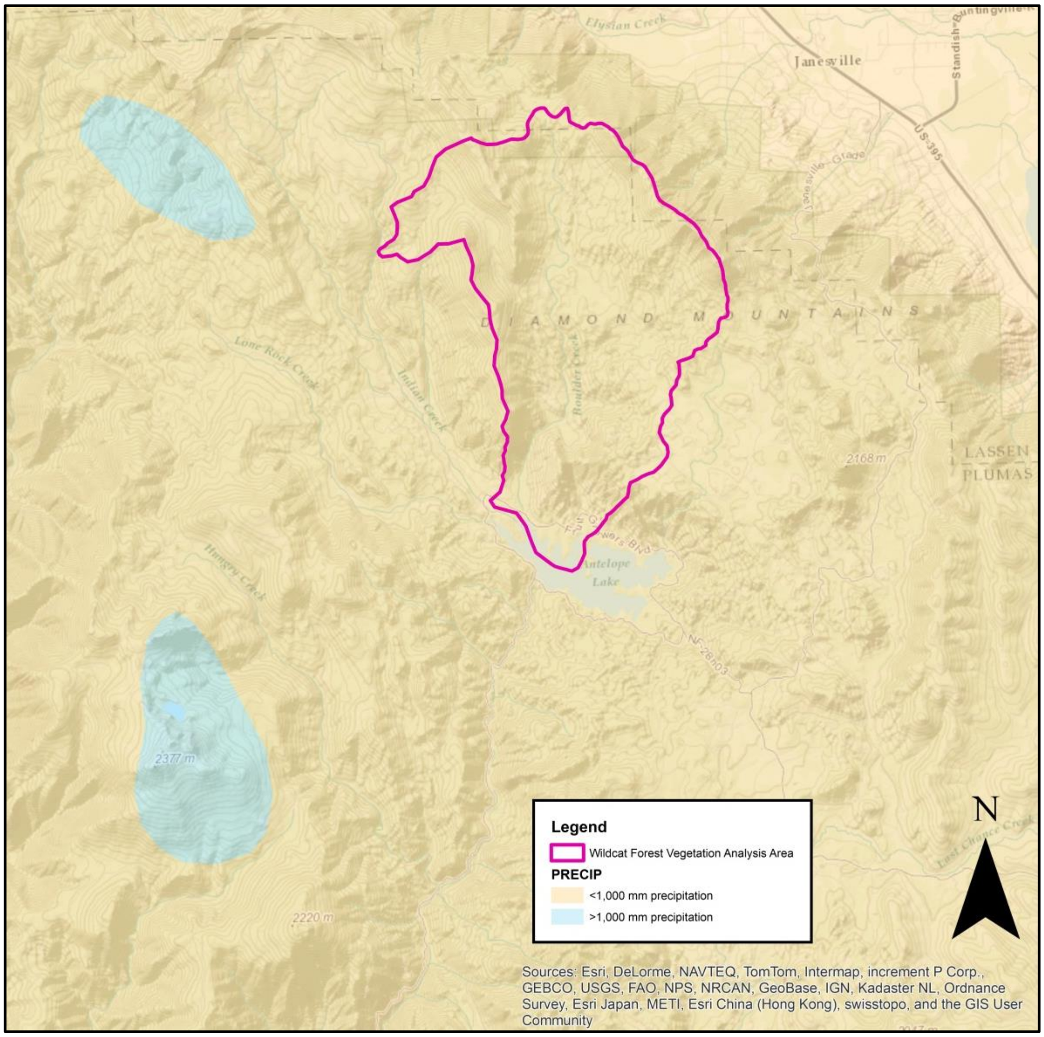


Figure 19. Wildcat forest vegetation analysis area and historical annual precipitation

In the Forest Health Protection report by Cluck (USDA 2014a), the project area, on average, does not typically receive more than 40 inches of annual precipitation (Table 19). However, topographical differences within the project area such as north facing slopes and drainages may have more available moisture than the general landscape.

Table 19. Average annual precipitation in the Wildcat Project area (USDA 2014a)

Average Annual Precipitation (inches)	Approximate Percentage of Project Area
30”–40”	35%
25”-30”	50%
20”-25”	15%

Major tree species include Jeffrey pine, sugar pine, western white pine, white fir, incense-cedar, lodgepole pine, Douglas fir and aspen. Other potential species may include ponderosa pine, black oak, cottonwood and red fir in higher elevations. A small portion of the proposed treatment area consists of high elevation true fir stands. With the possible exception of the true fir stands, species composition would have been predominantly fire-adapted yellow pine (Jeffrey and ponderosa pine) with much lower densities of shade-tolerant species, such as white fir (Scholl and Taylor 2010; Taylor 2004).

The Forest Survey Site Class (FSSC) in the project area ranges from 4 to 6 (based on an index where FSSC 7 represents the least productive site class); however the majority of the project area is primarily rated as site class 6. Soils in the project area are primarily derived from igneous parent materials. The area has experienced frequent fires and is adapted to an active fire regime. Please see the “Fuels” section for further discussion regarding fire history and behavior.

Geographic and Temporal Bounds

The geographic region defining the forest vegetation analysis area (Figure 18) encompasses several watersheds covering an estimated 13,263 acres. This area includes all watersheds in which proposed units reside. Watersheds boundaries are logical and ecologically relevant margins in determining the total and overall extent of treatment effects on forest vegetation. Under an intact and active disturbance regime, it has been suggested that stand heterogeneity might have been affected by topographical features (USDA 2009a) including ridgelines and drainages. Hence, the use of watershed boundaries as analysis areas makes ecological sense. This analysis area represents the furthest measurable extent that forest vegetation effects resulting from the proposed actions would occur. The analysis area includes vegetation occurring with the treatment units as well as the vegetation outside the treatment areas within the watersheds. Cumulative effects of other projects within the watersheds would likely affect forest vegetation within the project area and would be included in this analysis.

For the purpose of the vegetation analysis, the temporal bounds include a 20-year horizon for future effects. Within 20 years, treated stands would approach the typical reentry cycle for managed stands. This timeframe also allows for ensuring treatment activities are designed to be consistent with past direction from the Regional Forester to thin to “ensure that density does not exceed an upper limit (for example: 90 percent of normal basal area, or 60 percent of maximum stand density index)” and to “design thinnings to ensure that this level will not be reached again for at least 20 years after thinning.” (Blackwell 2004).

Background

In general, forested landscapes in the Wildcat Project area were characterized as having an open, all-aged structure as stated by Collins and Skinner in their “Fire and Fuels” science synthesis (USDA 2013a). Arguably, along with timber harvest, fire suppression has probably had the most dramatic effect on the forest vegetation composition and structure in the Sierra Nevada’s (Agee and Skinner 2005; Collins and Roller 2013; Collins et al. 2011). The selective removal of larger, fire resilient, shade intolerant conifers has led to a homogenization of forested stands across the landscape. When coupled with extensive fire suppression, this has led to increasingly larger fires with greater patches of high severity fire (Miller and Safford 2012). In turn, these large high severity patches have resulted in a greater homogenization of the forest (Miller et al. 2012).

Stand Density

Overall, there are approximately 360 TPA (Figure 20) with an average basal area of 180 ft^2 per acre. Of those 360 trees, about half are considered biomass tree (3.0” to 9.9” DBH). Only a rough quarter of the total trees per acre would be considered sawlog-sized trees and of those total sawlog-size trees, the overwhelming majority is classified by CWHR as small trees (Table 17).

Considering how historic TPA was well under a 100 TPA (Table 15) the overall, the current stand density could be described as overly dense and dominated by very small trees. The historical large tree component in the analysis area is certainly lacking.

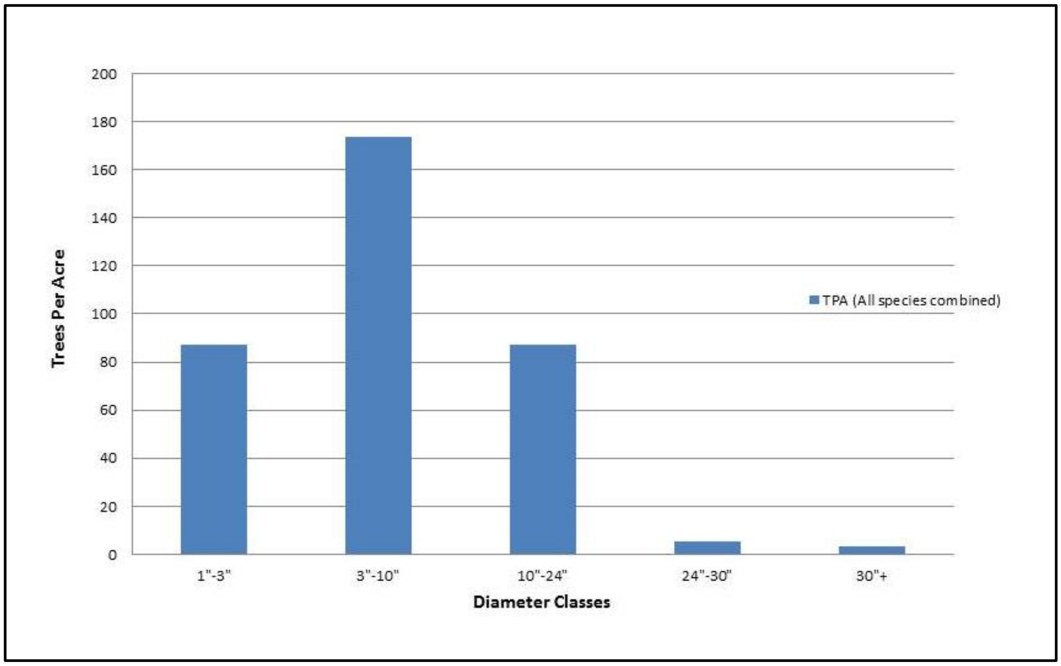


Figure 20. Current diameter distribution in the analysis area of all species combined

The average relative densities for stands within the Wildcat Project vegetation analysis area range from approximately 61 percent to 74 percent. As stands reach and enter 60 percent of relative stand density, self-thinning starts as resources per tree become increasingly limited. Often at these densities, growth slows down and overall stand vigor is decreased. This often puts stands at risk to insects and disease as individual and stand health decreases, potentially leading to insect outbreaks. When coupled with the recent drought in the area, the implications of high stand density are even more severe. Conifers, especially shade tolerant species such as true fir are drought intolerant and may be especially affected by drought resulting in widespread mortality (Macomber and Woodcock 1994; Guarin and Taylor2005).

The current combination of high stand density and drought could have a severe synergistic effect on stand health. With the increased susceptibility of mortality to insects and disease, dense stands are highly vulnerable to stand replacement fire. The additional mortality adds to an already high fuel loading, making the potential for uncharacteristic stand-replacement fires a more realized potential.

Desired relative densities would be below the 60 percent threshold of imminent competition mortality for 20 to 30 years (Blackwell 2004). Long and Shaw (2012) have also recommended keeping stands below 60 relative SDI to avoid "…substantial self-thinning…".These levels are substantially below the threshold of imminent competition mortality, and treatments within the desired range should have a reasonable "lifetime" before reaching densities at which mortality is expected to occur..

Species Composition

Currently, the Wildcat area is dominated by white fir. White fir makes up nearly two-thirds of basal area within the vegetation analysis area. Jeffrey pine is the next highest by basal area per acre with other tree species constituting a minor component.

As indicated previously under the "Affect Environment-Stand Density" discussion, white fir, being drought intolerant, may experience increased dieback as a result of the current drought condition (USDA 2014a). This increases forest vulnerability to bark beetle outbreaks, and increase susceptibility to uncharacteristic stand-replacing fire due to increased fuel loads from bark beetle related mortality.

Not only does white fir represent the majority of the basal area within the stand, it also has the highest presence. On average, shade tolerant conifers make up nearly 75 percent of the number of the individual trees per acre (Figure 21). Shade intolerant species such as Jeffrey pine make up approximately a quarter of the rest of the other stand species composition. The high presence of white fir indicates that many of these east side stands have shifted from historical yellow pine dominated to true fir dominated. This departure has an effect on the potential trajectory of stand development in the Wildcat Project area as desired shade intolerant, drought and fire resilient species such as pine become slowly replaced by shade tolerant, drought and fire susceptible white fir.

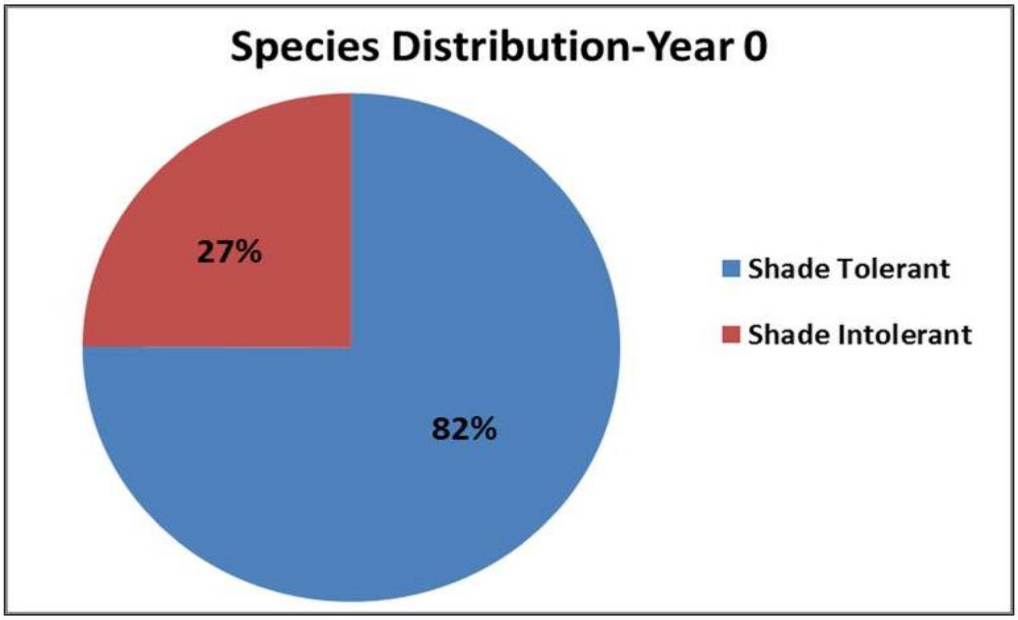


Figure 21. Distribution of shade tolerant to shade intolerant trees per acre

Landscape Heterogeneity

The majority of the vegetation type within the Wildcat Project area is considered conifer dominated forest (Figure 22). The other major vegetation types are hardwood forest types that include aspen stands and montane hardwood conifer. Non-forest vegetation types may include wet meadows, montane riparian, chaparral, etc.

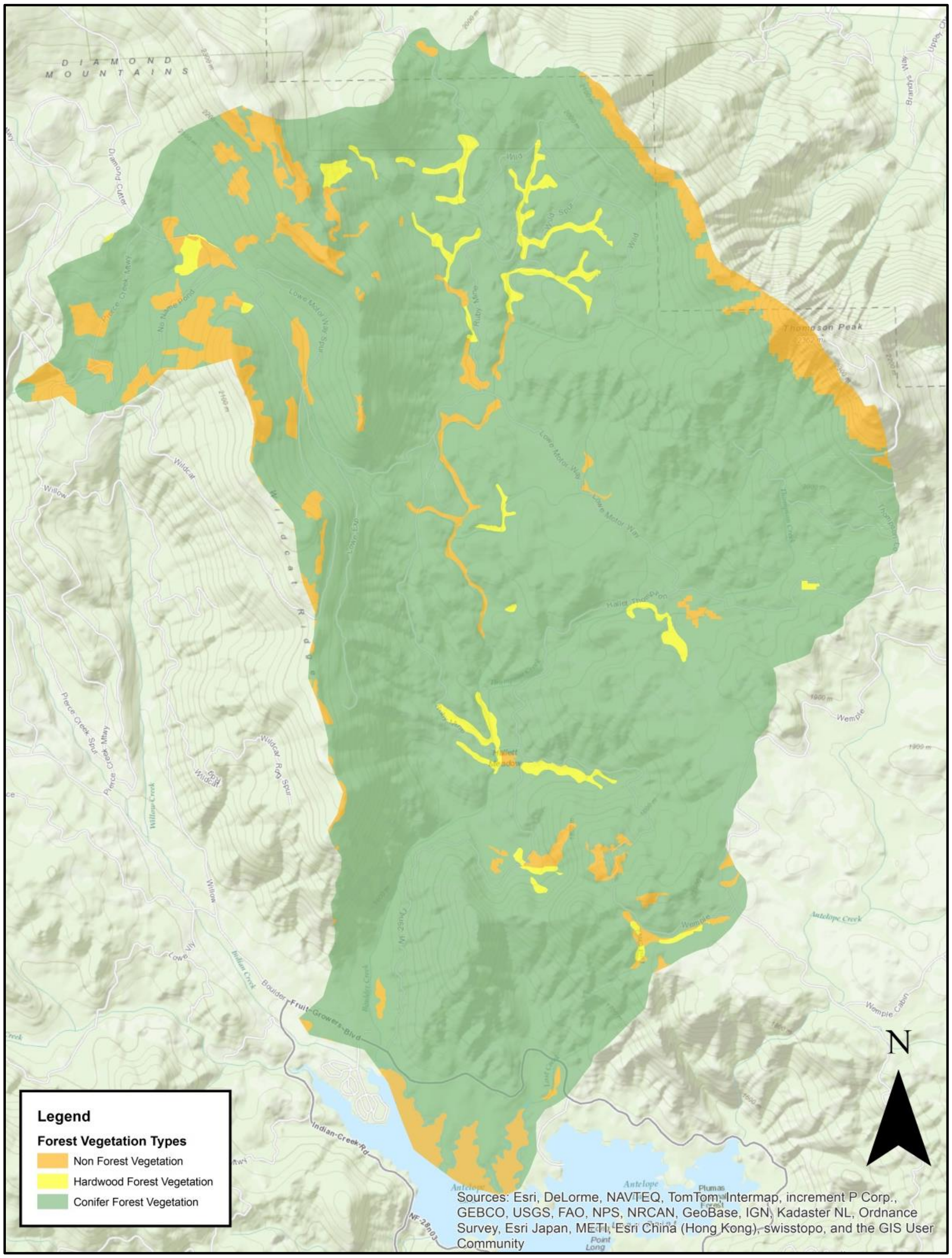


Figure 22. Wildcat analysis area vegetation distribution map

At the stand level, the combination of past management activities, fire exclusion and extensive drought related mortality had created relatively homogeneous areas typified by small trees existing at higher densities (CWHR size class 4, Figure 22) (Oliver et al. 1996). Within the forest conifer types, size class 4 comprises nearly 70 percent (Figure 23), indicating a homogenous landscape lacking in other seral stages.

Most of these stands are comprised of shade-tolerant species such as white fir. Desirable conifer shade intolerant species such as yellow pine and sugar pine appeared to be fading from the landscape. This was probably exacerbated by overstory removal of desired conifer species during the 1980's and 1990's. These high stand densities and high fuel loads created by density dependent and drought related mortality created overstocked stands with high accumulations of ladder and canopy fuels.

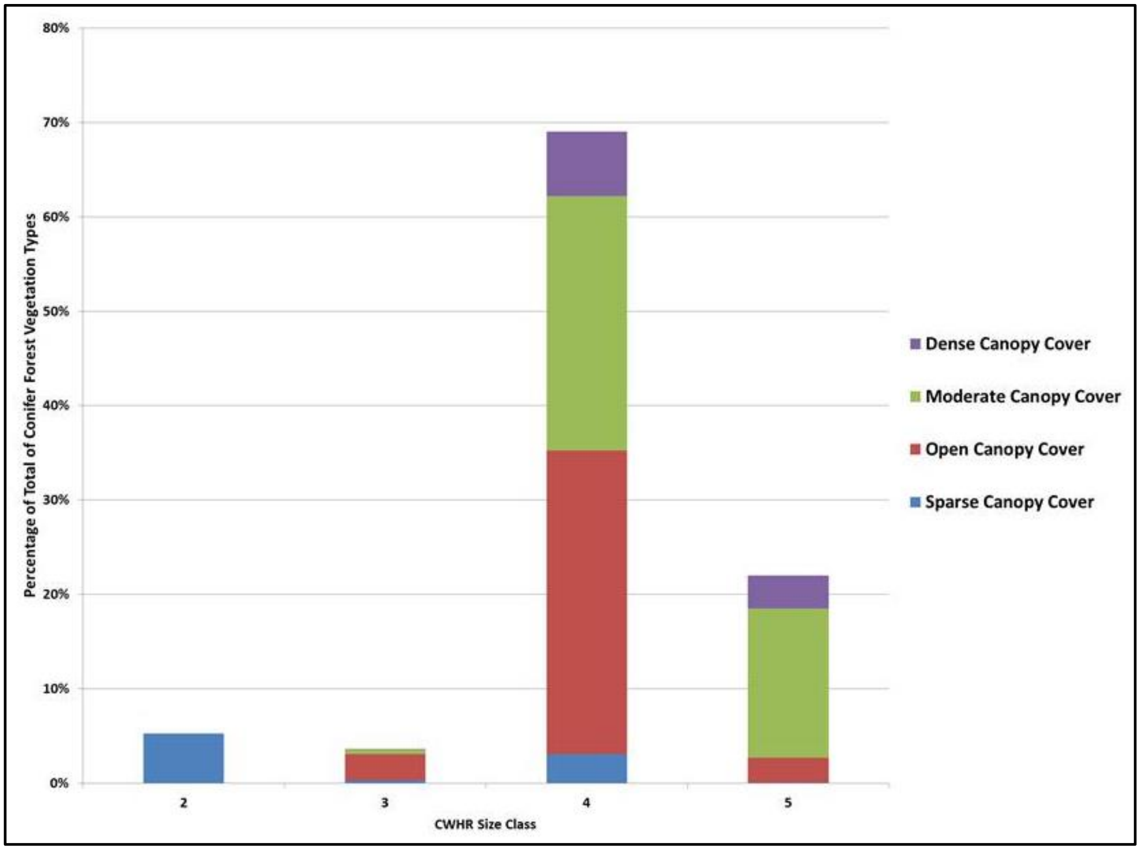


Figure 23. Percent distribution of CWHR size class forest vegetation type within the Wildcat Analysis area

Research suggests that under a natural fire regime, a highly heterogeneous landscape would have occurred with structural variation based on topography's influence on fire frequency and intensity (USDA 2009a; Beaty and Taylor 2001; Taylor 2004). Large diameter trees in open-canopy conditions (best represented by CWHR size class 5 and open/sparse cover) would have been more prevalent on the landscape (Stephens and Gill 2005; USDA 1992a; USDA 2007b). This would have been especially true in eastside type stands (Stephens et al 2011).

The current homogenous stand structure is unstable because of its vulnerability to high-severity fires, large insect and disease outbreaks, and landscape-level mortality from drought. A more diverse distribution of successional stages and stand structures would increase landscape resilience to these disturbances, which are projected to intensify with future climate change (USDA 2009a; North 2012; Stephens et al. 2010; Millar et al. 2007).

Aspen

Aspen stands are scattered throughout the project area but exhibit signs of decline due to conifer encroachment and the absence of disturbance. Aspen currently makes up very little of the species composition on the landscape. These shade-intolerant, resprouting species are adapted to frequent disturbance and historically contributed to landscape diversity. Due to past management practices (e.g. fire suppression and grazing) however, these valuable species have decreased in abundance from historical ranges. Aspen clones are found generally in more mesic sites, i.e. riparian areas and along drainages, where they were historically much larger than they are today. However, because aspen is usually found in more mesic sites, on the east side where Wildcat Project is, this also creates a good site for conifer growth. Thus conifer encroachment is a major factor in aspen decline.

For successful regeneration this species requires protection from browsing, favorable conditions (sufficient sunlight and warmer soils), and hormonal stimulation to initiate suckering (USDA 2006a). Aspen is more abundant on the eastern side of the Sierra Nevada's compared to the western side and would benefit greatly from restoration treatments.

Environmental Consequences

Direct Effects

These are effects on forest vegetation that are directly caused by treatment implementation or, as with Alternative B (no action), a lack of treatment or action.

Indirect Effects

These are effects on forest vegetation that are in response to the direct effects of treatment implementation or, as with Alternative B (no action), a lack of treatment.

Cumulative Effects

Direct effects would likely be limited to the project implementation phase. Indirect effects would last beyond the implementation period and occur within the temporal bound of the cumulative effect analysis as described above under "Geographic and Temporal Bounds".

In order to understand the contribution of past actions to the cumulative effects of the Proposed Action and No-Action alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects.

This cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. Focusing on individual actions would be less accurate than looking at existing conditions because there is limited information on the environmental impacts of individual past actions and it is not reasonably possible to identify each and every action over the last century that has contributed to current conditions. By looking at current conditions, the Forest Service is sure to capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects. The Council on Environmental Quality issued an interpretive memorandum on June 24, 2005, regarding analysis of past actions, which states, "agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions." For these reasons, the analysis of past actions in this section is based on current environmental conditions.

Cumulative Effects Common to Alternative A and Alternative B

As mentioned above, this cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. By looking at current conditions, the Forest Service is sure to capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects. The analysis of past actions in this section is based on current environmental conditions.

Past Projects

The cumulative effect of past management practices; fire exclusion and wildfires fires have largely shaped forest structure prior to the Wildcat Project. On public and private lands, past harvest activities focused on removal of dominant and co-dominant trees and retention of biomass and even-aged treatments.

Since the 1990's, overstory removal, sanitation cutting, commercial thinning (including single-tree selection), salvage cutting and removal of small trees has been the principal silvicultural treatment implemented on public lands in the analysis area. Some of these silvicultural treatments might have been incorporated into defensible fuel profile zones (DFPZ). The DFPZs within the project area include the Hallet and Antelope Border DFPZ. They were constructed in the 1990s and mid-2000s, respectively. These areas were treated to meet desired conditions in terms of potential fire behavior and tree mortality.

Other past activities include multiple fires such as the Cateyes (1996), Stream (2001), Boulder (2006) and Moonlight (2007) in more recent times. These fires had varying effects on forest vegetation which is reflected in the current condition of the project area. Past activities such as watershed and recreation improvement projects have been small in scale and localized in effects.

Recreation

Dispersed recreation use is moderate in the majority of the project area, with the exception of Antelope Lake. As a recreation area, Antelope Lake has several campgrounds: Boulder Creek campground (CG), Lone Rock CG, Long Point CG. There is also a boat launch, day use area and vista area for scenic viewing. In June 2010, eight new restrooms were installed at Lone Rock CG. Additionally, the 2005 Travel Management Final Rule would limit vehicle impacts to officially designated roads only, reducing potential effects to forest vegetation.

Season of use is generally May through November, with activities including camping, hiking, hunting, horseback riding, off highway vehicle riding, fishing, firewood cutting, wildflower viewing, by individuals and small groups. Project related impacts to activities and specific infrastructure such as; roads, OHV routes, single track trails, hiking trails and campgrounds are analyzed in the Recreation section. Recreation in the project area would have very little cumulative effect.

Christmas Tree and Firewood Cutting

In general, Christmas tree cutting would be highly dispersed and negligible and most likely confined to accessible areas during the holiday season. Firewood cutting will likely be limited to roadways as firewood cutters prefer not to cut trees that have blackened bark and are only allowed to cut standing dead trees within 100 feet of the roads. Overall, Christmas trees cutting and fuel wood cutting, would have a negligible effect on future stand and landscape-level forest vegetation, fuel loading, fire behavior, fire severity, or air quality due to the limited, highly localized, but largely dispersed nature of these activities. As a result cumulative effects would be negligible and immeasurable on a per acre basis.

Range

Portions of four range allotments are within the Wildcat project area: Antelope, Antelope Lake, Lights Creek and Lone Rock. The majority of the Wildcat Project is within the Antelope Lake Allotment and the Lowe Flat Pasture in the Antelope Allotment. Livestock generally prefer flatter open meadow areas instead of conifer dominated forest vegetation types. Forest vegetation treatment activities are coordinated with the Forest Range Staff and contracting personnel. All four mentioned range allotments are schedule for analysis and decision in the next two years where additional effects will be analyzed. Cattle have been known to browse on conifer seedlings, but negative impacts to regeneration appear to be minimal (Kosco and Bartolome 1983). Browsing on apsen sprouts may require mitigation measures if deemed necessary. Overall, cumulative effects to forest vegetation would be very minimal.

Miscellaneous Projects

Other miscellaneous projects include the Boulder Creek Watershed Improvement Project and various special uses in the project area. The watershed improvement project includes activities such as 1,900 feet of stream side stabilization and re-vegetation, repairing seven head-cuts and culvert work. The special uses in the project area include outfitter and guide permits as well as special use permit to operate a campground concessionaire. Overall, these miscellaneous projects would have very little cumulative effect.

Future Forest Health Projects

With the Moonlight Settlement Agreement (2012), funding was secured for post-fire restoration projects in the adjacent Moonlight Fire (2007). Many of the anticipated projects are still in the proposal phase with uncertainty over whether they will be funded and implemented. One project that may occur in the Wildcat Project area is the Lone Rock Project which intends to reduce stand densities, reduce tree hazards and fuels around the Antelope Lake campgrounds. However, this project is still in the reconnaissance and planning phase. Any projects that may occur within the same footprint as the Wildcat Project area will undergo through the NEPA process including cumulative effects analysis prior to decision and implementation.

Alternative B – No-Action – Direct and Indirect Effects

Under Alternative B, none of the proposed activities in Alternative A would take place. However, this does not imply that the current condition will remain static. In fact, no-action simply implies that natural processes will be allowed to occur, whether they are desirable or not. Existing stand conditions would persist and develop unaltered by active management.

Stand Structure-Relative Stand Density, Trees Per Acre and Basal Area

Under the “Affected Environment” discussion, the current relative SDI for the Wildcat Project varies from 61 percent to 74 percent. Without any activities proposed in the Proposed Action, current relative SDI’s would remain above the desired conditions (USDA 2004c,d). This would leave the stand at elevated risk to insects and disease. Without thinning, these stands would also experience reduced growth and density-dependent tree mortality as inter-tree competition for limited resources continues. No reduction in stand density will also likely to exacerbate the effect of the recent drought, putting the stand at further risk of loss to insects, disease and fire (USDA

2014a). Relative SDI is predicted to persist at high levels (Table 20) and density related forest health issues will continue into the long term without thinning. This contrasts sharply with previous studies that indicate relative SDI in pine dominated forests remained around 30 percent (Table 15). These studies show that the high range of rSDI was approximately 53 percent (Table 15), which is still below the current relative SDI in the Wildcat Project area (Table 20).

Table 20. Modeled rSDI over time (No-Action Alternative)

Year	rSDI
0	61% - 74%
10	65% - 80%
20	69% - 85%

Corresponding TPA is also expected to remain high and weighted towards smaller DBH ranges (less than 10.0” DBH) (Table 21). Ingrowth of trees into the 10.0” to 20” DBH class would continue over time. Already lacking on the landscape, the number of intermediate and large trees (greater than 19.9” DBH) would slightly increase, but stands would still be dominated by small and pole size trees. Besides contributing the high stand density, these trees would also present a hindrance to shade-intolerant species regeneration and a ladder fuel hazard to larger trees.

Table 21. Modeled TPA by DBH (inches) over time (No-Action Alternative)

Year	1”-3”	3”-10”	10”-20”	20”-24”	24”-30”	Greater than 30”	Average TPA
0	87	174	79	8	5	4	364
10	64	179	82	9	7	4	357
20	32	182	85	10	8	5	328

Under the No-Action Alternative, basal area is expected to stay above maximum thresholds of 100 ft^2 per acre to 150 ft^2 per acre for the Wildcat Project area to maintain forest health (USDA 2004c) (Table 22). Considering how the project area receives relatively low levels of annual precipitation 25 to 40 inches per year, Cluck (USDA 2014a) warns that prolonged drought may cause excess mortality, especially in the shade tolerant white fir.

Table 22. Modeled basal area over time (No-Action Alternative)

Year	Current Average Basal Area (ft^2/ac)	Percent Above Recommended BA[1]
0	180	20% - 80%
10	201	34% - 101%
20	221	47% - 121%

[1] Per R5 suggested appropriate BA target to reduce risk to insects (USDA 2004c)

Under the No-Action Alternative, stand structure is expected to be characterized as few large trees with a dense understory. Stand densities are expected to remain high over time, resulting in poor growth and low vigor. These stands will remain at high risk of loss to insects, disease and fire and would not meet the desired conditions of reduced stand densities, increased growth rates and disturbance resilience.

Species Composition

As indicated in the “Affected Environment” discussion earlier, shade tolerant species make up approximately three-quarters of the stand species composition by TPA (Table 20). This trend is expected to continue over time as much of the shade tolerant species is comprised of white fir

(Figure 24). Under the No-Action Alternative, the ratio of shade tolerant to shade intolerant is not expected to change primarily because white fir remains at a disproportionate amount. Although white fir is modeled to have a slight decrease, most likely due to high density, it still makes up of the majority of the tree species composition in the stands. This is a marked departure from historically what would have been described as pine dominated stands Table 15).

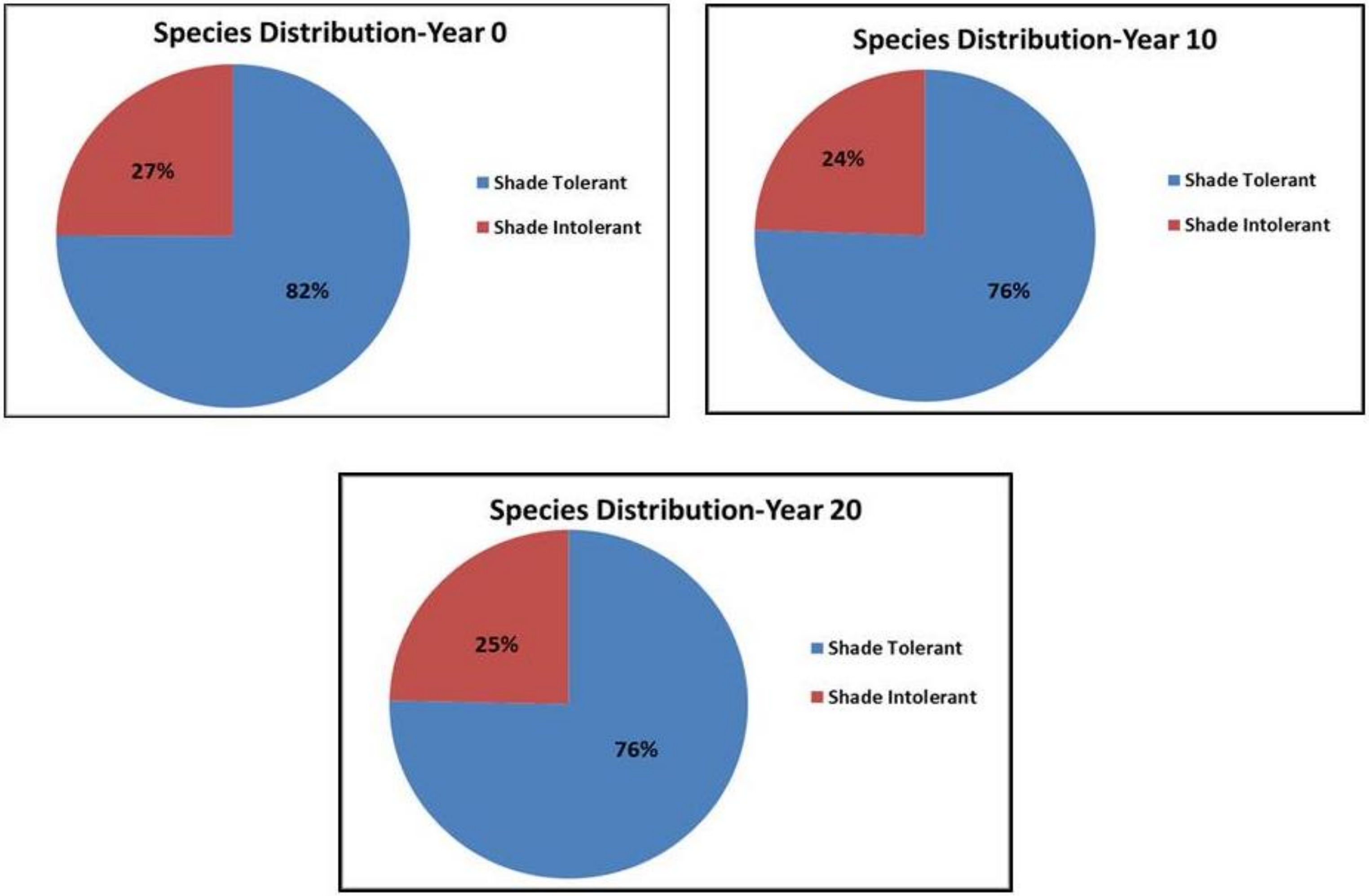


Figure 24. Shade tolerant to shade intolerant distribution by TPA over time (No-Action Alternative)

This trend is expected to continue because of the dense understory that helps perpetuate the regeneration of shade-tolerant white fir. As overstory trees succumb to competition-related mortality, understory trees would be expected to occupy the growing space and eventually develop into overstory trees. Because the smaller trees are consist primarily of shade-tolerant species (resulting in the lower percent of shade-intolerants by trees per acre versus basal area), shade-intolerant species regeneration would be minimal. Future intermediate and large size trees would be shade-tolerant. This will further exacerbate species composition problems in the future as the seed sources for regeneration would mainly consist of shade-tolerants.

Of concern are the species specific insects and diseases that are attacking white fir. As concluded by Cluck (USDA 2014a) fir engraver beetle is successfully attacking white fir stressed from a prolonged drought, Heterobasidion root disease and poor growing site and high stand densities in the Wildcat Project area. Heterobasidion root disease is especially widespread and estimated to be present in the north half of the Wildcat Project area (USDA 2014a).

Under the No-Action alternative, species diversity would be reduced, resulting in increased susceptibility to insects, disease, drought, and wildfire. This would not meet the desired conditions of increased composition and regeneration of shade-intolerant, drought- and fire-resistant species.

Landscape Heterogeneity

In the previous “Affected Environment” discussion, the majority of the Wildcat Project consists of conifer CHWR size 4, M and D density stands (Figure 23). Under the No-Action Alternative, this would not change. With no thinning activities, CWHR density class S and P stands would slowly get denser over time, becoming more homogeneous over time.

At current densities, stand growth is expected to be minimal (Table 23). The average quadratic mean diameter (QMD) across the project area is expected to grow by less than one inch over twenty years. As a result, many of these CWHR size 4 stands would not likely grow into the next larger size class. Contrast this to studies that estimate average diameters historically were approximately 20 inches or greater (Table 15). Over time, the amount of mid seral stands would increase, resulting in more skewed landscape distribution. Considering the project receives relatively low levels of annual precipitation, this homogenization of the area into closed canopy mid seral stands puts it at risk for major disturbance including insects, disease and fire. A homogenous landscape composed of stands of similar structure and composition is less resilient and more susceptible to insect and pathogen outbreaks, competition-related mortality, wildfire, and drought (USDA 2009a; North 2012; Stephens et al. 2010; Millar et al. 2007). This would not meet the desired conditions of uneven-aged, multistoried stands and heterogeneous stand structures that promote shade-intolerant species.

Table 23. Average canopy cover and QMD over time (No-Action Alternative)

Year	Canopy Cover (Percent)	QMD (inches)
0	44	14.8
10	47	15.3
20	50	15.7

Aspen

Under the No-Action Alternative, aspen stands would remain susceptible to conifer encroachment and associated declining health. Without the proposed removal of overstory conifers and prescribed fire, aspen would experience continuing lack of regeneration due to sub-optimal sprouting conditions (USDA 1985a, Pierce and Taylor 2010). Aspen depend on disturbance to create early seral conditions in which it thrives and dominates for a period. Although conifers eventually colonize the stand, aspen can rely on root reserves until the next disturbance creates favorable suckering conditions. Absence of stand-replacing disturbances combined with extended periods of high stand densities and insufficient sunlight may cause clones to deplete their root reserves and die completely. Over time, insufficient regeneration would lead to the eventual disappearance of these highly valued and infrequent species across the landscape as these stands develop into closed-canopy conifer stands.

Alternative B– No-Action – Cumulative Effects

Alternative B would not meet the purpose and needs discussed in Chapter 1. No treatments would be implemented, and existing forest health issues related to stand structure, composition, and landscape structure would remain unchanged. Stand densities would remain high, especially in small diameter trees, and susceptibility to insects, disease, fire, and drought would increase over time. Stand structure would favor the regeneration and growth of shade-tolerant species, resulting in a gradual species shift away from desirable shade-intolerant species. Seral stage diversity across the landscape would become more homogenized with an overabundance of mid-seral closed-canopy stands. Overall, Alternative B would not shift the current landscape towards desired conditions.

Under No-Action Alternative, only density-dependent mortality, wildfire, and wildfire suppression would modify stand and landscape structure. The creation of early seral stands would rely on disturbances. However, small-scale disturbances such as endemic disease and insect outbreaks, windthrow, low-severity fires, and minor mortality would decrease stand densities, but most likely not enough to significantly change structure or prevent large-scale impacts. The potential for large-scale disturbances such as disease and insect outbreaks beyond endemic levels, widespread drought, high-severity fires, and other major mortality events currently exists on the landscape and would increase with no active management. Without control, these impacts could significantly alter stand structure and landscape diversity beyond management intent or objectives. For example, widespread mortality from Jeffrey pine bark beetles or high-severity wildfire could shift species composition further from desired conditions or create a surplus of early seral stands at the expense of late seral stands, respectively.

No treatments would occur to enhance the development of mid- and late-seral open-canopy forests, and homogeneous closed-canopy stands across the landscape would be unstable. Late seral stands would eventually be created over a longer time period, but would not meet immediate management objectives identified in Chapter 1.

Aspen stands would remain at risk to conifer encroachment and would rely on disturbance to create optimal growing conditions and hormonal stimulation. In the absence of disturbance or management intervention aspen clones may disappear, further reducing species diversity on the landscape.

The cumulative effects of alternative B would occur in the context of past management, including wildfire suppression, and natural disturbances, such as wildfires and insect and disease outbreaks, which have largely influenced the forest vegetation that is present today. Past projects and events are reflected in the vegetation layer used to characterize the existing conditions (the baselines for analysis) in the analysis area.

Alternative A – Proposed Action – Direct and Indirect Effects

Under Alternative A (Proposed Action), the Wildcat Project proposes to primarily mechanically thin around 2,587 acres for general forest health objectives. Mechanical thin acres may be less due to RCA mitigation design features. Within these mechanical thin units, there will be roughly 183 acres of hand thin as a result of RCA mitigation design feature. Actual acres are dependent upon verified field conditions. There are also approximately 49 acres of hand thin only units proposed in Alternative A. There will also be an estimated 317 acres of aspen enhancement and restoration treatment. Approximately 102 acres would be prescribed burn only, although many units may receive prescribed fire as a follow-up treatment, if appropriate.

Mechanical thin units would primarily remove conifers in the form of sawlogs (10.0” DBH and up). Many units would also remove biomass (3.0” to 9.9”) as a product if feasible or efficient. In addition, depending upon desired conditions, there may be a secondary treatment of grapple pile and/or prescribed fire to further reduce fuels and increase stand resiliency.

Hand thinning units would generally occur within “Tractor Keep Out” (TKO) in Riparian Conservation Areas (RCA’s) and remove trees up to 9.9” through use of a chainsaw. Most felled material would be piled and burned, though biomass removal could occur if feasible. Within these treatment areas, 14 “sub-units” would have a more intensive hand thinning treatment to create Sierra yellow legged frog basking sites. The total acreage for these sites is approximately 1.3 acres with the average size being less than 0.10 acres.

Units that are proposed to be underburned only would receive very little manipulation other than hand lines around the unit boundary to meet the prescribed burning plan. There is no proposed vegetation treatment and no removal of forest vegetation other than potential incidental cutting of sapling size trees during fireline construction. Additional prescribed burning may occur in many mechanical thin units if necessary and feasible as a post-primary treatment.

The control of invasive plant species is proposed through the use of herbicides and manual treatment. Herbicides would be applied using a direct spray technique with a backpack-type sprayer or selection application technique such as “wicking”. These treatments are intended for invasive plants and would not be applied to conifer species. Other work proposed include watershed enhancement treatments including closing, decommissioning and obliterating roads, reconstructing water drafting sites, constructing reconstructing dips and constructing armored stream crossings. These watershed enhancement activities are usually confined to the transportation system away from forest stands. Any forest vegetation affected is usually along the transportation system right-of-way corridor.

Direct and Indirect Effects of Mechanical Thinning

Alternative A proposes to mechanically treat forest conifer vegetation from 3.0” to 29.9” DBH on an estimated 2,587 acres for forest health objectives. This discussion on the effect of mechanical thinning would not include aspen enhancement treatments. Please see further below under “Direct and Indirect Effects of Aspen Treatment” for further discussion regarding aspen areas.

Conifers 10.0” DBH and over would be removed as sawlogs. On approximately 2,587 acres, material from 3.0” DBH to 9.9” DBH would be removed as a biomass product if feasible or efficient. If biomass removal is not practical, this smaller material may be grapple piled and burned. In general, mechanical thinning would reduce stands to desired densities and decrease the ration of undesired shade tolerant to desired shade intolerant, fire resilient conifers. Mechanical thinning would also incorporate variable density.

As stated in Chapter 2, forest vegetation in mechanical thin units would be treated by various prescriptions of differing intensities. These prescriptions vary upon their desired residual basal area, canopy cover, species retention, etc. As such, treatment units may have multiple prescriptions dependent upon their existing forest stand condition, topography and aspect desired condition. Thinning prescription would vary across the landscape and are based upon vegetation type, topographic position, desired wildlife structures, and historic reference conditions. Sierra mixed conifer stands would generally retain higher densities compared to eastside pine types. And within these stand types, northeast aspects and drainages would contain higher densities than southwest aspects and ridgetops. High density clumps of large desirable trees would be retained and protected by low density gaps with open-canopy conditions. These features would break up the matrix of evenly-spaced trees that would comprise other areas of the stand. Scattered high-value legacy trees and black oaks would be retained and protected through radial thinning around selected trees. Areas of high wildlife habitat value would be retained as well. For example, a unit may have drier eastside type stands on the south facing slope, a mixed conifer stand in a moist drainage that bisects the unit and higher elevation true fir stands. Instead of a single basal area target, the treatment unit would be treated using a range and average residual basal area target.

Therefore, although the direct and indirect effects of mechanical thin analysis would often be discussed in averages regarding the measurement indicators, it should be noted that there is an inherent range. It is important to emphasize that this range is meant to reflect the variability of the treatment across the landscape. Furthermore, the application of these multiple prescriptions would be implemented through a variable density approach, as described above, with the intent of creating a diverse range of densities and structure within stands; essentially a "range within a range". This approach to treatment recognizes and integrates the inherent heterogeneity in a forested landscape (USDA 2012a).

Stand Structure-Relative Stand Density, Trees Per Acre and Basal Area

On average, mechanically thinning stands would initially bring the relative SDI in the affected areas to less than 40 percent of relative SDI (Table 24). The average relative SDI is expected to remain below 60 percent for at least an estimated twenty years, as opposed to the No-Action Alternative. Mechanical thinning would meet Regional direction in maintaining stand densities at a healthy level for at least twenty years after initial treatment (USDA 2004c,d). These projected rSDI's also correspond with estimated historical relative stand densities (Table 15)

Table 24. Modeled rSDI over time (Alternative A-mechanical thinning)

Year	rSDI Range (average)[1]	No-Action Alternative
0	13%-69% (36%)	61%-74%
10	16%-75% (40%)	65%-80%
20	18%-80% (43%)	69%-85%

1-The range and average relative SDI is based upon a maximum SDI of 450 and 550

Hayes et al. (2009) reported that stand density is the most important predictor of western pine beetle caused mortality on the landscape in California. With the recent drought in California and the Wildcat Project being in an area of lower precipitation, reducing stand densities in stands would be critical to increasing resiliency to insect and disease. In addition to increased resistance to insect attacks, maintaining stands at a lower rSDI encourages individual tree growth (Long 1985). This encourages growth of trees in CWHR size class 4 to grow to size class 5 and 6 over the long term. For further discussion regarding CWHR distribution over time, please see the "Landscape Heterogeneity" and "Cumulative Effects" discussion.

Another direct effect of mechanical thinning would be a reduction in TPA in affected areas (Table 25). In general, this would decrease the ratio of smaller trees to intermediate and larger-sized trees. Also, a reduction in sapling and pole-sized trees would decrease competition for shade intolerant conifer regeneration, thereby shifting the species composition towards a more resilient arrangement. This is a positive shift towards historical tree densities (Table 15), especially compared to the current existing and predicted future condition of the No-Action Alternative (Table 21).

Table 25. Modeled TPA by DBH (inches) over time (Alternative A-mechanical thinning)

Year	1"-3" (Range)	3"-10" (Range)	10"-20" (Range)	20"-24" (Range)	24"-30" (Range)	Greater Than 30" (No Range)	Average TPA (Range)
0	55 (0-87)	53 (0-174)	34 (2-79)	5 (1-8)	4 (1-5)	4	156 (32-357)
10	52 (42-62)	72 (0-147)	34 (2-79)	5 (1-9)	5 (1-7)	4	173 (74-299)
20	37 (33-40)	78 (0-147)	34 (2-81)	6 (1-10)	6 (1-8)	5	166 (70-283)

Landram (USDA 2004c) recommends thinning stands in the eastside to 100 BA. However, there is potential for higher precipitation (up to 45" per year) in some portions of the project area due to topographical heterogeneity. These areas are considered "transition zones" because of their increased annual rate of precipitate and it is recommended that they be thinned to 150 BA (USDA 2004c).

Table 26. Modeled basal area over time (Alternative A-mechanical thinning)

Year	Average Basal Area (Range)(ft^2)	Percent Above Recommended BA[1]
0	102 (39-172)	2%
10	116 (46-193)	16%
20	129 (56-213)	29%

[1] Based on average BA, per R5 direction regarding appropriate BA target to reduce risk to insects (USDA 2004c)

On average, in drier eastside stands, mechanically thinning units would meet target BA guidelines; although in about 20 year another initial entry may be warranted to maintain healthy stand densities. However, in areas where 150 ft^2 BA is appropriate, residual post-mechanically thinned areas would meet and stay under the guidelines for a minimum estimated 20 years after initial thinning. This would greatly extend the longevity of forest health benefits in these stands.

In general, forest structure would shift from dense, homogeneous stands comprised of mostly smaller trees into more diverse open-canopied stands with a more balanced range of diameter classes and increased stand level heterogeneity. Opening up stands would also create favorable conditions for shade intolerant conifer species regeneration and encourage their recruitment and growth. Less dense stands would also exhibit greater vigor and growth as well as increased resiliency to forest disturbances including insects, disease and fire.

Species Composition

Mechanically thinning areas not only reduces overall stand density. By selectively removing shade tolerant species over desired shade intolerant species, mechanically thinning wouldwould also shift the general composition of the forest towards a more desired condition. However, due to diameter limits and canopy cover and basal area retention guidelines, shade-tolerant species would still exist in the overstory. Nonetheless, mechanically thinning stands in the project area wouldwould reduce the average existing amount of white fir that currently exists by over 50 percent (approximately 289 TPA) to an estimated 125 TPA.

The shift of the amount of volume of shade-tolerant to shade-intolerant species wouldwould be much more balanced as a result of mechanical thinning (Figure 25). Currently, the percentage of basal area of shade-tolerant to shade-intolerant species is approximately 65 percent and 35 percent, respectively. This is essentially a 2 to 1 ratio of shade-tolerant to shade-intolerant. Immediately after mechanically thinning, treated stand are expected to be approximately 55 percent shade-tolerant and 45 percent shade-intolerant, or nearly 1 to 1, and to remain in a similar composition for at least 20 years. In areas, it may be appropriate to plant desired shade-intolerant conifer species to help balance species composition.

The discrepancy between species composition by basal area as opposed to trees per acre highlights an undesirable trend where shade-intolerant species comprise mostly of smaller diameter trees because smaller trees contribute less to basal area. Left untreated, these smaller trees would continue to grow where at some point, shade-tolerant species would complete dominate these stands in the overstory as well as the understory.

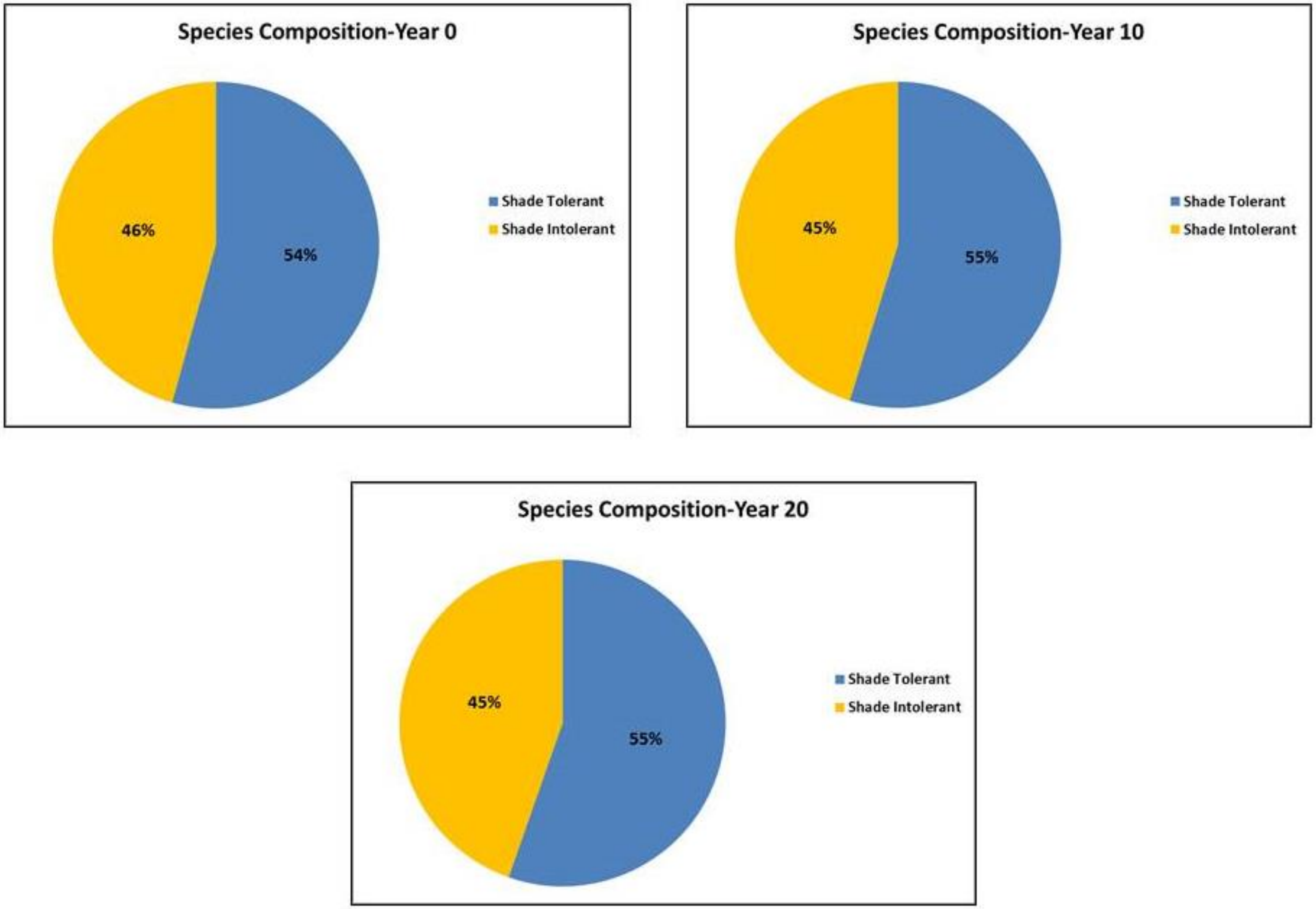


Figure 25. Shade tolerance to shade intolerance distribution by basal area over time (Alternative A-mechanical thinning)

Overall, the composition would be largely improved from current conditions and increase stand level species heterogeneity. In terms of TPA, reducing the amount of white fir by over 40 percent would decrease future seed sources. The marking prescription would also tend to focus on removing smaller trees first which most likely is white fir. Therefore the reduction of smaller shade-tolerant trees would be beneficial to shade-intolerant species by reducing competition and providing an understory more conducive to regeneration.

Landscape Heterogeneity

Besides stand level heterogeneity, mechanical thinning would also increase landscape-level heterogeneity. Seral stage distribution would become more diversified, especially through time as the landscape shifts from dense (CWHR density class M) to sparser canopied stands (CWHR density class P, Table 27), typical of eastside type stands.

Table 27. Average canopy cover and QMD over time (Alternative A-mechanical thinning)

Year	Mechanical Thin		No-Action Alternative	
	Canopy Cover	QMD	Canopy Cover	QMD
0	27%	21.1”	44%	14.8”
10	29%	22.2”	47%	15.3”
20	31%	21.6”	50%	15.7”

Opening up forested stands across the landscape would also increase average diameter growth. However, the recruitment of young trees can decrease the average stand diameter (Table 25), as is seen in year 20 of Table 27. Nonetheless, a reduction of rSDI generally encourages individual tree growth (Long 1985), which would increase average stand diameter. This is especially evident when compared to the projected No-Action Alternative stand QMD (Table 27).

It would also be noted that there is also a range of canopy covers and QMD projected for the treated areas for Year 0 (Table 27) from 15.1” to 29.7” DBH. Some treated areas with a larger residual stand QMD and increased growth may transition to CWHR size class 5 sooner than others. In other treated areas, canopy cover and densities may be thinned to near sparse levels (less than 10 percent canopy cover), increasing the percentage of this currently lacking density class (Figure 23). Overall, the ranges in residual canopy cover and average stand diameters emphasize the increased landscape heterogeneity that would result from implementing mechanical thinning.

A management strategy that encourages forest heterogeneity at multiple scales would improve in general, habitat quality, landscape connectivity and disturbance resilience (USDA 2009a). Oftentimes, other forests with intact disturbance regimes can serve as a proxy for desired conditions. Minnich et al. (2000) found that forests that currently still experience frequent low severity fires, like the project area historically would of, exhibit highly heterogeneous landscapes. Noss et al. (2006) also echoed this finding regarding forests that experience frequent low-severity fires. Overall, Alternative A is projected to shift the current landscape in the Wildcat Project area towards a more heterogeneous distribution of seral stages that more closely resembles the historical context.

Direct and Indirect Effects of Hand Thinning and Prescribed Burning

Due to similarity in impacts, the direct and indirect effects of both hand thinning and prescribed burning will be jointly discussed. Although prescribed burning has the potential to affect larger diameter trees, like hand thinning, prescribed fire is meant treat smaller diameter stems.

Alternative A proposes to hand thin approximately 49 acres. Conifers up to 9.9" DBH would be hand felled and the material piled. Out of those 49 acres, an estimated 42 acres may have this smaller non-sawlog size material removed as a biomass product if feasible.

In addition, there are an estimated 183acres of hand thinningwithin Riparian Conservation Areas (RCAs) that lie within mechanical thin treatment units that may occur, along with less than 1.5 acres of Sierra yellow legged frog basking sites. Hand thin units within mechanical treatment units may also have biomass removed if feasible and also dependent upon RCA mitigation requirements.

Prescribed fire as a primary treatment is proposed on approximately 102 acres in the Wildcat Project. The underburn is intended occur under existing canopy of trees and designed to reduce excessive live and dead vegetation. There would be no manipulation of forest vegetation in areas where prescribed fire is the primary treatment, save for construction of fireline around the burn units.

In general, although hand thinning and prescribed fire would have an effect on overall forest structure, species composition and landscape diversity, the main objective is to reduce the amount of ladder fuels and reduce the density of smaller sized trees.

Stand Structure-Relative Stand Density, Trees Per Acre and Basal Area

Both hand thinning and prescribed fire primarily affect smaller diameter classes. Prescribed fire as a primary treatment is usually intended for units that are considered appropriate to burn without prior forest vegetation treatment. Because of the nature of prescribed fire, its effects cannot be limited to specific diameter classes or species. However, fire intensity and severity is meant to be low, although occasional torching and mortality of larger trees is expected. Therefore, the prescribed fire tends to reduce forest vegetation in the understory (Table 28). Similarly, since hand thinning treatments treat only conifers 9.9" DBH and less, there would be a substantial reduction in these size classes.

As indicated in Table 28, most of the reduction in individual trees occurs in trees less than 10.0" DBH. In regards to prescribed fire, although there would be a slight reduction in small-sized trees, most of the mortality is largely concentrated in pole size trees and smaller. Hand thinning treatments also have the benefit of being species specific as opposed to prescribed fire where mortality of individual trees is harder to control. In general, this reduction in the understory would increase openings for shade-intolerant species regeneration and increase vigor and decrease density-dependent mortality within the understory.

Table 28. Modeled average TPA by DBH (inches) over time (Alternative A-Hand thinning and prescribed fire)

Year	1"-3"	3"-10"	10"-20"	20"-24"	24"-30"	Greater Than 30"	Average TPA
0	12	46	71	8	5	4	146
10	11	45	71	9	7	4	147
20	31	43	70	10	8	5	166

Although hand thinning would only remove non-sawlog sized trees (less than 10.0" DBH), because of the current proportion of trees pole size and smaller, overall stand density would decrease. Similarly, prescribed fire tends to reduce forest vegetation in the understory (0). This reduction in the understory would increase openings for shade-intolerant species regeneration and increase vigor and decrease density-dependent mortality within the understory.

The average rSDI is expected to range from approximately 43 percent to 56 percent, depending upon the treatment (Table 29). This is an improvement over the current and projected No-Action Alternative relative stand density (Table 29). However, re-entry for pine dominated sites may be warranted twenty years after this initial treatment if healthy stand densities are to be maintained.

Table 29. Modeled rSDI over time (Alternative A-hand thinning and prescribed fire)

Year	Hand Thinning	Prescribed Fire	No-Action Alternative
0	43%-52%	46%-56%	61%-74%
10	47%-57%	50%-61%	65%-80%
20	50%-61%	55%-57%	69%-85%

The same post-treatment results for rSDI are also echoed in average residual basal area. On lower quality sites with a lower recommended BA threshold, residual BA remains above desired levels (Table 30). However, sites where 150 ft2 is the recommended BA threshold, residual BA is predicted to remain near recommended thresholds for approximately ten years (Table 30). Overall, any reduction in basal area increases forest vigor and growth.

As expected, there is a corresponding reduction in the average BA as a result of these treatments (Table 30). However, because small trees contribute minimally to total stand basal area, hand thinning and prescribed burning would not greatly reduce basal area. Though in mixed conifer stands (recommended 150 ft^2 BA per acre), these treatment effects would be more pronounced as these stands tolerate a higher BA. Pine dominated stands would require additional treatments in the future to meet forest health objectives. Regardless, any reduction in basal area in the treatment areas would tend to positively affect growth and forest health for the residual stand.

Table 30. Modeled basal area over time (Alternative A-hand thinning and prescribed fire)

Year	Basal Area		Percent Above Recommended BA[1]	No-Action Alternative Basal Area
	Hand Thinning	Prescribed Fire		
0	151	145	-3%-51%	180
10	169	164	9%-69%	201
20	186	183	22%-86%	221

1 Based on average BA, per R5 direction regarding appropriate BA target to reduce risk to insects (USDA 2004c)

Although the effects of hand thinning and prescribed fire to forest structure are minor as compared to mechanical thinning treatments, there is a measurable effect. In general, these treatments would reduce stand density, reduce the disproportionate amount seedling and sapling size trees and align residual BA closer to desired levels. The risk of density-dependent mortality would be decreased as stand vigor and health improves.

Species Composition

Hand thinning and prescribed fire would also shift the species composition in treated areas. Hand thinning would be able to selectively remove shade tolerant species over desired shade intolerant species, shifting the general composition of the forest towards a more desired condition. Prescribed fire only treatments by nature cannot specifically remove individual trees or target species. However, the majority of understory trees is comprised of shade-tolerant white fir. Hence, white fir is most affected by prescribed fire treatments. Both treatments would primarily affect trees in the understory with hand thinning limited to an upper diameter limit of 9.9” DBH and less. Either treatment would leave more shade-tolerant species in the overstory, though occasional torching in prescribed fire may remove individuals on an incidental basis.

Nonetheless, these treatments would help shift the balance of shade tolerant to shade intolerant species towards a more balanced proportion (Figure 26).

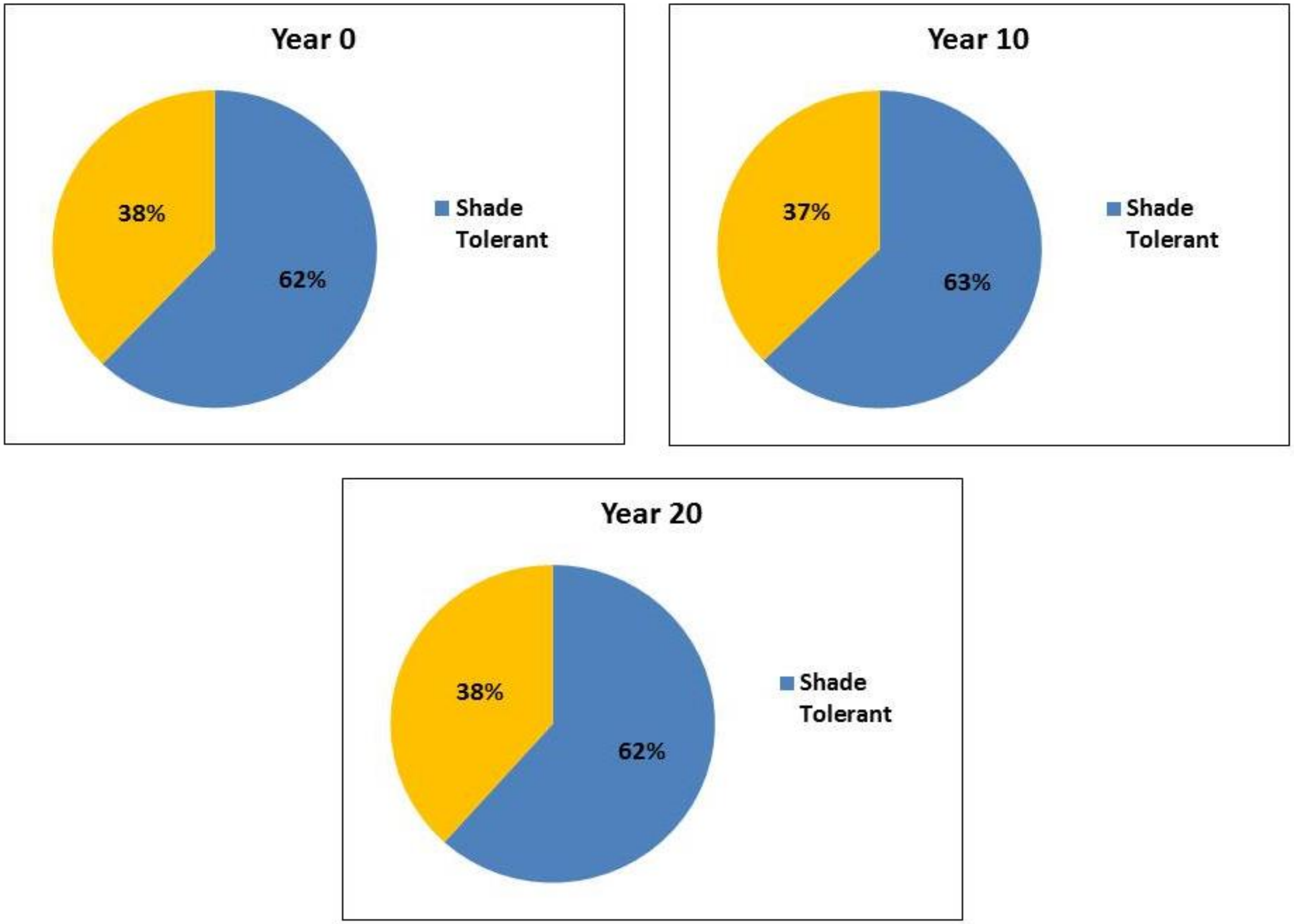


Figure 26. Shade tolerance to shade intolerance distribution by TPA over time (Alternative A-hand thinning and prescribed fire)

Overall, because hand thinning and prescribed fire would generally not treat larger trees, it would have the greatest effect on the understory species composition and not the overstory. Also, most of the effect would be in the actual number of trees and not the distribution by volume (BA). However, by reducing the existing amount of smaller shade-tolerant trees, the future amount of larger shade-tolerant trees would also in turn, be reduced.

Landscape Heterogeneity

As stated earlier, both hand thinning and prescribed fire often affects the understory more than the overstory in treated areas. Even hand thinning in the basking frog sites where the understory may be more extensively thinned, the overstory remains intact. The resulting landscape from prescribed fire only treatments is often dependent upon the size , shape and spatial arrangement of fuels within the treatment unit (Fernandes and Botelho 2003). As such, post-treatment forest vegetation effects are often mosaic in canopy. Regardless, as a result, canopy cover remains essentially unchanged for either treatment (Table 31). However, because both treatments would reduce the amount of small diameter trees, the overall stand diameter does increase (Table 31). When compared to untreated stands (Table 31), hand thinned and prescribed fire only areas are also projected to maintain larger average stand diameters over time. Furthermore, because of prescribed fire's mosaic effect on the landscape, it does effectively increase landscape heterogeneity.

Table 31. Average canopy cover and QMD over time (Alternative A-hand thinning and prescribed fire)

Year	*Hand Thinning*		*Prescribed Fire*		*No-Action Alternative*	
	Canopy Cover (Percent)	*QMD (Inches)*	*Canopy Cover (Percent)*	*QMD (Inches)*	*Canopy Cover (Percent)*	*QMD (Inches)*
0	***39***	***16.5***	***38***	***15.7***	***44***	***14.8***
10	***42***	***17.5***	***41***	***16.1***	***47***	***15.3***
20	***44***	***18.5***	***44***	***16.9***	***50***	***15.7***

Overall, size class and seral stage would not be altered by hand thinning or prescribed because mostly small trees are being removed. However, the reduction in the component of closed canopy stands would increase general resilience to disturbances such as insects, disease and fire. The reduction of small trees would also decrease the presence of ladder fuels, thereby increasing resistance to stand replacing fire. And as expected, a reduction in stand density would have a positive effect on stand vigor and growth.

Direct and Indirect Effects of Aspen Treatment

Aspen treatment is one the Purposes and Needs of the Wildcat Project. As currently proposed, roughly 181 317 acres of would receive aspen would receive mechanical treatment through a combination of mechanical thin, hand felling and leave or endlining of hand felled material. An additional estimated 120 acres would be hand-felled and larger sawlog-sized trees would be endlined out. Piling and burning may also occur. Although the mechanism of removal might be different in mechanical thin versus hand-felled and endlined treatment units, the prescriptions would be the same and hence, the effects to forest vegetation would also be the same.

Aspen stands are scattered throughout the project area but exhibit signs of decline due to conifer encroachment and the absence of disturbance. These shade-intolerant, resprouting species are adapted to frequent disturbance and historically contributed to landscape diversity. However due to past management practices (e.g. fire suppression and grazing), these valuable species have decreased in abundance from historical ranges. Aspen is more abundant on the eastern side of the

Sierra Nevada's compared to the western side and would benefit greatly from restoration treatments. Hence, prescriptions for aspen treatment would emphasize the removal of as many competing conifers 29.9" DBH and less as possible. The reduction in conifers would reduce shading and future seed sources. Because the nature of aspen treatment precludes the canopy cover restrictions that mechanical thin treatments face, there tends not to be an inherent range in the management indicators. As such, the management indicators would be discussed as projected averages.

Stand Structure-Relative Stand Density, Trees Per Acre and Basal Area

The reduction of conifers is an important component of aspen restoration treatments. In addition to reducing conifer competition, the reduction in rSDI would increase growth and vigor for aspen stands. After aspen treatment, rSDI is projected to stay well below recommended thresholds for at least twenty years, if not longer (Table 32). The longevity of these treatments would benefit aspen vigor for several decades.

Table 32. Modeled rSDI over time (Alternative A-aspen treatment)

Year	rSDI (450 max)	rSDI (550 max)
0	15%	12%
10	18%	15%
20	21%	17%

Aspen stands would also benefit from the corresponding general reduction in the amount of trees per acre and basal. After treatment, the average TPA is expected to be approximately 39 (Table 33) and BA well below the recommended thresholds (Table 34). The remaining TPA in size classes under 30.0" DBH are indicative of potential operational challenges that prevent complete removal of conifers such as hydrology or soil resources concerns.

Although the average TPA is projected to increase in year 10 and 20, approximately 50 percent of those individuals would be considered seedlings, and thus, are not yet seed bearing and more vulnerable to low severity fire. Reductions in basal area would also generally increase the vigor and growth of aspen as competition for resources, especially sunlight decrease. In general, the reduction of the amount of conifer seed sourced-sized trees would reduce shading and seed sources, enabling aspen to regenerate and compete successfully.

Table 33. Modeled TPA by DBH (inches) over time (Alternative A-aspen treatment)

Year	1"-3"	3"-10"	10"-20"	20"-24"	24"-30"	Greater Than 30"	Average TPA
0	8	18	8	1	1	4	39
10	44	21	10	1	1	4	81
20	33	24	13	1	1	4	75

Table 34. Modeled basal area over time (Alternative A-aspen treatment)

Year	Average Basal Area (ft^2)	Percent Above Recommended BA[1]	
		100 ft^2	150 ft^2
0	41	-59%	-73%
10	48	-52%	-68%
20	56	-44%	-63%

[1] Based on average BA, per R5 direction regarding appropriate BA target to reduce risk to insects (USDA 2004c)

Species Composition

As expected, aspen treatment would have a noticeable effect on species composition in treated aspen stands. After treatment, the overall amount of individuals by species drops by quite a magnitude (Table 35). For instance, on average, there are approximately 300 white fir TPA in the project area. After treatment, there is over 80 percent reduction in these shade-tolerant individuals. Considering that white fir is less drought-tolerant, but more shade-tolerant than the pines in project area, it is able to grow and reproduce under overstory shade in the more mesic sites that aspen occupy in the eastside (USDA 1983a). It then eventually overtops aspen, shading and crowding it out. A major reduction in this conifer competitor is an important factor to aspen enhancement.

Table 35. Average trees per acre by species over time (Alternative A-aspen treatment)

Year	Major Conifer Species (0.0" And Up)							
	Jeffrey Pine	Sugar Pine	Western White Pine	Aspen	White Fir	Lodgepole Pine	Incense Cedar	Douglas-fir
0	10	1	0	0	55	2	2	0
10	10	1	0	12	54	2	1	0
20	10	1	0	12	52	2	1	0

Just as important in reducing the individual amount of conifers is their reduction in volume. A large reduction in TPA with a corresponding decrease in BA indicates that multiple diameter classes were removed. As discussed in the section above, although a large amount of small trees were removed, there was a less marked decrease in basal area (Figure 24). However, that is not the case in aspen treatments. Conifer competitors are reduced on average, to approximately 40 ft^2 of basal area per acre after treatment (Table 36). When compared to the total current estimated BA of conifers, approximately 180 ft^2 per acre (0), the aspen treatment effectively reduces conifer competition. Overall, the discernible decrease in conifers in aspen areas would encourage aspen growth, vigor and reproduction.

Table 36. Residual basal area of conifers only over time (Alternative A-aspen treatment)

Year	Aspen Treatment	No-Action Alternative
0	41	178
10	48	200
20	55	219

Landscape Heterogeneity

As an under-represented forest vegetation type at risk in the project area, any treatment that can promote and enhance aspen would contribute to landscape heterogeneity. As stated earlier, as a shade-intolerant species, conifer encroachment has a detrimental effect to aspen growth and regeneration. After treatment, the canopy cover is predicted to drop to sparse levels (Table 37). This reduction in canopy cover would greatly encourage aspen vigor with more sunlight reaching the surface (USDA 1985a, Pierce and Taylor 2010). Besides enhancing an under represented forest type, reducing canopy cover would also shift current tree density levels towards a more historical condition.

Table 37. Average canopy cover over time (Alternative A-aspen treatment)

Year	Canopy Cover (Percent)
0	11
10	13
20	15

Overall, aspen enhancement treatments are expected to increase landscape heterogeneity. Not only would treated areas experience new aspen growth and vigor and perhaps expansion, but aspen stands would be thinned to more historic and sustainable conifer densities.

Alternative A – Proposed Action – Cumulative Effects

The cumulative effects of Alternative A would occur in the context of past management, including wildfire suppression, and natural disturbances, such as wildfires and insect and disease outbreaks, which have largely influenced the forest vegetation that is present today. Past projects and events are reflected in the vegetation layer used to characterize the existing conditions (the baselines for analysis) in the analysis area. Present and future projects on the landscape are expected to have a minor effect on vegetation distribution. These effects would most represent the cumulative effects of Alternative B. Past activities were mostly focused on overstory removal of desirable timber species, and more recently after the 1980's, clearcuts that were reforested after harvest. This has resulted in conversion of mid to later seral forest to early seral structure, dominated by young shade-intolerant species in the case of clearcuts and a mixture of suppressed shade-tolerant trees in the overstory removal harvests. Due to the dispersed nature of these activities and their size relative to the analysis area, impacts have been for the most part negligible. Past wildfires occurred within areas of the analysis area but burned at sufficiently low severities to have a negligible impact at the landscape level.

The cumulative effects analysis takes all proposed activities in consideration at once and as a whole. Therefore, this discussion would include how prescribed burning only, mechanical treatment in conifer and aspen stands, hand thinning of small trees, hand felling of small diameter trees and larger trees in aspen units, directly and indirectly affect forest structure, species composition and landscape heterogeneity over time.

Potential post-treatment activities such prescribed burning, physical removal of small trees as a biomass product, grapple piling, hand piling fuels and burning and dispersed interplanting are also considered in this cumulative effects discussion. Other proposed activities including herbicide treatment of invasive plant species and roadwork would have minor effects to forest vegetation because of their scale and localized nature. In general, the activities and treatments included Alternative A would meet the Purposes and Needs described in Chapter 1. In regards to forest vegetation resources, aspen and forest health would generally improve.

Forest Structure

A general reduction in relative stand density index is expected to occur as a result of all proposed forest vegetation treatments, including areas treated only with prescribed fire. The intensity would vary by treatment and by prescription, but in general, the amount of trees would be reduced, and hence, stand density accordingly. Overall, on treated areas, forest health, vigor, and resilience to disturbance would be improved through density reduction. Existing insect and disease infestations would continue to recruit snags, but risk of high rates of mortality from these agents would be reduced.

Within all treated stands, forest structure would become less homogenized and diversified as small trees are removed (,Table 25 and Table 34). Diameter distributions would be more balanced, especially in mechanical thin treatment areas that can remove larger trees 10.0" and greater in DBH. Even with the inherent diameter limitations of hand thinning, the reduction of seedling to pole size trees would help shift the current diameter distribution to a more historically accurate one. Units with prescribed fire as primary treatment would also have similar results to hand thinning, albeit with potential snag recruitment as a result of fire. On a whole, susceptibility to large scale disturbances would be decreased as a result of diversified seral stages and structures across the landscape.

Potential post-primary treatment activities include hand piling or grapple piling and burning of additional ground fuels, post-thinning prescribed fire, hand thinning of small standing fuels or removal of small non-sawlog material as a biomass product. These treatments would likely further reduce both the individual amount and shade-tolerant species presence of pole size and smaller trees, especially any post-treatment prescribe fire. The low intensity and severity effects of prescribed after mechanical thinning would further increase stand vigor and help shift the landscape towards a more fire-adapted environment. Increased resiliency to insects, disease and fire would result from the decrease in the stand density of small, ladder fuels and ground fuels. Interplanting of desired shade-intolerant species would help shift current species distribution towards desired levels.

Additional proposed activities including herbicide treatment of invasive plant species and roadwork would have minor effects to forest structure because of their scale and localized nature. Herbicide mitigation measures would greatly reduce the potential for "over spray" onto small conifers, greatly reducing the potential for collateral damage. Any potential mortality of conifers is likely to be very small and incidental, with little effect to overall forest structure.

Species Composition

The prescription and design features for mechanical thinning and hand thinning all emphasize the removal of shade-tolerant conifers and the retention of desired shade-intolerant trees whenever possible. As a result of the treatments, species composition is expected to shift towards a more balanced condition. Although prescribed fire cannot specifically target shade-tolerant trees, the current distribution of pole size trees and smaller is primarily consisted of white fir, as shown by the post-hand thinning species distribution by species . And as evidenced by the amount of trees per acre by species, white fir is predicted to be greatly reduced in prescribed burn only areas.

Especially in mechanically thin treated areas where larger trees can be selectively removed, the proportion of basal area distribution by species is expected to shift towards shade-intolerant species such as Jeffrey pine (Figure 25). Aspen treated areas (both mechanical and hand fall) would also have discernable effects to species basal areas distribution as well. The difference between aspen and mechanical thin is that aspen treated areas would not just remove shade-tolerant trees. This is an important facet and requirement for a successful aspen enhancement treatment. The lower intensity treatments of hand thinning and prescribed burning are also expected to shift species composition by basal area as well. As discussed, hand thinning does not have the same effect on residual BA as mechanical thinning does due to the smaller size trees removed. Prescribed fire has the greater potential to affect basal area distribution because trees larger than 9.9" DBH may be killed, but not likely to the same level as mechanical thin and aspen treatment. Overall, these primary treatments are expected to shift the distribution of mixed conifer species and shade-tolerant to shade intolerant species towards a desired composition.

Currently, there is concern that species specific insects and diseases such as Heterobasidion root disease and fir engraver beetle are attacking and killing white fir. The increase in white fir mortality could result in additional fuel loading. Treating these stands would help shift conifer species composition and decrease the amount of host white fir available to these insects and diseases reducing the potential for excessive stand mortality, reducing the overall fuel loading potential.

Additional proposed activities including herbicide treatment of invasive plant species and roadwork would have minor effects to forest species composition because of their scale and localized nature. Herbicide mitigation measures would greatly reduce the potential for “over spray” onto small conifers, greatly reducing the potential for collateral damage. Any potential mortality of conifers is likely to be very small and incidental, with little effect to overall forest species composition.

Landscape Heterogeneity

On a stand level, the current condition could be described as relatively homogeneous with few large trees in the overstory and a dense overstory dominated by shade-tolerant white fir (Figure 20). When treated, the structural heterogeneity of these stands increase as diameter classes and species composition becomes better balanced. As these treatments extend beyond the stand level towards a larger scale, so too does landscape heterogeneity increase. The various mechanical thinning intensities based on vegetation type, topographic position, desired wildlife structures, and historic reference conditions would be used throughout thinned stands to diversify existing arrangements. Sierra mixed conifer stands would generally retain higher densities compared to eastside pine types. Within these vegetation types, northeast aspects and drainages would contain higher densities than southwest aspects and ridgetops. High density clumps of large desirable trees would be retained and protected by low density gaps with open-canopy conditions. These features would break up the matrix of evenly-spaced trees that would comprise other areas of the stand. Scattered high-value legacy trees and black oaks would be retained and protected through radial thinning around selected trees. Areas of high wildlife habitat value would be retained as well.

As described previously, the majority of the conifer dominated stands are CWHR size class 4 with moderate to dense canopies (Figure 23). The desired condition is to shift the size distribution towards more early seral stands (CWHR size classes 2 and 3) and later seral stages (CWHR size class 5). Considering that the eastside was historically open canopy pine stands, the desired condition would be a shift towards CWHR density of S and P. The treatment activities proposed in Wildcat would increase landscape heterogeneity by decreasing stand densities which would increase growth of residual trees towards larger average stand diameters while providing openings for early seral stage stands over time (Table 38).

Table 38. Average canopy cover and QMD over time (Alternative A-all primary treatments)

Year	Canopy Cover (Range)	QMD (Range)
0	28 (11-43)	19.8” (15.1”-29.7)
10	30 (11-46)	20.6” (15.7”-31.1”)
20	32 (14-49)	20.4 (16.1”-25.3”)

As seen in Table 38, the average canopy cover across treated areas shows a general shift towards open canopy stands. However, the ranges in residual canopy cover indicate a broad distribution of stand densities, thereby increasing landscape heterogeneity. Likewise, the average stand diameter increase from the current condition (Table 23) and although QMD is modeled t drop slightly due to ingrowth in and mortality in year 20, the lower range of diameters show a general increasing trend.

All primary treatments are expected to generally decrease the average canopy cover in the project area. This includes hand thin and prescribed fire only treatments (Table 32), although at a lesser extent. In addition, closed canopy stands are shifted towards open canopy stands as a result of treatment (Table 39). These values take into consideration potential hand thinning that may occur in mechanical thin units as a result of RCA mitigations. Considering that the project area generally lies in the lower precipitation east side, an increase in open canopy stands is especially desirable and appropriate.

Table 39. Pre and post-treatment CWHR density class changes for forest vegetation types only (size class 4 and 5)

Density	Acres (Approximate)	Percent Change
D	994	-20%
M	4832	-6%
P	4698	+13%
Grand Total	10525	

Comparison of Alternatives

As mentioned earlier, forest stand dynamics would continue to occur under the No-Action Alternative. In the analysis area, forest structure, species composition and landscape heterogeneity would continue to change throughout time even if no active management, with the exception of fire suppression, whether the outcome is desirable or not. By contrast, the Proposed Action seeks to implement treatments to shift forest vegetation towards the desired conditions of increased forest stand vigor and resiliency, a more balanced species composition and greater landscape heterogeneity. Under the Proposed Action, approximately 3,057 acres are proposed for forest vegetation treatments. The proposed treatments include mechanical thinning for forest health and aspen enhancement, hand thinning, including for aspen enhancement and prescribed burning. Potential secondary treatments include various combinations of grapple piling and burning, hand piling and burning, biomass removal as product, interplanting shade-intolerant conifers and prescribed burning. The values under the "Proposed Action" column in Table 40 indicate the cumulative average of all proposed activities with their predicted range when applicable.

Table 40. Comparison of alternatives by measurement indicators

Forest Health Components	Measurement Indicator	No-Action Alternative	Proposed Action (Ranges)-Post Treatment
Forest Structure	Stand Density (rSDI)	61%-74%	33%-40%
	Basal Area	180	106
	Trees Per Acre	364	141
Species Composition	Percent of Shade-Intolerant Species (by BA)	35%	43%
Landscape Heterogeneity	Percent of Conifer 4/5 S/P Stands[1]	42%	47%
	Percent of Conifer 4/5 M/D Stands[1]	58%	53%

	Canopy Cover	44%	28%

[1] Percent distribution is within conifer type stands, CWHR size 4/5 only

Forest Structure

Under the No-Action Alternative, the rSDI would remain in the zone of imminent mortality (rSDI 60 percent and above), have basal areas above USFS Region 5 recommended thresholds and over 350 TPA (Table 40). The Proposed Action would reduce the average rSDI to desired levels below 60 percent, the average post-treatment BA would be under 180 ft^2 and residual TPA would be under half of the current condition (Table 40). Overall, forest structure would be improved by the Proposed Actions. Reducing densities, volume and the amount of trees per acre would diversify forest structure, encourage growth, especially of shade-intolerant species. Considering that interplanting may occur as a follow-up treatment, planted seedling would be able to take advantage of the reduced under and midstory.

Species Composition

Under the No-Action Alternative, shade-tolerant species make up approximately two-thirds of the stand volume in the treated area (Figure 27 and Table 40). This is a marked departure from the desired condition of shade-intolerant conifer dominated stands. This current distribution is most likely to either stay the same or shift towards more shade-tolerant composition as pines get outcompeted over time.

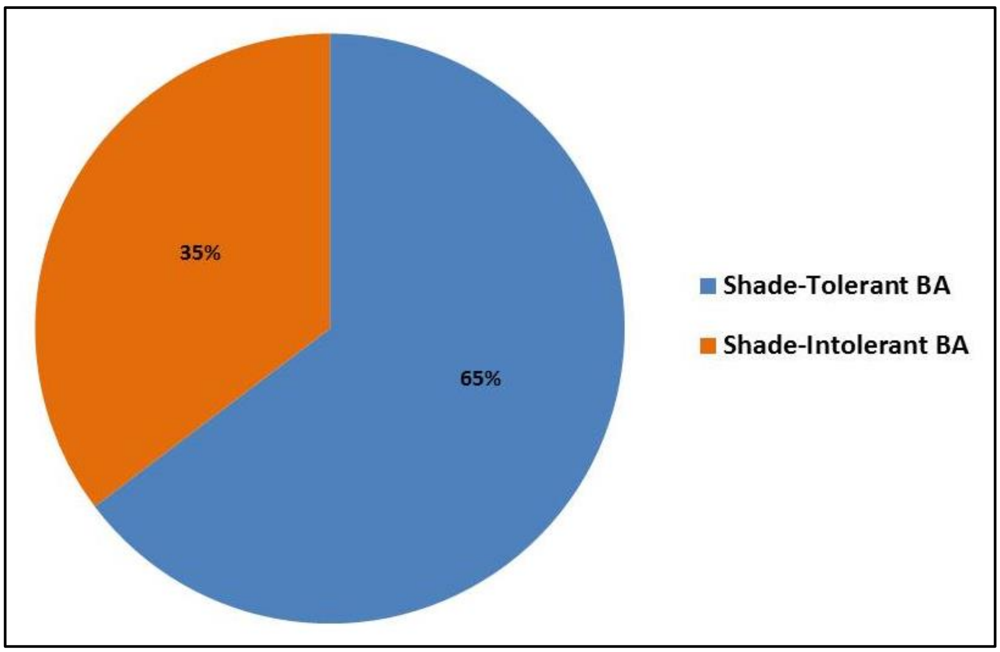


Figure 27. Distribution of shade tolerant to shade intolerant trees by basal area (No-Action Alternative)

Under the Proposed Action, the species composition by basal area is shifted towards a more balanced distribution of shade-tolerant to shade intolerant species. After implementation, treated stands would nearly have a 1:1 ratio of shade-tolerant to intolerant species by basal area (Table 40 and Figure 28). Considering that thinned areas may be interplanted with desired shade-intolerant conifers, this distribution would be expected to shift even more towards shade-intolerant species.

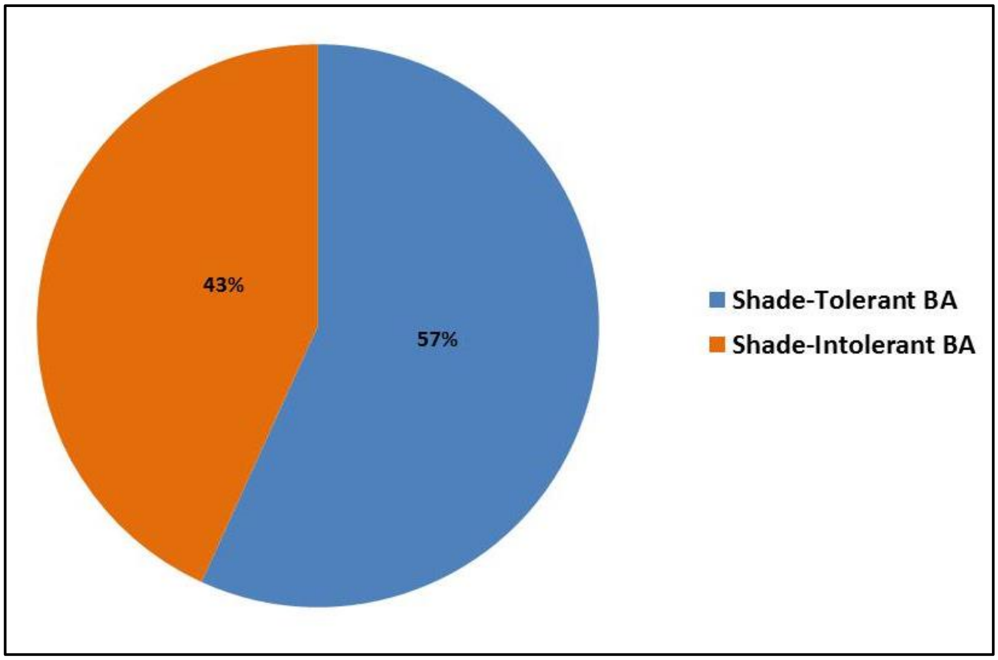


Figure 28. Distribution of shade tolerant to shade intolerant trees by basal area (Proposed Action)

Landscape Heterogeneity

Under the No-Action Alternative, closed canopy stands would not be treated. Over time, it is likely that the percentage of closed canopy stands would increase. Landscape heterogeneity would decrease as the distribution of close canopy stands departed from historical stand conditions. The Proposed Action would treat approximately 533 acres of closed canopy CWHR size class 4/5 forest vegetation stands and shift them towards more open canopy conditions (Table 41). These values take into consideration potential hand thinning that may occur in mechanical thin units as a result of RCA mitigations. This would increase landscape heterogeneity as well as increase growth and resiliency in these treated stands after project implementation. Over time, the increased growth would encourage CWHR size class 4 stands to develop into the underrepresented CWHR size class 5 stands (Figure 23).

Table 41. Pre and post-treatment CWHR density class changes for forest vegetation types only (size class 4 and 5) (Acre values are approximate)

Density	Approximate Before Acres	Approximate After Acres	Approximate Acres Change	Percent Change
D	1236	994	-242	-20%
M	5123	4832	-291	-6%
P	4165	4698	+533	+13%

Grand Total	10525	10525		

Compliance with the Forest Plan and Other Direction

1988 Plumas National Forest Land and Resource Management Plan and 2004 Sierra Nevada Forest Plan Amendment

The Wildcat Project is designed to fulfill the management direction specified in the (PNF LRMP) (USDA 1988a,b), as amended by the Sierra Nevada Forest Plan Amendment (SNFPA) FSEIS and ROD (USDA 2004a, b). Fuel and vegetation management activities are designed to comply with the standards and guidelines as described in the (USDA 2004a, b). Forest vegetation treatment activities through their design and objective would establish and maintain a pattern of area treatments that is effective in:

- Modifying fire behavior through small tree diameter treatments including possible biomass removal which would manage current and future fuel profiles.
- Culturing stand structure and composition to generally resemble pre-settlement conditions by incorporating variable density marking implementation.
- Reducing susceptibility to insect/pathogen drought-related tree mortality through lowered residual densities.

National Forest Management Act

The Wildcat Project also meets the National Forest Management Act (NFMA) of 1976, including its amendments to the Forest and Rangeland Renewable Resources Planning Act of 1974 which state that it is the policy of the Congress that all forested lands in the National Forest System be maintained in appropriate forest cover with species of trees, degree of stocking, rate of growth and conditions of stand designed to secure the maximum benefits of multiple use sustained yield management in accordance with land management plans. Both acts also state “insure that timber will be harvested from national Forest System land only where – (ii) there is assurance that such lands can be adequately restocked within five years of harvest.”

Economics

Introduction

The demographic and economic information for the counties in which the Plumas National Forest is situated has been compiled to provide a baseline for studying the socioeconomic impacts of the Wildcat Project.

This economic analysis addresses the 2004 Sierra Nevada Forest Plan Amendment Record of Decision which acknowledges the need to retain industry infrastructure by supplying wood by-products as result of treatments. As such, this analysis will look at value generating activities and "service" treatments.

Effects Analysis Methodology

This economic analysis focuses on those revenues and treatment costs associated with implementing fuel reduction and forest health activities proposed in the Wildcat Project. The purpose of this economic analysis is to present the potential revenues and costs associated with Proposed Action and No-action Alternative for comparison purposes. Timber harvest values used in this economic analysis were based on the California State Board of Equalization Timber Harvest Values (January 1, 2014 – June 30, 2014). Harvest costs and road improvement costs were developed from the latest "green" timber sale Timber Evidence Appraisal (TEA) values including "Log Cost" and "Haul Cost. Predicted harvest volumes, including non-sawlog material, were generated through the Forest Vegetation Simulator (FVS) model. This program uses stand attribute data along with proposed prescriptions and outputs various indicators, including stand volume.

This analysis does not address potential secondary post-treatments such as follow-up prescribed fire or grapple piling. The reason is that while these activities are analyzed for potential impacts to resources, they are not primary treatments. These potential post-treatments are meant to occur only if the primary treatment does not meet the Purposes and Needs of the project. In addition, these post-treatments are service items and will be funded by appropriated dollars on case by case basis and would not have an effect of the project value on definite basis. Additionally, to include these treatments as a cost item would drastically increase the cost of this project even though there is no definite certainty these post-treatment activities are needed.

In addition, this analysis does not include monetary values assigned to resource outputs such as wildlife, watersheds, soils, recreation, visual quality or fisheries. It is intended only as a relative measure of differences between alternatives based n direct costs and values used.

Measurement Indicators

Receipt Act

Receipt Act payments are distributed pursuant to the National Forest Management Act (Public Law 94-588). Under this law, 25 percent of National Forest revenues are allocated to the state in which the forest is situated. The amount returned is based on the National Forest acreage within each county. The Plumas National Forestlands account for approximately 72 percent of Plumas County. According to state law, Receipt Act funds must be divided evenly between public schools and public roads of the county or counties in which the National Forest is located and may not be spent on anything else.

Receipt Act payments are based on 25 percent of the total revenues collected from timber, grazing, land use, recreation, power, minerals, and user fees. Within the 11 western states, however, payments are based on 50 percent of revenue from grazing. Historically, at least 90 percent of total revenues have come from timber sale receipts. As a result, the amount of money available for distribution each year fluctuates widely, depending on the amount of timber harvested on National Forests. With the steep decline in timber harvesting since the early 1990s, Receipt Act payments to Plumas County have dropped off dramatically.

As of the end of fiscal year 2013 (FY13), Plumas County stopped receiving funds from the Rural Schools and Community Self-Determination Act. This Act is a “stop gap” measure to provide Plumas County public schools with federal funding because of the lack of reliable timber receipts due to the current erratic schedule of Forest Service timber sales. However, this Act is not permanent and is meant to address shortages in public school funding to the end of FY13. No renewal or replacement of the Act has been discussed. It is unknown what financial decisions public schools will need to make during and after FY14 (USDA 2014a).

Timber Yield Tax

The second source of revenues to local government is the timber yield tax, which is administered by the State Board of Equalization. The Forest does not pay this tax; instead, it is paid by private timber operators, based on the amount of timber harvested in a given year on both private and public lands. The tax is 2.9 percent of the value of the harvested timber. The taxes are collected by the state, and approximately 80 percent is returned to the counties from which the timber was harvested. The amount of revenues disbursed to the counties can be affected by decisions about the amount of timber to be offered for sale each year on the forest.

Total Harvest Value

The total harvest value is essentially the “stumpage” or “standing timber” value of the sawlogs prior to harvest and milling. The total harvest value provides a baseline to compare what the gross value of forest product goods are in a project. If a project has multiple prescriptions or alternatives, the total harvest value allows comparison of the gross economic impact of each. Total harvest value is not to be confused with mill delivered or “pond values”. Mill delivered prices are what a lumber mill pays the logger for delivered wood and includes the standing timber costs, logging cost and profit margin. The total harvest value is also not the same as the Region 5 Forest Service timber sale advertised rates and minimum sale values. These prices are calculated through the TEA process where the actual volume harvested along with an on the ground assessment of logging costs and similar timber sale values are considered.

The total harvest value is calculated using the pertinent California State Board of Equalization harvest value and the amount of board feet calculated to be harvested. The calculated volume harvested is also broken down by diameter classes and species as these often get different market prices.

Harvest Costs

The harvest costs is the expenses of removing forest products from the project area including both sawlog and non-sawlog (biomass) materials. It is a general *estimation* of harvesting and transportation costs. These values are used to gauge the cost effectiveness of the Proposed Action and in applicable cases, other action alternatives. As mentioned, these values are for use in this economic analysis and any actual timber sale valuation will go through the Timber Evidence Appraisal process.

Total full time jobs

An economic product of the Proposed Action is jobs. Either through service contracts or timber harvests, personnel is required to implement activities. In addition to directly creating jobs, indirect jobs are also created. These indirect jobs can take many forms such as support type services or businesses including banks, grocery stores, heavy-equipment mechanics, etc. A Proposed Action or action alternative that maximized the creation of full time jobs is economically preferable.

Total employee-related income

The "total employee related income" stimulated by a project is an important component because it is an indicator of a project's overall economic impact. This measure relates to how the money spent on a project ripples throughout the community. It shows the magnified effect of how a relative small sum of money spent can generate a larger amount of revenue within a community. In economics, the multiplier effect refers to the idea that the initial amount of money spent by an individual or organization leads to an even greater increase in income overall. Timber removed in the forest translates into a whole host of different jobs from loggers to truck drivers to human resources personnel at the local sawmill, not to mention the whole suite of support industries such as lodging, fueling and restaurants.

Affected Environment

Although some economic effects are dispersed over a broad area, most economic impacts of the Wildcat Project are felt locally in primarily in Plumas County and to a lesser extent, Lassen County. The Plumas National Forestlands account for approximately 72 percent of Plumas County.

Local factors influencing Plumas County's economy include isolation from urban job markets, reliance on natural resource-based industries and high seasonal fluctuations in employment. In this local economy, forest health and community health often share interdependent goals.

The local community is dependent upon the forest products industry located within reasonable hauling distance from the project area. Since the late-1980's, the number of sawmills within the area have dwindled from approximately nine to essentially two, located in Quincy and Chester. And although there use to be three cogeneration facilities in the vicinity, Loyalton has not operated since approximately 2010 and the Westwood facility has also closed. The only remaining cogeneration plant within reasonable hauling distance is at Honey Lake, southeast of Susanville, CA. In the mid-1990's, Sierra Pacific Industries (SPI) mill reduced the number of work shifts from three shifts to two shifts. In the beginning of 2014, SPI announced it would rebuild its large-log sawmill located in Quincy in early 2014 and would probably continue to the end of the calendar year. During this time the small-log mill and cogeneration would continue to operate. Currently, the Collins Pine owned mill in Chester is operating customarily.

The Plumas National Forest directly contributes to the regional economy in two primary ways: (1) through the generation of income and employment opportunities for residents of the immediate area, and (2) through direct and indirect contributions to local county revenues. The Plumas National Forest also contributes in secondary ways, through production of goods and services in local and regional markets.

People employed by the forest products industry also spend their earnings within the community on rent, mortgages, at restaurants and local shops, etc. This money spent supports a very diverse local economy that is not directly dependent upon forest products. Those who permanently reside in Plumas County further contribute to its economic stability by paying property tax.

The Bureau of Land Management administers the Payments in Lieu of Taxes, which apply to many different types of federally owned land, including National Forest System lands. Payments in Lieu of Taxes compensate counties for the loss of property tax revenues due to nontaxable federal land in the county. Payments are made annually and are based on local population, federal acreage in the county, and other federal payments during the preceding fiscal year. The minimum payment is 75 cents/entitlement acre. The county may use these funds for any purpose. The forest has no control over the disbursement of these funds, and the amount disbursed every year is unaffected by forest land management decisions.

Analysis Area

Geographic

Although it is acknowledge that a biomass cogeneration facility is in and forest labor may come from Lassen County, the geographic boundary of this economic effect analysis is Plumas County. This is mainly because the Wildcat Project is entirely located within Plumas County and both mills that are likely to take logs are located in Plumas County as well. Therefore, it is anticipated that Plumas County will experience the vast majority of economic effects.

Temporal

The time frame for completing the activities proposed in the Wildcat Project is anticipated to take approximately two to five years. Therefore, the temporal boundary will consider not consider economic effects past five years.

Background

Since its incorporation in the mid-1800s, transportation to Plumas County has been limited. Due to Plumas County’s geographic isolation, job market creation has been difficult. Like all communities in California, Plumas County has experienced growth over the century. However, with over 70 percent of the county’s land base on Federal lands, the population of Plumas County has generally experienced a slower growth rate than California overall (Figure 1). In some instances, including the previous decade, the population has actually shrunk. This slower and sometime negative growth rate underscores Plumas County’s isolation from the rest of the state.

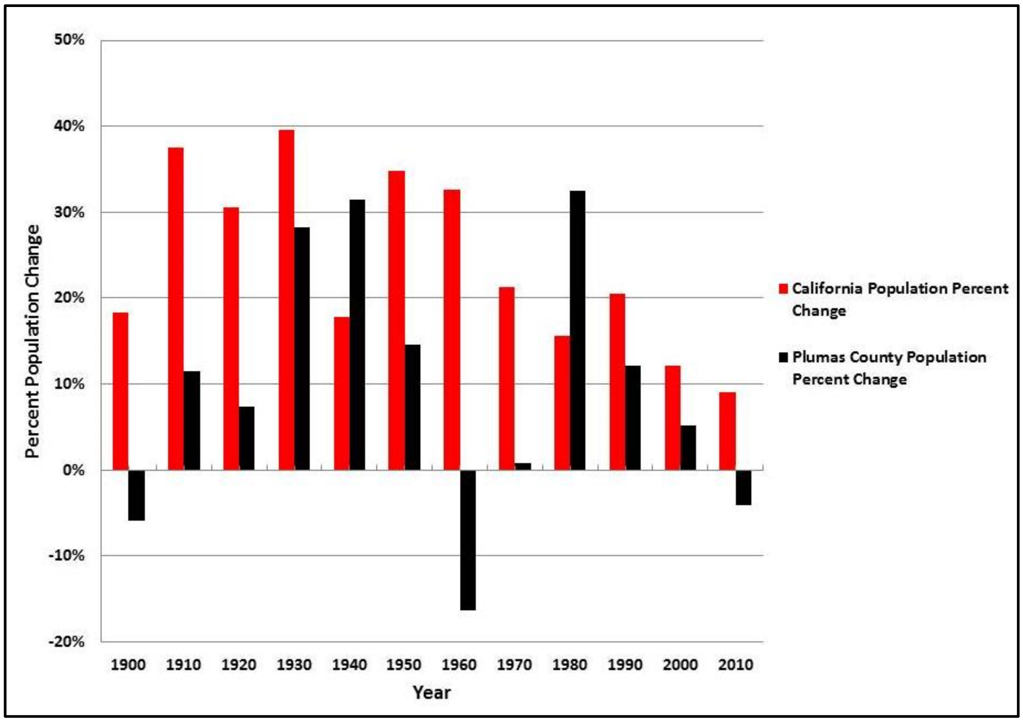


Figure 1. Percent population change in California and Plumas County (California EDD, 2014)

The county's isolation has most likely contributed to a lack of economic diversity being developed. The majority of employers within Plumas County comprise mostly of government which includes local, state and Federal (Figure 2). Other major contributors to the Plumas economy include "Educational and Health Service", "Trade, Transportation and Utilities" and "Leisure and Hospitality". Unlike manufacturing jobs where a product is created, the majority of the jobs in Plumas County are service oriented. These service jobs can vary in job security as they are dependent upon a predictable and reliable source of customers. Government jobs are reliant upon taxes, either local state or Federal. Budget cuts or changes in the tax base can adversely affect the funding of positions. Because of geographic isolation, many businesses and industries in the area are tied to each other, at least partially. And if the economic situation is dire enough, people will move on to other areas with better job prospects, which is an arguable reason for the population decline in 2010 (Figure 1). As people leave, houses become vacant and businesses have fewer customers to serve. This decline in fiscal health can turn into a negative-feedback cycle resulting in more people leaving and jobs getting reduced. When one business fails, the ripple effect can often be felt throughout the community. Therefore, maintaining economic diversity and health is especially important in a community such as Plumas County.

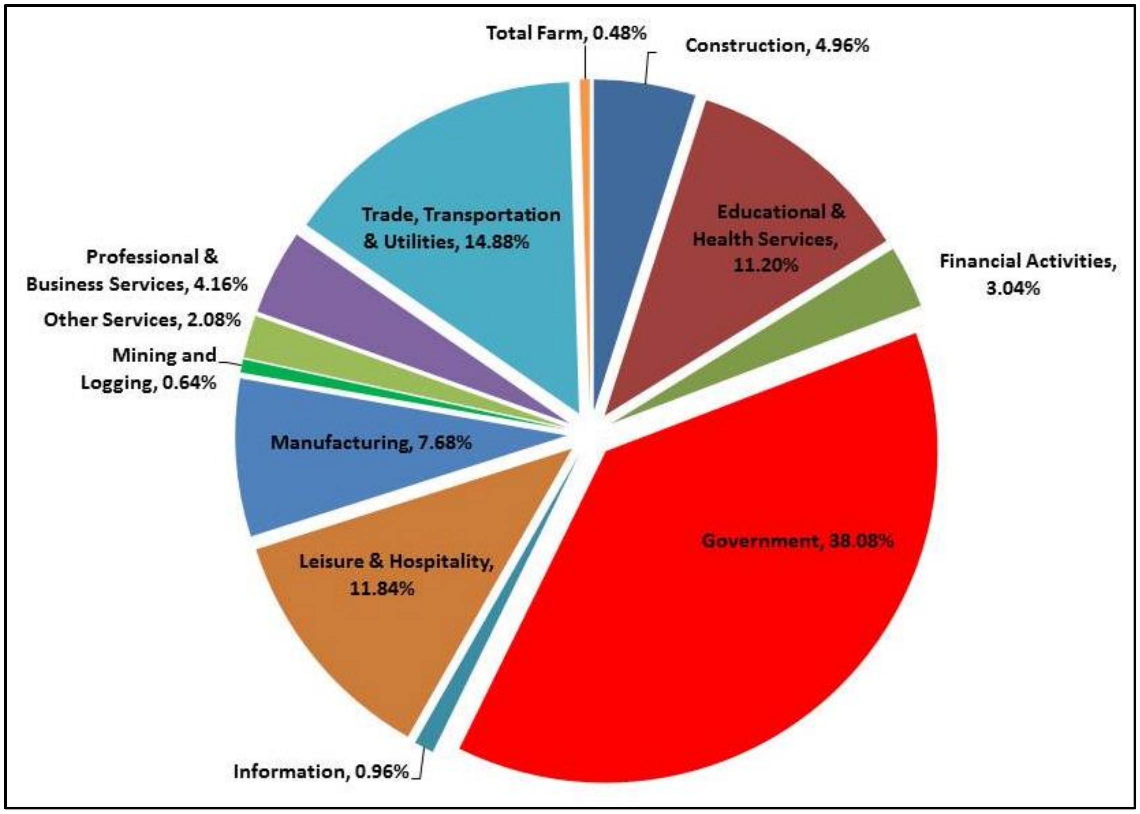


Figure 2. Plumas County employment by industry in 2013 (California EDD, 2014)

Many of Plumas County's mainstay businesses have essentially remained the same for the last 75 years. The county has ventured into other various sources of jobs and revenue generators with the establishment of Feather River College in 1968 and the sponsorship of various festivals such as High Sierra Music Fest, Railroad Days and Gold Digger Days. However, Plumas County's location still prevents it from being a true tourist destination or pass-through like the nearby town of Truckee, CA. Plumas County lacks nearby Lake Tahoe, and most importantly, accessibility. Plumas County's location makes it economic health and local job markets highly sensitive.

The employment situation within Plumas County could be described as highly seasonal. The unemployment starts to dip in the spring months and starts to rise again in the fall as it has since at least 1990 (Figure 3). Plumas County's seasonal employment fluctuations demonstrate the importance that spring and summer have on the local economy. Although not all forest products related, the majority of jobs in the spring and summer can certainly be attributed to the timber industry. Due to peaks in employment during spring and summer month's residents of Plumas County rely upon these months for the bulk of their employment. In addition to wages earned during these critical seasons, the majority of unemployment checks that are received in the winter are based upon wages earned in the spring and summer. Income earned and saved during the work season is continually spent throughout the calendar year. In the case of forest products, logs harvested during the summer provide material for the local sawmill which employs people throughout the year. Year round work contributes to the economic stability to the local community. The economic effects of spring and summer employment linger long after the end of the work season.

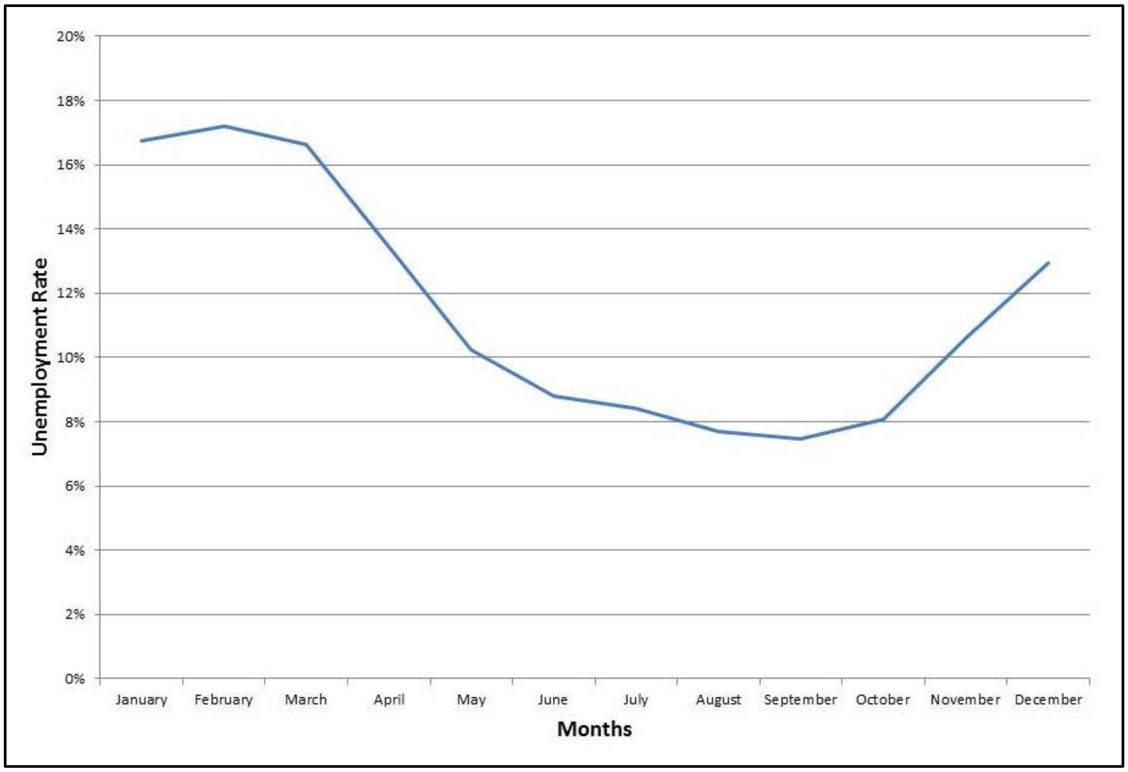


Figure 3. Average unemployment rate (1990 to 2013)

Environmental Consequences

Implementation of the No-action Alternative would have a negative impact on the local industries that depend on service contracts or a steady supply of timber, as well as counties that use timber yield taxes to fund county programs.

Alternative B – No-action Alternative – Direct and Indirect Effects

Under the No-action alternative, none of the activities proposed in the Wildcat Project would be implemented. No timber or biomass would be harvested and no service treatments would be implemented. Therefore, the total harvest value would be non-existent as well as no total harvest costs would be incurred. As such, no funds would be generated for the U.S. Treasury or returned to local counties. No additional employment opportunities or wages paid to primary and service industry employees would be circulated through the local economy.

Alternative B – No Action – Cumulative Effects

The cumulative impact of no-action alternative would negatively affect local industries dependent on Forest Service contract work or a steady supply of timber, as well as counties that use the timber yield taxes to fund county programs. The local economy would also not receive benefits from associated employment, such as in food, lodging, and transportation businesses. The continuation of current conditions under the No-action Alternative would preclude and/or notably limit opportunities for long-term employment and rural community stability.

Throughout northern California, cumulative years of reduced timber harvesting activities (including those on federal lands) have resulted in the loss of infrastructure to complete such an activity as well as fuel reduction and forest health improvement treatments. The loss of such infrastructure, including local mill closures, could significantly reduce or eliminate future economic and environmental opportunities from National Forest lands.

In addition, without the forest health and fuel reduction activities proposed in the Wildcat Project, forest health conditions would continue to degrade. This has the potential to cost more tax dollars in the future in the event of wildfire, insects or disease. A major disturbance, such as a wildfire, would effectively "liquidate" timber volume in one event. Instead of scheduled, sustainable thinnings over time, a one-time salvage of affected stands would be the only economic recourse.

Alternative A– Proposed Action – Direct and Indirect Effects of Mechanical Thinning, Hand Thinning of Aspen and Biomass Removal

Under Alternative A (the Proposed Action), the Wildcat Project proposes remove sawlogs and biomass primarily through mechanically thinning (approximately 2,594 acres). Additional hand thinning of larger conifers in approximately 120 acres of riparian conservation areas (RCA) to meet aspen enhancement objectives would also yield additional timber volume. If feasible, biomass is planned to be removed on an estimated 2,631 acres. These activities would yield a commercial product and probably add most to the local economy.

Receipt Act

The Forest Service is expected to contribute an estimated $25,651 in Receipt Act payments. These payments go back to Plumas County where the funds are divided between public schools and public roads. Plumas County previously received money from the Secure Rural Schools and Community Self-Determination Act instead of the Receipt Act. However, currently, the Secure Rural Schools and Community Self-Determination Act has not been reauthorized for 2014 and the fate of this Act is unknown.

Yield Tax

The amount of yield tax that private timber operators would pay to the State of California is calculated to be approximately $7,361. About 80% of this tax would be returned to the community from where it was collected. This tax money can be an important source of funds for Plumas County. These funds may be used the County to pay for various programs. With the recent economic downturn, local government is especially in need of extra money as community members may still rely upon government services.

Total Harvest Value

The total sawlog value for the Wildcat Project is estimated to be approximately $253, 817. This value is based upon the California State Board of Equalization Timber Harvest Values (January 1, 2014 through June 30, 2014). This total harvest value reflects the standing (stumpage) value of the timber and does not include any logging or "stump to truck" costs (Stier 2003). Nor is this value to be confused with delivered prices that a mill would pay a timber operator or logger. Other factors may affect the total harvest value including the size of trees, ease of logging and current market conditions. This estimate of harvest value is therefore a relative calculation designed to indicate the economic impact of the Proposed Action.

Treatment (Harvest) Costs

It is estimated that it will cost an approximate $1,931,244 to harvest sawlog and non-sawlog (biomass) volume in the Wildcat Project. These estimated treatment costs are calculated from recent green timber sale appraisals that have sold on the Mt. Hough Ranger District. Inputs to the harvest cost economic model include subsoiling landings, hauling and surface replacement costs.

As this analysis serves as a predictor of economic effects and as a tool for decision-making, actual timber sale costs will go through the TEA process as currently required.

The costs for removing forest products may be offset through use of grants, appropriated dollars or trust funds. The leverage of such funds would be done through either an Integrated Resource Service Contract (IRSC) or an Integrated Resource Timber Contract (IRTC). Either way, these contracts would allow the Forest Service to use additional funds to essentially “subsidize” needed thinnings that otherwise may not be sold under a traditional timber sale contract due to low volume, difficult logging access, poor timber markets, etc. And these contracts would allow for the removal and purchase of commercial size sawlogs, thus maintaining a timber supply to local mills. The use of an IRSC or IRTC does mean that timber receipts are retained and local governments do not receive 25 percent as they would with traditional timber sales. However, in lieu of the estimated $25,651 in Receipt Act payments, the use of IRSC or IRTC means that important planned treatments get realized which translates into jobs created. If the entire estimated harvest costs are covered by various funds, this would imply that a potential 1.9 million dollars would be paid out to contractors for logging related activities. In addition, by paying the logger to move logs from the stump to the mill, less risk is incurred by the logger, while still allowing the logger to purchase and sell logs to the mill.

Total full time jobs

Implementation of the Wildcat Project Proposed Action is predicted to generate approximately 102 full-time jobs. Direct employment includes jobs related to timber removal as well as forest fuels mitigation and watershed improvement treatments. Indirect employment opportunities include support jobs such as fuel suppliers, mechanics and lodging. Jobs in support industries can be especially important for Plumas County because they provide jobs, but are not directly related to the forest products industries. These support industries also service the rest of Plumas County. If these other support services were to disappear, it would affect the local community as people go out of town to find other vendors to meet their needs.

Total employee-related income

The total income generated by the employment opportunities of the Wildcat Project is estimated to be approximately $4,391,581. This income can have direct, indirect or induced effects on the local economy. Direct effects are associated with the primary producer. For example, the manufacturing of lumber from the Wildcat Project would have a direct effect on employment opportunities. Indirect effects account for money generated in service industries that serve the lumber manufacturer. These industries may include logging, trucking, and fuel supplies. Wages paid to workers by the primary and service industries are circulated through the local economy for food, housing, transportation, and other living expenses. The sum of direct, indirect, and induced income is the total monetary impact of the project.

Alternative A – Proposed Action – Cumulative Effects

Implementation of the Proposed Action would have an increase in the overall economic activity across the board in Plumas County. The money generated by this project would stimulate other businesses, benefit public schools, local government and Plumas County infrastructure long past the end of the work season and project length.

Over time, economic benefits from the Wildcat Project would help sustain the local economy and forest management industries. Forest ecosystem treatments, whether it be mechanical fuel reduction treatments, road decommissioning or pre-commercial thinning requires a workforce with the proper skill and equipment to make it possible. Local contractors enable the Forest Service to more effectively manage their lands at best value to the tax payers, while also benefitting the local community.

In the 21st century, a rural economy like Plumas County, economic diversification is important for community growth and stability (Kennedy et al. 2001). Forest management plays a role in economic diversification through jobs in the woods, manufacturing of timber products and the various non-forestry related jobs that are integral with running a business such as bookkeeping, human resources and mechanics. The economic benefits derived from the Proposed Action allow Plumas County residents to maintain their presence here, adding to the local tax base and spending their earnings at other businesses. All of this is vital if Plumas County is to remain a viable community.

Comparison of Alternatives

In general, the No-action alternative would not generate any type of economic benefit to the local community (Table 43). As a result, no harvest or treatment costs would be incurred. Although treatments in the Proposed Action may cost an estimated $2,000,000, there is a potential for costs to be offset by grants, appropriated dollars or other trust funds. Also, in addition to meeting forest health objectives, implementation of the Wildcat Project would generate an estimated 102 jobs and $4,000,000 in total employee related income (Table 43). Overall, the Proposed Action would a positive benefit to the local community while the No-action Alternative would not.

Table 43. Comparison of economic indicators

Economic Indicator	Proposed Action	No-action Alternative
Receipt Act	$7,361	$0.00
Yield Tax	$25,651	$0.00
Total Harvest Value	$253,817	$0.00
Treatment (Harvest) Cost	$1,931,244	$0.00
Total Full Time Jobs	102	0
Total Employee Related Income	$4,391,581	$0.00

Recreation, Lands and Scenic Resources

Introduction

The Wildcat Project analysis for recreation, lands and scenic resources encompasses a variety of resources on the PNF including developed recreation sites, portions of the Antelope Lake Recreation Area, a small number of motorized and non-motorized PNF trails, NFS roads within the project area, dispersed camping sites, and the Thompson Peak Semi-Primitive Area. This analysis includes the effects of the proposed action on recreation, lands, and scenic resources.

Effects Analysis Methodology

Potential impacts of management actions to recreation, lands and scenic resources are described below. This analysis focuses on the recreation opportunity spectrum (ROS), visual quality objectives (VQOs), recreation facilities, dispersed camping sites, portions of the Antelope Lake Recreation Area, roads, motorized and non-motorized trails, and the Thompson Peak Semi-Primitive Area. Direct, indirect, and cumulative impacts are described for these resources. The geographic extent of this analysis is the project boundary. This extent is appropriate because direct, indirect and cumulative impacts will be contained within this perimeter. The timeframe for this analysis is five years. This is an appropriate temporal bound because the activities associated with this project should be completed within five years.

A Recreation, Lands and Scenic Resources Report was completed for resources within the Wildcat Project by Erika Brenzovich in July 2014. This report is incorporated by reference and is available in the project record (USDA 2014g).

The following GIS data were used to complete this analysis: Plumas National Forest Roads and Trails layers, Plumas National Forest Recreation Opportunity Spectrum, and Plumas National Forest Visual Quality Objectives.

The Recreation Opportunity Spectrum (ROS) is used as an indicator in the recreation analysis to measure beneficial or adverse effects on recreation resources. The Recreation Opportunity Spectrum (ROS) is a system used to divide the Forest into recreational opportunity areas based on area size, distance from roads, and the degree of development. Existing and potential recreation activities are identified within each category to guide future management. Categories within this analysis range from Semi-Primitive Non-Motorized to Roaded Natural. The three ROS classifications identified in the PNF LRMP (USDA 1988a,b) that apply to this project area are:

- Semi-Primitive Non-Motorized – a predominantly unmodified natural environment of a size and location that provides a good to moderate opportunity for isolation from sights and sounds of people.
- Roaded Modified – These lands lie along the major travel ways and viewsheds. Nearly all developed sites are in this class. Paved roads and hardened sites are common within this ROS class. Roads, landings, slash and debris are evident.
- Roaded Natural – those areas coded as Middle ground, Background or Unseen, and Sensitivity Level II or III. This is the general management area of the Forest typified by pick-up trucks and many miles of dirt and gravel roads.

The Visual Management System (VMS) was developed to provide a process for the “seen” aspects of both the land the activities which occur on it. The PNF LRMP (USDA 1988a,b) uses the VMS to manage visual qualities for activities that occur on the forest. Under VMS, Visual

Quality Objectives (VQOs) are used to identify Variety Classes and Sensitivity Levels for managing scenic quality on NFS lands. VQOs are used as a measurement indicator in the scenery analysis to measure impacts to scenic resources within the Wildcat Project, particularly the Thompson Peak Semi-Primitive Area where a VQO of Retention is assigned. There are four Visual Quality Objectives (VQOs) outlined in the PNF LRMP (USDA 1988a,b) within the Wildcat Project area:

- Retention: People's activities are not to be evident to the casual forest visitor.
- Partial Retention: People's activities may be evident but must remain subordinate to the characteristic landscape.
- Modification: Activities may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture.
- Maximum Modification: Activities may dominate the characteristic landscape but should appear as a natural occurrence when viewed as a background.

Affected Environment

Recreation

The recreation analysis boundary for the Wildcat Project incorporates portions of the Antelope Lake Recreation Area which includes three developed recreation sites (Lone Rock Campground, Boulder Creek Campground, and Antelope Picnic Area). The analysis area also includes dispersed (undeveloped) recreation sites scattered throughout project area, several motorized trails, one non-motorized trail, and NFS roads within the project area as the pertain to recreation opportunities.

A variety of recreation activities occur within the analysis area. The types of developed and dispersed recreation opportunities that occur within the analysis area include: camping, picnicking, motorized boating, non-motorized boating, swimming, fishing, driving for pleasure, OHV riding, mountain biking, road biking, snowmobiling, wildlife viewing, hunting, rock hounding, geocaching, Christmas tree cutting, and firewood cutting.

The Plumas National Forest had an estimated 671,000 visitors during fiscal year 2010 based on results from the National Visitor Use Monitoring (NVUM) survey that was conducted from October 2009 through September 2010 (USDA 2015). The NVUM survey was designed to assess existing recreation demand on the Forest by surveying visitors on what they did during their visit, and visitors could check multiple activities. The study resulted in two categories of visitor use, activities visitors participated in and the main activities of visitors. Table 42 below shows the main types of activities that occur on the Plumas National Forest by percentage from the 2010 NVUM survey.

Table 42. Plumas National Forest visits by participation and main activity from National Visitor Use Monitoring Surveys (USDA 2015)

Activity	% Participation	% Main Activity	Avg. Hours Doing Main Activity
Relaxing	44.7	11.0	41.6
Viewing Natural Features	43.7	14.3	2.6
Hiking / Walking	3.82	13.2	5.2

Fishing	37.9	26.9	5.9
Viewing Wildlife	33.4	0.8	13.5
Motorized Water Activities	24.3	10.1	5.1
Developed Camping	23.3	6.1	52.8
Driving for Pleasure	20.8	2.8	1.7
Other Non-motorized	15.0	3.0	1.5
Picnicking	13.3	3.3	8.5
Non-motorized Water	10.4	2.4	4.0
Bicycling	4.7	0.2	2.8
Some Other Activity	4.5	3.1	5.2
Gathering Forest Products 4.1 0.3 3.0	4.1	0.3	3.0
Nature Study	4.0	0.0	0.0
Visiting Historic Sites	3.8	0.0	0.0
Resort Use	3.7	0.1	44.5
Motorized Trail Activity	2.5	1.0	6.0
OHV Use	2.4	0.2	7.6
Nature Center Activities	1.6	0.0	0.0
Primitive Camping	1.1	0.5	39.7
Other Motorized Activity	0.8	0.0	0.0
Cross-country Skiing	0.6	0.0	2.0
Backpacking	0.5	0.0	2.0
Hunting	0.4	0.0	0.0
No Activity Reported	0.4	0.4	
Horseback Riding	0.3	0.0	0.0
Snowmobiling	0.2	0.1	2.0
Downhill Skiing	0.2	0.1	2.0

There were approximately 21,309 visitor days at campgrounds at Antelope Lake in 2010 (Damm 2010). Recreation use decreased after the Moonlight and Antelope fires by approximately 22 percent, and has not yet come back to pre-fire levels.

The Department of Water Resources, Northern Region Office (DWR), conducted a recreation survey of day use at Antelope Lake Recreation Area in 2009 to estimate the amounts and types of lakeside recreation use and angler success. No previous recreation day use surveys had been performed at Antelope Lake up until 2009. DWR survey results found an estimated total day use on Antelope Lake of 64,369 hours. These surveys estimated 23,253 hours of non-fishing related recreation and 41,116 hours of fishing on Antelope Lake between May 10 and September 30, 2009. The most frequently observed activities were beach use, swimming and wading, and fishing. (Boyt 2011).

According to the DWR 2009 survey, the majority (nearly 83 percent) of recreational visitors to Antelope Lake originated in California. California residents came from 25 different counties, of which 71 percent were from adjacent northeast counties. Place of residence for anglers differed slightly from recreational visitors. About 18 percent of anglers came from Nevada, 72 percent from California's northeastern counties, and three percent came from Sacramento Valley counties (Boyt 2011).

There are approximately 2.03 miles of motorized trails within the analysis area and .21 miles of non-motorized trails. There are approximately 42.46 miles of roads within the recreation analysis area that are available to all recreation users (Table 43).

Table 43. Trails and roads within Wildcat Project Area

Motorized Trails and NFS Roads in Wildcat Project Area	# of miles
Total miles of motorized trails	2.03
4WD> 50”- Four-Wheel Drive vehicle > 50”	1.46
ATV – All Terrain Vehicle	.57
Total miles of NFS roads	42.46
Total miles motorized trails and roads	44.49

Lands Resources

There are several Special Uses that occur within the analysis boundary. Royal Elk Park Management operates the two campgrounds within the analysis boundary under a Special Use Permit with the PNF which operate and maintenan three campgrounds, a boat launch, and a general store located under there permit that they operate near Lone Rock Campground. There are three fishing outfitters that operate are under Special Use Permit at Antelope Lake and one recreation event that occurs annually at Antelope Lake, the Indian Valley Century Bike Ride.

Scenic Resources

The majority of the Wildcat Project area falls within a VQO of Modification (10,378 acres). Approximately 2,611 acres of the project area is within a VQO of Retention, 982 acres within a VQO of Partial Retention, and 641 acres within a Maximum Modification VQO.

The Thompson Peak Semi-Primitive Area overlaps with the Wildcat Project area (2,049 acres). The PNF LRMP identified a VQO of “Retention” to the Semi-primitive area which means people’s activities should not be evident to the casual forest visitor. Proposed Action management treatments are designed to meet the standard VQO of Retention, while adequately reduces fuels likely to promote a catastrophic wildfire event, managing vegetation to lower hazards while enhancing visual experiences. The Proposed Action includes approximately 177 acres of mechanical treatments within the Semi-primitive area and approximately 11 acres of hand thinning within the Semi-Primitive Area.

According to the PNF LRMP, all lands within the Semi-Primitive Area Prescription are to be managed in accordance with the ROS class of Semi Primitive Non-Motorized (SPNM) (USDA 1988c). Forest Service policy requires that SPNM areas be analyzed when projects may affect the wilderness characteristics of these areas, since they have the potential to be designated as wilderness. Five wilderness characteristics must be considered when activities have the potential to affect wilderness character. Four of these wilderness characteristics are from Section 2 (c) of the Wilderness Act of 1964: untrammeled, natural, undeveloped, and outstanding opportunities for solitude or a primitive and unconfined type of recreation. There is a fifth quality, the unique qualities of a particular wilderness area, which is used to monitor wilderness character although it is not listed in the Wilderness Act.

Scenic resources just outside the project area have been drastically diminished by the four catastrophic fires that occurred within the last 13 years (2007 Moonlight Fire, 2007 Antelope Complex, 2006 Boulder Fire, and 2001 Stream Fire)

Environmental Consequences

Recreation Resources

Alternative A – Proposed Action – Direct and Indirect Effects

Under the Proposed Action (Alternative A), mechanical and hand thinning treatments would occur on approximately 3,514 acres. Prescribed fire would occur on approximately 102 acres in the project area with follow-up treatment on approximately 2,862 acres. Control of invasive plants would occur on approximately 26 acres, along with watershed condition restoration treatments of 18 sites along National Forest System Roads and decommissioning a total of 6.1 miles of existing non system roads and 0.72 miles of NFS system roads.

Direct and Indirect Effects of Mechanical and Hand Thinning and Prescribed Fire

Under the Proposed Action, mechanical and hand thin treatments would occur on approximately 3,514 acres within the project area. Approximately 177 of the total acres would be mechanically treated and approximately 11 acres would be hand thinned within the Thompson Peak Semi-primitive Area. Prescribed fire treatments would occur on approximately 102 acres.

There would be no direct effects from these activities on the Antelope Lake Recreation Area and the three developed recreation sites at Antelope Lake because there are no planned mechanical thinning, hand thinning, or prescribed fire activities within these developed recreation areas. However, there may be short term negative indirect effects on Antelope Lake Road (FS Rd 27N43) as a result of logging traffic. Project design features for the Antelope Lake Recreation Area and developed recreation sites listed in Table 3would ensure that negative indirect impacts would be minimized and ensure that visitor health and safety would be protected during hauling activities. These impacts would only occur on weekdays since project design features listed in Table 3 ensure that no hauling would be permitted on weekends.

There would be no negative direct impacts to dispersed recreation areas, roads, or trails from mechanical or handing thinning, or prescribed fire activities because long term access to these areas would be maintained on the 2.03 miles of OHV trails, .21 miles of non-motorized trails, and 42.46 miles of system roads. There may be a short term closure of OHV trails, system roads, and dispersed recreation areas during mechanical treatment operations. However, long term positive impacts to these resources would likely outweigh the short term impacts because Proposed Action treatments would protect these areas from future catastrophic fires and ensure long term recreation access to these areas. Project design features listed in Table 3 would ensure that visitor safety is protected in general forest areas where dispersed recreation occurs.

The potential wilderness character of the Semi-Primitive Non-Motorized (ROS class within the Thompson Peak Semi-primitive Area) would be maintained because opportunities for solitude would continue after treatments are completed. None of the other five wilderness characteristics of the Semi-Primitive Non-Motorized would be negatively impacted from mechanical or hand thinning treatment activities (untrammeled, natural, undeveloped, or unique qualities of the Semi-Primitive Non-Motorized area).

Direct and Indirect Effects of Watershed Enhancement Activities

The existing 2.03 miles of OHV trails and .21 miles of non-motorized trails would be maintained with implementation of the road decommissioning portion of the Proposed Action and no direct or indirect impacts would occur to those resources. The 6.1 miles of road decommissioning proposed on non-system roads would not have any direct or indirect impacts to recreation resources because these roads are not considered open and legal to OHV or vehicular access according to the Plumas National Forest Public Motorized Travel Management, 2010 Record of Decision (USDA 2010). Since non-motorized recreation uses such as hiking, equestrian use, and mountain biking could still occur on the 6. 1 miles of non-system roads proposed for decommissioning, there would be no short term or long term impacts to those uses because recreation use by non-motorized uses could continue.

Decommissioning of .72 miles of NFS road 28N99 would likely have minor negative impacts to recreation resources because a portion of this road would be closed to motorized use once it is decommissioned. This impact is considered minor when taken in context with the 4000 plus miles of roads on the PNF available to motorized uses (including 42 miles of OHV trails) within the project area). Since the southern portion of NFS road 28N99 is proposed for decommissioning but not to be obliterated, non-motorized uses would continue on this road, therefore there would be no direct or indirect impacts to non-motorized uses.

Direct and Indirect Effects of Invasive Plant Treatments

The Human Health and Risk Assessment (Appendix E) addresses potential for chemical exposure by Forest visitors engaged in recreation and other user activities. It is not anticipated that any impacts to human health would occur as a result of herbicide treatments since project design features are designed to minimize human health impacts to recreation users and the public.

There would be no direct or indirect impacts to developed recreation sites from invasive plant treatments because there are no developed recreation sites proposed for treatments.

Recreation opportunities under the Recreation Opportunity Spectrum would be maintained or improved in dispersed recreation areas with implementation of invasive plant treatments under the Proposed Action. Invasive plant treatments would ensure that invasive plants are controlled or eradicated in these dispersed recreation areas, thereby having positive indirect impacts to recreation resources since invasive plants can be a nuisance to visitors at recreation sites, camping areas, and trails. Treatments would likely result in a minor inconvenience to visitors if workers are conducting invasive plant treatments in dispersed recreation areas. This impact is short-term in nature since proposed treatments would only occur until the invasive plant is controlled or eliminated.

Alternative A – Proposed Action – Cumulative Effects Common to All Treatments

There are no known past, present or reasonably foreseeable future projects within the project area that when considered with mechanical and hand thinning treatments, prescribed fire, watershed enhancement treatments, or invasive plant treatments under the Proposed Action would have any significant adverse cumulative effects on the Antelope Lake Recreation Area, the Thompson Peak Semi-primitive Area, developed recreation sites, dispersed recreation areas, roads, or trails or any other recreation opportunities in the project boundary.

Alternative B – No-Action Direct and Indirect Effects

There would be no direct effects from the No-Action alternative on recreation resources because current recreation opportunities would be maintained without implementing mechanical thinning, hand thinning, or prescribed fire treatments. There would be no negative direct impacts to dispersed recreation areas, roads, or trails without implementing these management treatments. There would be no short term closures of OHV trails, system roads, and dispersed recreation areas without management treatments. However, without implementing management treatments there would likely be long term indirect impacts to recreation resources. Without management treatments, the landscape where recreation activities occur would likely be at a risk to catastrophic wildfire events, thereby risking long term recreation access to these general forest areas. It is likely that ROS classes for these areas would eventually no longer meet desired conditions identified in the PNF LRMP for Semi-primitive Non-Motorized, Roaded Natural, and Roaded Modified.

There would be no direct or indirect effects without implementing watershed enhancement treatments or invasive plant treatments in the No-Action alternative. OHV and passenger vehicle access is limited to NFS roads and trails within the project area. Since the roads proposed for decommissioning are not legally open to OHVs or passenger vehicles, no impacts to these resources could occur from road decommissioning

Alternative B – No-Action – Cumulative Effects

There are no known past, present or reasonably foreseeable future projects within the project area that when considered with the No-Action alternative would have any significant adverse cumulative effects on the Antelope Lake Recreation Area, the Thompson Peak Semi-primitive Area, developed recreation sites, dispersed recreation areas, roads, or trails or any other recreation opportunities in the project boundary.

Lands Resources

Alternative A – Proposed Action – Direct and Indirect Effects

There would not be any negative direct impacts to land uses under special use authorization from any of the vegetation treatments under the Proposed Action. There would likely be beneficial impacts to some of these lands uses such as the Outfitter and Guide permits that use dispersed recreation areas since mechanical and hand thinning treatments along with prescribed fire treatments would help protect areas used for Outfitter & Guide Activities from future catastrophic wildfires. As described under impacts to Recreation Resources in this section, potential impacts to lands resources are similar, and therefore there would not be any negative direct or indirect impacts to visitors engaged in activities under special use authorization. The Human and Human Health and Risk Assessment for the Wildcat Project (located in the project record) addresses potential for chemical exposure to herbicide treatments by Forest visitors engaged in recreation and other user activities.

Direct or indirect impacts on land uses from proposed watershed enhancement activities would have a negligible negative effect since only .72 miles of NFS roads would be impacted within a total NFS road system of over 4000 miles on the PNF and 42.46 miles within the Moonlight project area. Since the 6.1 mile of road decommissioning proposed addresses non-system roads only that are not open to OHV or vehicular access there would not be a direct or indirect effects to lands resources. Outfitter & Guide permits can still access these roads via non-motorized means.

There would not be any negative direct or indirect impacts to lands resources from invasive plant treatments. Outfitter & Guide activities under special use authorization are focused at Antelope Lake Recreation Area. There would likely be positive long term impacts to lands resources where invasive plant treatments are proposed since invasive plants would be controlled and or eradicated and provide a better recreation experience for Outfitter & Guide clients.

Alternative A – Proposed Action – Cumulative Effects Common to All Treatments

There are no known past, present or reasonably foreseeable future projects within the project area that when considered with mechanical and hand thinning treatments, prescribed fire, watershed enhancement treatments, or invasive plant treatments under the Proposed Action would have any significant adverse cumulative effects on lands resources in the project boundary.

Alternative B – No-Action – Direct and Indirect Effects

There would be no direct or indirect effects from the No-Action alternative on lands resources within the Wildcat Project area since none of the proposed management activities would occur. Under the No-Action alternative, no implementation of management treatments would allow current forest conditions to be maintained, which would in-turn allow Outfitter and Guides to continue operations in existing areas in the short term range. However, it is likely that the No-Action alternative would create a high risk situation within the dense stands in the project area for future catastrophic fires and make long term Outfitter & Guide access at risk to these areas.

Without implementation of invasive plant treatments under No-Action, there would be no long term control or eradication of invasive plants in dispersed recreation areas, thereby having potential negative indirect impacts to recreation resources since invasive plants can be a nuisance to visitors at recreation sites, camping areas, and trails. There would be no direct or indirect impacts to lands resource without implementing road enhancement treatments.

Alternative B – No-Action – Cumulative Effects

There are no known past, present or reasonably foreseeable future projects within the Wildcat Project Area that when considered with the No-Action alternative, would have any significant adverse cumulative effects on recreation resources in the project boundary.

Scenic Resources

Alternative A – Proposed Action – Direct and Indirect Effects

Direct and Indirect Effects of Mechanical and Hand Thinning and Prescribed Fire

Under the Proposed Action alternative, the alternative would meet the VQO’s of Retention, Partial Retention, and improve VQO’s within Modification and Maximum Modification as seen from all viewsheds. There would be no long term negative impacts to scenic resources from mechanical or hand thin treatments, or prescribed fire, since these treatments are designed to create a natural by retaining variable forest structure. There may be short term impacts on visual resources within the Retention and Partial Retention VQOs while management activities are still evident (until hand piles are burned and evidence of landings is no longer visible). However, there would be beneficial long term impacts to all VQO’s within the project area as the variable forest structure is achieved, and shrubs and small trees begin to spread throughout these areas as sun light reaches the forest floor. To the casual forest visitor the visual evidence of the management action would begin to disappear in the Retention and Partial Retention VQOs and desired conditions achieved.

There would likely be beneficial indirect impacts to these areas because treatments proposed in this alternative would improve overall forest health by reducing overcrowding and ladder fuels, thereby lowering the risk of a future catastrophic wildfire event destroying the visual quality of the project area. Color, texture, line and form would also be sustained, which would improve the permanency of the visual quality. The Proposed Action would meet the VQO's of Retention, and Partial Retention, and improve Modification as seen from all viewsheds.

Management treatments proposed under Alternative A within the Thompson Peak Semi-primitive area would not have any long term negative direct or indirect effects on the Retention VQO. It is likely there would be positive long term impacts on the Retention VQO because treatments would allow the visitor to see a more natural-appearing landscape along the viewshed of NFS road 28N02. Project Design Features listed in Table 3 for the Thompson Peak Semi-primitive Area would ensure VQOs of retention are met for this area.

Direct and Indirect Effects Common to Watershed Enhancement and Invasive Plant Treatments

There would be no negative direct or indirect effects to scenic resources from watershed enhancement treatments or invasive plant treatments in the Proposed Action. Decommissioning of non-system roads would likely improve viewsheds within Retention and Partial Retention VQOs as evidence of these non-system roads begin to disappear.

Alternative A – Proposed Action – Cumulative Effects Common to All Treatments

There are no known past, present or reasonably foreseeable future projects within the Wildcat Project area that when considered with mechanical and hand thinning treatments, prescribed fire, watershed enhancement treatments, or invasive plant treatments under the Proposed Action would have any significant adverse cumulative effects on scenic resources.

Alternative B – No-Action – Direct and Indirect Effects

There would be no direct impacts to scenic resources under the No-Action alternative. The current forest density of the Wildcat Project would persist without implementation of management treatments. To the casual visitor, current forest stands would be natural-appearing and VQOs of Retention and Partial Retention would continue to be met along the three visual corridors of the project area (even without the variable forest structure created by management treatments).

However, as the forest health of the project area degrades over time without management treatments, there would likely be negative indirect impacts to scenic resources. Some of these problems would be density effecting tree health, rising catastrophic fire probability, and reduction of tree species diversity. The dense growth and dead matter on the ground surface would eventually not meet the desired conditions of the Retention and Partial Retention VQOs as described in PNF LRMP. Any one of these scenarios would not create a sustainable forest character into the future and the project area would no longer meet the VQOs of Retention and Partial Retention, even the Modification VQO. If a catastrophic wildfire would occur under the No-Action alternative, the results would leave a visual impact for 30 to 50 years before the vegetation would recover to a similar condition. This would significantly change the form, texture, line, and color in the area and would not meet Partial Retention or even Modification VQOs.

There would be no short term direct or indirect impacts to visual resources without implementing watershed enhancement treatments or invasive plant treatments. There would likely be negative direct impacts to Retention and Partial Retention VQOs in the long term without implementing road decommissioning of non-system roads since these roads would continue to appear on the landscape.

Alternative B – No-Action – Cumulative Effects

There are no known past, present or reasonably foreseeable future projects within the project area that when considered with the No-Action alternative, would have any significant adverse cumulative effects on scenic resources in the project boundary.

Terrestrial and Aquatic Wildlife Resources

Introduction

The purpose of this terrestrial and aquatic wildlife species analysis is to determine whether the Wildcat Project would result in a trend toward listing or loss of viability for USDA Forest Service sensitive species, and to document effects on threatened, or endangered species and/or their critical habitat as part of determining whether formal or informal consultation with the United States Department of the Interior Fish and Wildlife Service (USFWS) is needed. The Wildcat Biological Assessment/Biological Evaluation (BA/BE) was prepared in accordance with legal requirements set forth under Section 7 of the Endangered Species Act [19 U.S.C. 1536 (c), 50 CFR 402] and standards established in Forest Service Manual direction (FSM 2672.42). The analysis also evaluated potential project effects on Region 5 Forest Service Management Indicator Species.

Six categories of species are considered in the BA/BE (hereafter TES species); threatened, endangered, proposed, candidate and Forest Service sensitive species and Management Indicator Species. Species federally listed as endangered by the USFWS are species currently in danger of extinction throughout all or a significant portion of their range. Species listed as threatened are likely to become endangered within the foreseeable future throughout all or a significant portion of their range. A proposed species is any species that is proposed in the Federal Register to be listed as a threatened or endangered species under the Endangered Species Act (ESA) (50 CFR 402.03).

Candidate species are plants and animals for which the U.S. Fish and Wildlife Service (FWS) has sufficient information on their biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a proposed listing regulation is precluded by other higher priority listing activities. Forest Service sensitive species are designated by the Regional Forester and are species for which population viability is a concern, as evidenced by: (1) significant current or predicted downward trends in population numbers or density, and/or (2) significant current or predicted downward trends in habitat quantity or quality for these species. Forest Service direction is to maintain viable populations of and habitat for sensitive species to ensure that species do not become threatened or endangered because of Forest Service actions (FSM 2670.2, 2670.3, 2670.5, 2672.4).

This section of the EA consists of both a Biological Assessment for federally listed wildlife species potentially occurring on the PNF (USDI 2013a, updated September 18, 2011, accessed April 8, 2013) and a Biological Evaluation for Region 5 Sensitive Species (updated July 3, 2013). Table 44 contains a list of TES species that potentially occur on the PNF and may be addressed in the BA/BE.

Table 44. Threatened, Endangered, Proposed, Candidate and Sensitive Animal Species that potentially occur on the Plumas National Forest.

Threatened, Endangered and Sensitive Species (Scientific Name)	Species Status*	Habitat or Ecosystem Component	Category for Project Analysis**
Invertebrates			
Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*)	FT	Elderberry trees (*Sambucus* spp.)	1
Western bumble bee (*Bombus occidentalis*)	USFS : S	Access to Flowering Plants and Abandoned Rodent Burrows	3
Fish			
Hardhead minnow (*Mylopharodon conocephalus*)	USFS : S, DFG : SSC	Riverine and Lacustrine	1
Amphibians			
California red-legged frog (*Rana aurora draytonii*)	FT	Riverine and Lacustrine	1
Foothill yellow-legged frog (*Rana boylii*)	USFS : S, DFG : SSC	Riverine and Lacustrine	1
Sierra Nevada yellow-legged frog (*Rana sierrae*)	FE, USFS : S, DFG : SSC	Riverine and Lacustrine	3
Reptiles			
Western pond turtle (*Actinemys marmorata*)	USFS : S, DFG : SSC	Riverine and Lacustrine	2
Birds			
Bald eagle (*Haliaeetus leucocephalus*)	USFS : S, SE, USFWS : BCC	Large trees adjacent to riverine and lacustrine	2
California spotted owl (*Strix occidentalis occidentalis*)	USFS : S, USFS : MIS, DFG : SSC, USFWS : BCC	Late Seral Closed Canopy Coniferous Forest	3
Greater sandhill crane (*Grus canadensis tabida*)	USFS : S, ST	Open habitats (grasslands and croplands), shallow lakes, fresh emergent wetlands	2
Great gray owl (*Strix nebulosa*)	USFS : S, SE	Late Seral Closed Canopy Coniferous Forest adjacent to wet meadows	3
Northern goshawk (*Accipiter gentilis*)	USFS : S, DFG : SSC	Late Seral Closed Canopy Coniferous Forest	3
Willow flycatcher (*Empidonax trailii brewsteri*)	USFS : S, SE, USFWS : BCC	Riparian with Dense Willows	2
Yellow-billed Cuckoo (*Coccyzus americanus*)	FT	Large patches of riparian vegetation along low gradient open river valleys	1
Mammals			

Threatened, Endangered and Sensitive Species (Scientific Name)	Species Status*	Habitat or Ecosystem Component	Category for Project Analysis**
American marten (*Martes americana*)	USFS : S	Late Seral Closed Canopy Coniferous Forest	3
California wolverine (*Gulo gulo luteus*)	FP, USFS : S, ST	Late Seral Closed Canopy Coniferous Forest	1
Pacific fisher (*Martes pennanti pacifica*)	FP, USFS : S, DFG : SSC	Late Seral Closed Canopy Coniferous Forest	3
Gray wolf (*Canis lupus*)	FE	Generalist: Forest, Grassland, Tundra, Desert	2
Pallid bat (*Antrozous pallidus*)	USFS : S, DFG : SSC	Open, Dry Habitats with Rocky Area	3
Townsend's big-eared bat (*Corynorhinus townsendii*)	USFS : S, DFG : SSC	Mesic Habitats	3
Fringed myotis (*Myotis thysanodes*)	USFS : S	Hardwood-conifer Open Canopy Forest	3

***Species Status: FE** = Federal Endangered, **FT** = Federal Threatened, **FP** = Federal Proposed, **FC** = Federal Candidate,
USFS : S = U.S. Forest Service - Sensitive, **USFS : MIS** = U.S. Forest Service – Management Indicator Species, **SE** = State Endangered,
ST = State Threatened, **DFG : FP** = State Fully Protected, **DFG : SSC** = State Species of Special Concern,
USFWS : BCC = U. S. Fish and Wildlife Service Birds of Conservation Concern, **SOI** = Species of Interest.

** **Category 1:** Species whose habitat is not in or adjacent to the aquatic or terrestrial wildlife analysis areas and would not be affected by the project. **Category 2:** Species whose habitat is in or adjacent to the aquatic or terrestrial wildlife analysis areas , but would not be either directly or indirectly affected by the project. **Category 3:** Species whose habitat would be either directly or indirectly affected by the project.

Note: Sensitive Species identified for analysis are those included on a proposed updated USFS Region 5 update with an implementation date of July 3, 2013. Projects with NEPA decisions after this date are required to use this updated list.

Several TES species identified in the list have been eliminated from further analysis, based on past analysis and concurrence from the USFWS (Rotta 1999, USFWS letter 1-1-99-I-1804 dated August 17, 1999) or due to lack of species distribution and/or lack of designated critical habitat. These species are listed below:

- Winter-run Chinook salmon (*Oncorhynchus tshawaytsha*)
- Conservancy fairy shrimp (*Branchinecta conservatio*)
- Central Valley steelhead (*Oncorhynchus mykiss*)
- Delta smelt (*Hypomesus transpacificus*)
- Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*)
- Central Valley spring-run Chinook salmon (*Oncorhynchus tshawaytsha*)
- Carson wandering skipper (*Pseudocopaeodes eunus obscurus*)
- Critical habitat for vernal pool invertebrates (Butte County)
- Critical habitat for California red-legged frog

See the Focal Area of Analysis section below for a discussion of why the analysis of some species were brought forward into this Environmental Assessment while others were discussed in the BA/BE.

Table 45. Selection of MIS* for Project-Level Habitat Analysis for the Wildcat Project.

Habitat or Ecosystem Component	CWHR Type(s) defining the habitat or ecosystem component[1]	Sierra Nevada Forests Management Indicator Species *Scientific Name*	Category for Project Analysis [2]
Riverine & Lacustrine	lacustrine (LAC) and riverine (RIV)	aquatic macroinvertebrates	3
Shrubland (west-slope chaparral types)	montane chaparral (MCP), mixed chaparral (MCH), chamise-redshank chaparral (CRC)	fox sparrow *Passerella iliaca*	3
Oak-associated Hardwoods & Hardwood/conifers	montane hardwood (MHW), montane hardwood-conifer (MHC)	mule deer *Odocoileus hemionus*	3
Riparian	montane riparian (MRI), valley foothill riparian (VRI)	yellow warbler *Dendroica petechia*	3
Wet Meadow	Wet meadow (WTM), freshwater emergent wetland (FEW)	Pacific tree (Chorus) frog *Pseudacris regilla*	3
Early Seral Coniferous	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), eastside pine (EPN), tree sizes 1, 2, and 3, all canopy closures	mountain quail *Oreortyx pictus*	3
Mid Seral Coniferous	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), eastside pine (EPN), tree size 4, all canopy closures	mountain quail *Oreortyx pictus*	3
Late Seral Open Canopy Coniferous	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), eastside pine (EPN), tree size 5, canopy closures S and P	sooty (blue) grouse *Dendragapus obscurus*	3
Late Seral Closed Canopy Coniferous	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), tree size 5 (canopy closures M and D).	California spotted owl *Strix occidentalis occidentalis*	3
		northern flying squirrel *Glaucomys sabrinus*	3
Snags in Green Forest	Medium and large snags in green forest	hairy woodpecker *Picoides villosus*	3
Snags in Burned Forest	Medium and large snags in burned forest (stand-replacing fire)	black-backed woodpecker *Picoides arcticus*	2

* American Marten and Greater Sage Grouse are not MIS for the Plumas NF (USDA Forest Service 2007a)

1 All CWHR size classes and canopy closures are included unless otherwise specified; dbh = diameter at breast height; Canopy Closure classifications: S=Sparse Cover (10-24% canopy closure); P= Open cover (25-39% canopy closure); M= Moderate cover (40-59% canopy closure); D= Dense cover (60-100% canopy closure); Tree size classes: 1 (Seedling)(<1" dbh); 2 (Sapling)(1"-5.9" dbh); 3 (Pole)(6"-10.9" dbh); 4 (Small tree)(11"-23.9" dbh); 5 (Medium/Large tree)(>24" dbh); 6 (Multi-layered Tree) [In PPN and SMC] (Mayer and Laudenslayer 1988).

2 Category 1: MIS whose habitat is not in or adjacent to the analysis area and would not be affected by the project.

Category 2: MIS whose habitat is in or adjacent to analysis area, but would not be either directly or indirectly affected by the project.

Category 3: MIS whose habitat would be either directly or indirectly affected by the project.

Analysis Framework: Statute, Regulatory Environment, Forest Plan and Other Direction

Regulatory Environment

Direction relevant to the Wildcat Project as it affects terrestrial and aquatic wildlife includes:

Federal Laws

- Bald and Golden Eagle Act of 1940, as amended
- Departmental Regulation 9500-4
- Code of Federal Regulations (23, 36, 50 CFR)
- Endangered Species Act (ESA 1973)
- Forest Service Manual and Handbooks (FSM/H 1200, 1500, 1700, 2600)
- National Environmental Policy Act (NEPA 1969)
- National Forest Management Act (NFMA 1976)
- The Migratory Bird Treaty Act of 1918, as amended
- USFWS Species List (updates through September 18, 2011)

Forest Service direction for TES species incorporated in the BA/BE can be found in the Forest Service Manual (FSM 2670.31, FSM 2670.32). Information regarding threatened, endangered, proposed, candidate and sensitive animals is also obtained through the cooperation of the USFWS and the California Department of Fish and Wildlife (CDFW).

Effects Analysis Methodology

Specific Assumptions

The following assumptions apply specifically to the wildlife analysis:

Assumption 1: All standards and guidelines, standard operating procedures (SOPs), project specific design features and mitigations would be fully adhered to and implemented, including the use of the appropriate Limited Operating Periods (LOPs).

Assumption 2: All activities proposed would be completed within approximately three to five years.

Assumption 3: All wildlife inhabited trees (nest trees, roosts, etc.) would be retained unless they pose a safety hazard.

Assumption 4: Analysis assumes occupancy unless project area has been surveyed to protocol and found to be absent of the species.

Assumption 5: Proposed activities have the potential to affect TES species, either directly by the modification or loss of habitat or habitat components, and rarely from direct mortality if nest trees are felled, or indirectly through habitat modification (e.g., changes to canopy cover, age class structure and species composition).

Assumption 6: Aquatic species spend all or significant portions of their life cycles either in or moving through stream and/or riparian habitats.

Assumption 7: Aquatic habitats and associated stream systems can tolerate certain levels of land disturbance. However, widespread or intense land disturbances applied in sensitive areas such as RCAs can substantially impact the immediate area or downstream channel stability and water quality.

Specific Methodology

The Wildcat Project was reviewed on the ground, as well as, using satellite imagery (NAIP), vegetation layer spatial datasets, species specific spatial datasets and known information to help determine suitable habitat for TES species. In the field, areas identified as suitable habitat in the analysis area were surveyed. Species nest sites and locations were recorded using Global Positioning System (GPS) and incorporated into spatial datasets. For the analysis of effects, changes to suitable habitat and impacts to management units (i.e., protected activity centers, PACs; nesting territories, etc.) were determined using a spatial dataset of the vegetation layer combined with type of treatments (e.g. mechanical tree harvest, biomass removal, prescribed fire).

All vegetation information is displayed using the California Wildlife Habitat Relationships (CWHR) vegetation codes and serves as the baseline acres for analyses (Appendix B of USDA 2014b). Forest-wide vegetation typing is updated after fires and forest activities to most accurately represent available habitat types. Vegetation burn severity data, aerial photos, and satellite imagery were used to generate the post-fire CWHR vegetation map used for these analyses.

Data Sources

GIS layers containing the following information: vegetation layer, ownership, aquatic features (streams, springs and lakes, etc.), riparian/aquatic management areas (Riparian Conservation Areas (RCAs), Critical Aquatic Refuges (CARs), and species management layers (e.g., Protected Activity Centers, PACs; Home Range Core Areas, HRCAs), fire severity, CWHR pre- and post-fire vegetation, slope, elevation, gradient, aquatic features. Project survey reports and incidental detection records located in the Natural Resources Inventory System (NRIS database). Equivalent Road Area (ERA) as compared to Threshold of Concern (TOC) calculations analyzed at the sub-watershed scale.

Terrestrial and Aquatic Wildlife Measurement Indicators

Direct and Indirect Effects of Wildcat Project

Measurement Indicator 1: Flame length under 90th percentile weather conditions within ¼ mile of spotted owl and goshawk PACs, spotted owl HRCAs, proposed critical habitat for the Sierra Nevada Yellow-legged Frog and Critical Aquatic Refuges (CARs). Proposed critical habitat for the Sierra Nevada Yellow-legged Frog was designated within Boulder and Lone Rock Creek watersheds in the Wildcat project area (Federal Register April 25, 2013). CARs are subwatersheds designated with known locations of TES species or rare aquatic- or riparian-dependent plant or animal species (USDA 2004).

Indicator Measure 2: Landscape heterogeneity (CWHR distribution and canopy cover, used for acres of suitable habitat modified or lost), Aspen Health (tree density by species).

Indicator Measure 3: Equivalent roaded acres (ERA) and miles of stream habitat enhanced were used as indicator for aquatic species.

Methodology: Indicator Measure 1 is comprised of a GIS analysis as well as FlamMap5 fuel modeling of the proposed fuel reduction treatments in relation to suitable habitat for each key late successional-species such as goshawk and spotted owl. Analysis focuses on potential suitable habitat and qualitatively discusses the potential affects to habitat components. Suitable habitat is species specific, for example, goshawk habitat consists of specific nesting and foraging habitat features. Indicator Measure 2 is comprised of a quantitative assessment of CWHR size classes. Due to the scarcity of quantitative data on habitat components such as snags, structural diversity, down woody debris, prey species and competitors, this information has been included qualitatively. Wildcat Project activities were analyzed to determine if it would exceed a species' threshold of tolerance by examining direct and indirect effects of the project on a species basis and coupled these potential effects with species-specific cumulative effects in the analysis area.

Cumulative Effects Analysis

According to the Council on Environmental Quality (CEQ) NEPA regulations, "cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions (40 CFR § 1508.7).

Terrestrial and Aquatic Wildlife Methodology: In order to understand the contribution of past actions to the cumulative effects of the alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects. This cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for not taking this approach. First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions over the last century (and beyond), and trying to isolate the individual actions that continue to have residual impacts would be nearly impossible. Second, providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the alternatives. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because there is limited information on the environmental impacts of individual past actions, and one cannot reasonably identify each and every action over the last century that has contributed to current conditions. Additionally, focusing on the impacts of past human actions risks ignoring the important residual effects of past natural events, which may contribute to cumulative effects just as much as human actions. By looking at current conditions, we are best able to capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects.

The Aquatic Analysis Area is the same as terrestrial wildlife and hydrology analysis area (approximately 13,376 acres and includes nine HUC6 subwatersheds (Figure 38). The watersheds delineated for analysis encompass areas where actions are proposed and/or cumulative effects of fire and past harvest with the proposed action are significant. The base GIS layer used to create the project level watersheds was the HUC6 GIS layer from the national data set. The HUC6 GIS layer was subdivided into the project analysis watersheds based on Region 5 protocols (watersheds optimally are to be between 500 and 2000 acres). The analysis area includes complete drainage for all proposed treatment units. Within each subwatershed in the analysis area, past management activities were analyzed to account for the cumulative amount of land disturbance that has occurred within each subwatershed. The project hydrologist completed a Cumulative Watershed Effects (CWE) analysis in which cumulative impacts are addressed using the Equivalent Roaded Acres (ERA) model (USDA 2011a). Upper limits of watershed “tolerance” to disturbance are estimated for the ERA model and this upper limit is called the Threshold of Concern (TOC). For additional information on ERA and watershed Threshold of Concern, refer to the Watershed and Soils section of this Environmental Assessment.Present and future projects planned that overlap with the analysis area may have cumulative impacts to wildlife, fisheries and amphibians. In this analysis, each present and future project is analyzed by species in order to understand the contribution of present and future projects to the cumulative effects of the alternatives.

Past, Present and Reasonably Foreseeable Actions

Forest Vegetation, Fire, Watershed Restoration

Past management practices that are largely responsible for shaping forest structure prior to the Wildcat Project include wildfire exclusion and past harvest activity. On public and private lands, past harvest activities focused on removal of dominant and co-dominant trees and retention of biomass and even-aged treatments. Since the 1990’s, overstory removal, sanitation cutting, commercial thinning (including single-tree selection), salvage cutting and removal of small trees has been the principal silvicultural treatments implemented on public lands in the analysis area. Some of these silvicultural treatments were incorporated into defensible fuel profile zones (Hallet, North Antelope and Antelope Border). They were constructed in the 1990s to mid-2000s. Defensible fuel profile zones were treated to modify potential fire behavior and tree mortality. Past activities such as watershed and recreation improvement projects have been small in scale and localized in effects. Other past activities include multiple recent fires such as the Cateyes (burned in 1996), Stream (2001), Boulder (2006) Wheeler (2007) and Moonlight (2007). These fires had varying effects on forest vegetation. Past watershed restoration projects, such as the installation of logs into streams, have been small in scale and localized in effects.

Recreation

Dispersed recreation use is moderate across the majority of the project area, with the exception of Antelope Lake. Antelope Lake Recreation Area has several campgrounds, restrooms and a boat launch. . The primary season of recreational use is May through November, with activities including camping, hiking, hunting, horseback riding, off highway vehicle riding, fishing, firewood cutting, wildflower viewing, by individuals and small groups. Project related impacts to activities and specific infrastructure such as; roads, OHV routes, single track trails, hiking trails and campgrounds are analyzed in the Recreation section of this EA. Recreation in the project area would have very little cumulative effect on terrestrial and aquatic wildlife.

Christmas tree and Firewood Cutting

In general, Christmas tree cutting would be highly dispersed and negligible and most likely confined to accessible areas during the holiday season. Firewood cutting is limited to roadways as firewood cutters are only allowed to cut standing dead trees within 100 feet of the roads. Overall, Christmas trees cutting and fuel wood cutting, would have a negligible effect on future stand and landscape-level forest vegetation, fuel loading, fire behavior, fire severity, or air quality due to the limited, highly localized, but largely dispersed nature of these activities. Some firewood cutting would have localized effects on snag densities, but over the entire analysis area, is limited. As a result cumulative effects would be negligible and immeasurable on a per acre basis.

Range

Portions of four range allotments are within the Wildcat project area: Antelope, Antelope Lake, Lights Creek and Lone Rock. The majority of the Wildcat Project is within the Antelope Lake Allotment including the Lowe Flat Pasture. Livestock generally prefer relatively flat open meadow areas over conifer dominated forest vegetation types. Forest vegetation treatment activities are coordinated with the Forest Range Staff. All four range allotments are schedule for evaluation under the National Environmental Policy Act in the next two years, during these analyses additional effects on terrestrial and aquatic wildlife will be assessed. While livestock may affect grassland, aspen and riparian habitats, they appear to have little cumulative impacts on mature conifer species.

Miscellaneous Projects

Other miscellaneous projects include the Boulder Creek Watershed Improvement Project and various special uses in the project area. The watershed improvement project includes activities such as 1,900 feet of stream side stabilization and re-vegetation, repairing seven head-cuts and culvert work. Special use activities permitted include outfitter and guides, as well as a campground concessionaire. Overall, these miscellaneous projects would have very little cumulative effect.

Future Forest Health Projects

Funding was secured for post-fire restoration projects with the Moonlight Settlement Agreement in the adjacent Moonlight Fire (which burned in 2007). Many of the anticipated projects are still in the proposal phase with uncertainty over whether they will be funded and implemented. One project that may occur in the Wildcat Project area is the Lone Rock Project which intends to reduce stand densities, reduce tree hazards and fuels around the Antelope Lake campgrounds. This project is still in the reconnaissance and planning phase. Any projects that may occur within the same footprint as the Wildcat Project area would undergo the NEPA process, including cumulative effects analysis, prior to decision and implementation.

Affected Environment

Many of the forested areas in the Wildcat project appear to be at or above “normal” stocking levels and have exhibited an elevated level of tree mortality caused by bark beetles during and after periods of drought (Cluck 2014). This mortality combined with high stand density has resulted in heavy fuel loading in many areas and a corresponding increase in potential fire behavior.

Approximately two thirds of the Wildcat project area receives less than 30 inches of annual precipitation. This is below what is generally required for healthy white fir forests which is one of the dominant tree species in the analysis area. White fir forests are in the following mortality risk categories under the associated precipitation categories: Extreme risk: 20-25 inches of annual precipitation (~15 percent of Wildcat project area). High Risk: 25-30 inches of annual precipitation (~50 percent of Wildcat project area). Medium Risk: 30-40 inches of annual precipitation (~35 percent of Wildcat project area).

Geographic Analysis Area

The treatment area is defined as the units to be treated, which equals approximately 3,064 acres (Figure 7). For the purpose of the aquatic and terrestrial analysis area (hereafter analysis area) it was defined by the geographic region defining the watershed analysis area encompassing nine Wildcat Project sub-watersheds, seven of which are contained by the Boulder Creek HUC 6

(Hydrologic Unit Code) watershed. The analysis area totals approximately 13,376 acres, which is entirely on National Forest lands. The watershed analysis boundary follows Wildcat Ridge north from Antelope Lake up to Wheeler Sheep Camp, east through Bear Flat and southeast along Thompson Peak Ridge. The watershed boundary then follows the Mt. Hough Ranger District boundary south past Wimp Mountain and back to Antelope Lake (Figure 38). The direct and indirect effects of each alternative, together with the additive or cumulative effects of each alternative, have been considered in evaluating impacts to TES species and TES habitat. This threshold of tolerance will be assessed through determination of whether or not the effects to the species may lead to a trend toward listing under the federal Endangered Species Act.

Duration of Impacts

The direct effects would likely be limited to the project implementation phase (3-5 years). Indirect effects would last beyond the implementation period and occur within the temporal bound of the cumulative effects analysis. Cumulative effects are based on past actions that have occurred in the Wildcat Project area in the past 30 years (for which there is some information available on the effects on wildlife). For the purpose of the wildlife analysis, the temporal bounds include a 30-year horizon for future effects because modeling indicates that, within that timeframe, the treated stands would approach stocking levels corresponding with forest development (i.e. young forested stands could develop within this timeframe). General trends and trajectories of stand development that extends beyond 30 years are discussed in this analysis to document when habitat conditions suitable for specific species would likely be reached.

Forest-wide vegetation typing into California Wildlife Habitat Relationships (CWHR) classifications (Mayer and Laudenslayer 1988) was done using both eVeg data as well as Wildcat area vegetation mapping completed by contract after the Moonlight Fire (referred to as Ward data, who was the contractor). All vegetation information is displayed using the CWHR vegetation codes and serves as the baseline acres for analysis. Other sources of information used in the assessment of effects were aerial photos, data generated from common stand exam plots, and field reconnaissance.

Focal areas of Analysis

The National Environmental Policy Act process requires agencies to identify the significant environmental issues deserving study and de-emphasizing insignificant issues, narrowing the scope of the environmental assessment. The Wildlife Analysis methods included the preparation of a Biological Assessment/Biological Evaluation (USDA 2014a), a Management Indicator Species Report (USDA 2014b) and a Migratory Bird Report (USDA 2014c). Each of these reports included an analysis of species or species groups. Through this process, key effects to wildlife species were recognized and these species are brought forward into the Wildcat Environmental Assessment. Due to the high visibility of old forest species in California, and the potential impacts of fuel reduction treatments, the effects on California spotted owl, northern goshawk are emphasized in this EA. The western bumblebee analysis of effects was included because of the proposed use of herbicides. The Sierra Nevada yellow-legged frog, which is listed as “Endangered” under the Endangered Species Act, is present in areas proposed for treatment and is therefore emphasized. Sooty grouse was brought forward because the proposed action included design features to improve late-seral open forest habitat. Fuel reduction treatments would affect snag habitat resources and therefore three sensitive bat species, which utilize snag habitat, are brought forward in this analysis. Hairy Woodpecker, which also represents green forest snag habitat, also could have been used. Because the analysis for both bats and hairy woodpeckers would be similar, the hairy woodpecker analysis was not brought forward into this environmental analysis but is included in the MIS report (USDA 2014b). Often, American marten and Pacific Fisher analyses are emphasized during fuel reduction projects. Marten and fisher were not emphasized in this analysis due to the absence of current and historical sightings in the area despite multiple survey efforts and because late-successional closed-canopy forest habitat analysis was already emphasized in both the California spotted owl and northern goshawk analyses. Project-specific surveys following baited-camera protocol (Zielinski and Kucera 1995) were conducted and failed to detect any fisher in the Wildcat Project area.

The valley elderberry longhorn beetle, California wolverine, Foothill Yellow-legged Frog, hardhead minnow and California red-legged frog do not have habitat within or adjacent to the wildlife analysis area (Table 44). These species will not be discussed further because the project would not directly or indirectly affect these species or their habitats. Greater Sandhill Crane, Bald Eagle and gray wolf habitat occurs within the analysis area, but these species will not be discussed further because the habitat factors for these species would not be directly or indirectly affected by the project; therefore, the project would not affect these species or their habitat. Species with habitat that would be either directly or indirectly affected by the Wildcat Project (Table 44) are analyzed in this EA. This section of the EA will evaluate the direct, indirect, and cumulative effects of the alternatives on these species and their habitats. Category 3 species known to be present and have habitat that may be affected are considered key species and are carried forward into this EA. See below, focal areas of analysis, for a discussion of why some species are not carried forward into this EA. Potential impacts to all category 3 species were considered in detail within the Wildcat BA/BE and MIS report (USDA 2014a, USDA 2014b). An assessment of potential direct, indirect and cumulative impacts of the proposed action on some species (western pond turtle, great gray owl, and willow flycatcher) was found to be negligible and/or discountable (USDA 2014). These species will not be discussed further in this EA. Black-backed woodpecker is an indicator for snags in burned forest habitat. Because this project does not target treating burned forest habitat, black-backed woodpecker analysis is not emphasized in this EA. All other species are analyzed in the above reports and are incorporated by reference.

Affected Environment – Sierra Nevada Yellow-Legged Frog (*Rana sierra*)

Population Status

The Sierra Nevada yellow-legged frog (*Rana sierrae*) is an endangered species endemic to Region 5. Most populations occur on public lands. *R. sierrae* (SNYLF) are located on the El Dorado, Inyo, Lassen, Plumas, Sierra, Stanislaus, Tahoe and Lake Tahoe Basin National Forests. *Rana sierrae* were once extremely abundant throughout their range. Historically *Rana sierrae* and *Rana muscosa* were found throughout the Sierra Nevada mountain range in California and Nevada and along the transverse range in southern California. Prior to 2007, these two species were considered to represent a single species; *Rana muscosa sensu lato* (Vrendenburg et al. 2007). Northern Sierra Nevada frogs belong to *R. sierrae* based on genetic work, morphology and acoustics. As most studies cite *Rana muscosa sensu lato*, and both species occupy similar niches in their respective ranges, this document will address citations relevant to *Rana sierrae*.

The U.S. Fish and Wildlife Service (FWS) designated the SNYLF as endangered under the Endangered Species Act (Federal Register, Vol. 79, No. 82. April 29, 2014). and is currently evaluating public comments (http://www.gpo.gov/fdsys/pkg/FR-2013-04-25/pdf/2013-09598.pdf) on proposed critical habitat for the frog (Vol 78, No 80, April 25, 2013).

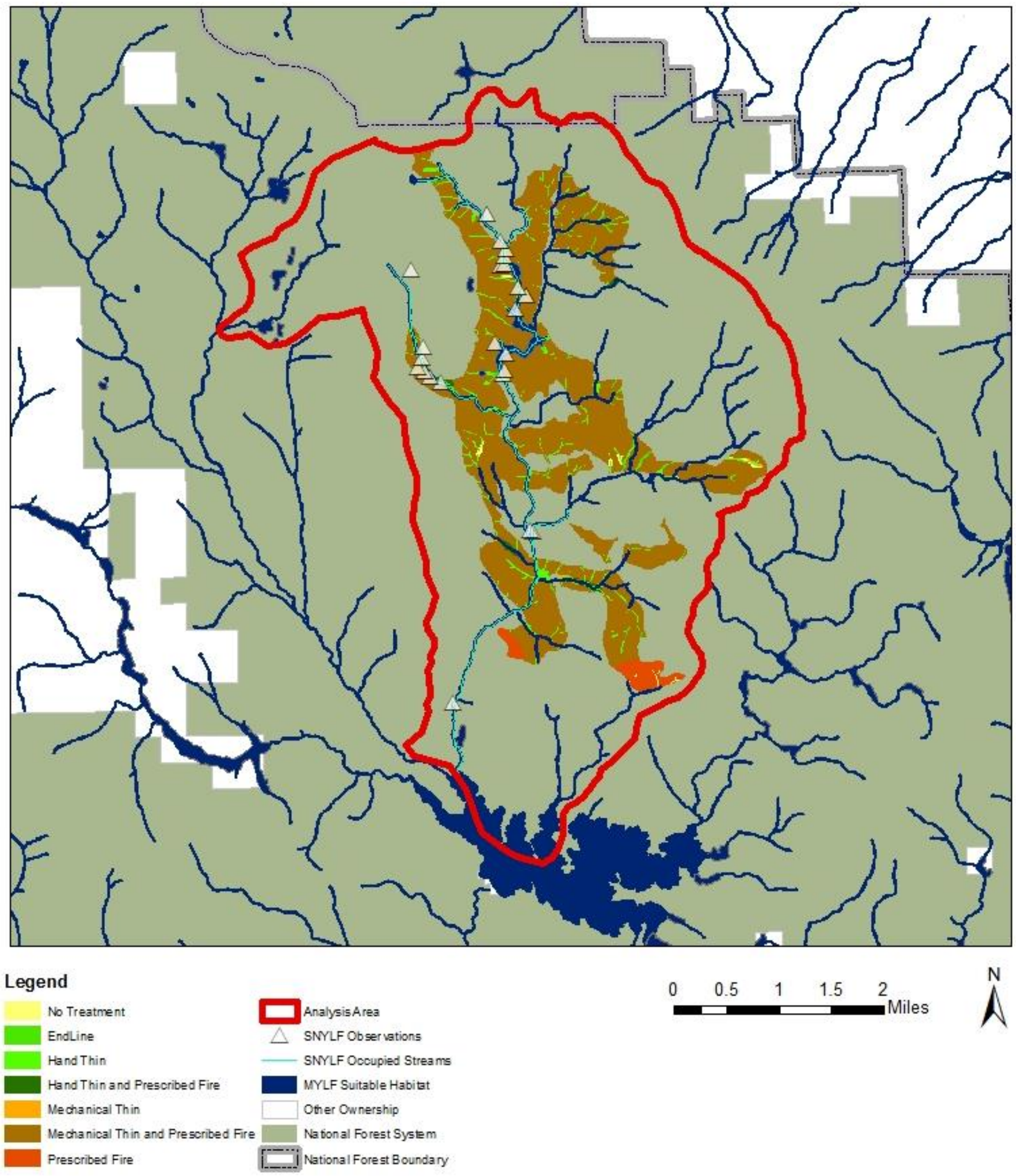


Figure 29. Sierra Nevada Yellow-legged Frog detections, occupied habitat and suitable habitat in the Wildcat Project Area. Suitable habitat would is all mechanical equipment exclusion, but does have hand (chainsaw) thinning and end-lining proposed.

Habitat Requirements

Sierra Nevada yellow-legged frogs occur on moderate to high gradient channels on the Plumas National Forest (Natural Resources Information System (NRIS) wildlife database accessed 2014). Historically streams with a bank of less than 10 inches in vertical height with a moderately rocky, sparsely vegetated bank harbored the densest populations (Mullally and Cunningham 1956). Abundance of SNYLF has not been estimated in Plumas National Forest streams, nor do we understand whether the species' ecology differs in the Northern Sierra where populations are more dispersed and often stream dwelling. To address this knowledge gap, population monitoring of the SNYLF was conducted in the HFQLG project area during 2009-2011 (USDA 2011b). This study monitored populations of SNYLF in a moderate to high gradient stream (5-12 percent). The high gradient reach was comprised of 91 percent (1,824 meters) high gradient and low gradient riffles, with the remaining 9 percent (17 meters) comprised of mid-channel and plunge pools habitat. Similarly, the lower gradient reach was comprised of 97 percent (356 meters) high and low gradient riffles, and 3 percent (42 meters) mid-channel pool habitat. Suitable habitat includes both aquatic habitat for breeding and rearing which includes permanent water that is of sufficient depth not to freeze solid to the bottom during the winter and aquatic nonbreeding habitat that may not hold water long enough for the species to complete its aquatic life cycle. This habitat provides for shelter, foraging, predator avoidance, and aquatic dispersal of juvenile and adult frogs. Suitable habitat includes upland areas extending 25 meters (82 feet) from the stream bank or shoreline. Areas between high mountain lake habitats, the upland area extends up to 300 meters from the shoreline. The entire area of meadow systems is suitable for dispersal and foraging.

Proposed critical habitat (Federal Register, Vol. 78, No 80, 2013) for the Sierra Nevada Yellow-legged Frog occurs in the Wildcat project area. The proposed subunit 2A; Boulder/Lone Rock Creeks, is located entirely within the boundaries of the Plumas National Forest. This subunit is considered to contain the physical or biological features essential to the conservation of the species, is currently functional habitat sustaining frogs, and is needed to protect core surviving populations and their unique genetic heritage. Primary constituent elements within the proposed critical habitat unit that are considered as suitable habitat include: aquatic breeding, aquatic non-breeding and upland areas adjacent to aquatic habitats. Upland areas (watershed catchment basins) are adjacent to and surround suitable habitat and provide for the natural hydrologic regime of aquatic habitats. These upland areas should also allow for the maintenance of sufficient water quality to provide for the various life stages of the frog and its prey base.

Yellow-legged frogs are highly aquatic, typically utilizing only the immediate bank and emergent rocks and logs. Frogs have not been detected greater than 23 meters from a stream bank (MGW Biological and Klamath Wildlife Resources 2006). They prefer well illuminated, sloping banks of meadow streams, riverbanks, isolated pools, and lake borders with vegetation that is continuous to the water's edge (Martin 1992, Zeiner et al. 1988). Frogs space use patterns involve three main sites: overwintering, breeding and foraging.

Tadpoles and adults overwinter in deep pools with undercut banks that provide cover (Martin 1992). Suitable breeding habitat is considered to be low gradient (up to 4 percent) perennial streams and lakes. Streams in this category generally have the potential for deep pools and undercut banks which provide the habitat requirements of this frog. At relatively high elevations, breeding occurs between May and August as soon as the meadows and lakes are free of snow and ice. At lower elevations, breeding occurs between March and June once high water in streams subsides. Yellow-legged frogs usually lay their eggs in clusters submerged along stream banks or on vegetation. Tadpoles require at least one year before metamorphosis to the adult stage. Tadpoles in some high elevation populations may require up to three years before metamorphosis (Knapp 1996). Frogs appear to be quite tolerant of variable water temperatures, as they are able to fully function in water as cold as 3C (37.4F), and tadpoles have been found in water as warm as 27C (80.6F); however, these values may represent maximum tolerances for this species (Mullally and Cunningham 1956). Body temperature is regulated by being primarily diurnal, basking throughout much of the day, utilizing the warmer shallow areas in lakes and streams, and occupying colder water areas to reduce body temperature when necessary (Bradford 1984).

Adults primarily feed on aquatic and terrestrial invertebrates favoring terrestrial insects such as beetles, flies, ants, bees, and true bugs (Jennings and Hayes 1994). Adults also consume Pacific treefrog (*Pseudacris regilla*) tadpoles, and this prey item appears to be an important component of their diet in some populations (Zeiner et al. 1988, Pope and Matthews 2001). SNYLF tadpoles graze on algae and diatoms along rocky bottoms in streams, lakes and ponds. Garter snakes and introduced trout prey upon SNYLF tadpoles and adults (Zeiner et al. 1988, Knapp 1996).

A dispersal study was conducted in Bean Creek near Meadow Valley, California (MGW Biological and Klamath Wildlife Resources 2006). In the fall, as temperatures decline, frogs have been found to move as far as one mile downstream within the stream channel. The lateral movement of SNYLF away from the channel has been found to be no greater than 23 meters (MGW Biological and Klamath Wildlife Resources 2006).

Populations of SNYLFs occur on moderate to high gradient channels on the Plumas National Forest (NRM 2013). Historically streams with a bank of less than 10 inches in vertical height with a moderately rocky, sparsely vegetated bank harbored the densest populations (Mullally and Cunningham 1956). Abundance of SNYLF has not been estimated in Plumas National Forest streams, nor do we understand whether the species' ecology differs in the Northern Sierra where populations are more dispersed. To address this knowledge gap, population monitoring of the SNYLF was conducted in the HFQLG project area during 2009-2011 (USDA 2011b). This study found populations of SNYLF in a moderate to high gradient stream (5-12 percent). The high gradient reach was comprised of 91 percent (1,824 meters) high gradient and low gradient riffles, with the remaining 9 percent (17 meters) comprised of mid-channel and plunge pools habitat. Similarly, the lower gradient reach was comprised of 97 percent (356 meters) high and low gradient riffles, and 3 percent (42 meters) mid-channel pool habitat. South Fork Rock Creek can generally be characterized as an intermittent channel with consistent perennial flows during the run-off and into the early summer months, though flows typically cease by mid-summer and result in long stretches of dry channel and isolated standing water within pool habitats (USDA 2011b).

Female frogs can have live 13-14 years with males living 11-12 years (Matthews and Miaud 2007). Matthews and Preisler (2010) estimated over eleven percent of a population survived to an age of 10 years old (N = 44 individuals). Males lack vocal sacks and do not produce the typical mating calls that are common in many frog species, nor do males form breeding aggregations (Matthews and Miaud 2007). Frogs grow faster and are generally larger at lower elevations, likely because the relatively longer summer at lower elevations provides greater time foraging and growth compared to higher elevation sites (Matthews and Miaud 2007). However, populations at higher elevations, where summer is relatively shorter, often exhibit higher annual survival rates in years with a relatively large snowpack.

Analysis Area Surveys

Habitat types in the project area consist of a heterogeneous mosaic of different canopy covers dominated by Sierra mixed conifer, pine, pine/fir, and these habitats are interspersed with meadows, brush fields, open rock areas, rock outcrops, and riparian zones. Potential habitat has been identified throughout the project area along perennial and intermittent streams and water bodies above 3,500 foot elevation. All available SNYLF surveys/sightings were utilized to determine occupied habitat within the analysis area. Historic survey data were acquired from USDA Forest Service Natural Resource Manager databases (Natural Resources Information System (NRIS) wildlife database accessed 2014.), and visual encounter surveys were conducted by Forest staff on 20 miles of stream habitat (5,000 - 7,200 feet elevation) in the Wildcat Project

Area (Fellers and Freel 1995). Surveys included the main stem and tributaries of Boulder and Thompson Creeks. Most stream reaches were surveyed once, while some stream reaches surrounding Lowe Flat and segments of Boulder Creek north of Lowe Flat were surveyed twice Two individuals were located during project specific amphibian surveys in an area outside treatment units in an unnamed tributary stream to Boulder Creek in section 22 of T28N and R12E.

Affected Environment – California Spotted Owl (*Strix occidentalis occidentalis*)

Population Status

Four demographic studies of California Spotted Owl have been ongoing for a number of years within the Sierra Nevada: (1) Eldorado National Forest (since 1986); (2) Lassen National Forest (since 1990); (3) Sierra National Forest (since 1990); and (4) Sequoia-Kings Canyon National Park (since 1990). One of the primary objectives of these demographic studies is to monitor rate of change (lambda, λ) in owl populations (i.e., the number of owls present in a given year divided by the number of owls present the year before). For these demographic models a lambda (λ) value of 1 indicates a stable population; less than one indicates the population is decreasing, and greater than 1 indicates an increasing population. For the California spotted owl demographic studies, lambda has been estimated individually for each study area at five-year intervals (Franklin et al. 2004, Blakesley et al. 2010). The most recent analysis, using data collected between 1990 and 2005, provided estimates of lambda for all four Sierra Nevada demography study areas (Blakesley et al. 2010):

- Lassen: $\lambda = 0.973$ (95% confidence interval, 0.946-1.001);
- Eldorado: $\lambda = 1.007$ (95% confidence interval, 0.952-1.066);
- Sierra: $\lambda = 0.992$ (95% confidence interval, 0.966-1.018);
- Sequoia-Kings Canyon: $\lambda = 1.006$, (95% confidence interval, 0.947-1.068).

Although researchers update demographic estimates for individual study sites annually in unpublished reports, the most recent meta-analysis of data from all four study sites in the Sierra Nevada (Blakesley et al. 2010) provides the most robust demographic estimates available. With the exception of the Lassen study area, owl populations were stable, with adult survival rate highest at the Sequoia-Kings Canyon study site. The 95 percent confidence limit for lambda in the Lassen study area ranged from 0.946 to 1.001 (estimated value 0.973), which barely includes 1, and the analysis estimated a steady annual decline of 2-3 percent in the Lassen study population between 1990 and 2005. Recent demographic modeling efforts in central and northern Sierra Nevada reported similar lambda estimates (Conner et al 2013, Table 2; Tempel et al. 2014, Figure 3) to those summarized in the most recent meta-analysis (Blakesley et al. 2010).

Habitat Requirements

The California Spotted Owl is currently managed as a USDA Forest Service sensitive species. Definitions of suitable habitat are derived from those listed in Verner et al. (1992), USDA 2004a, and 70 Federal Register, June 21, 2005. Based on these definitions the following CWHR types in the analysis area provide high quality nesting habitat: Sierran Mixed Conifer, White Fir, and Ponderosa Pine (5D, 5M). These CWHR types have the highest probability of providing stand structure associated with preferred nesting, roosting and foraging. Suitable foraging habitat is found in the same forest types listed above for nesting habitat (CWHR 5D, 5M) as well as 4D and 4M. Stands considered to be suitable for foraging have at least two canopy layers, dominant and co-dominant trees in the canopy averaging at least 12 inches in dbh, at least 40 percent canopy closure, and higher than average levels of snags and downed woody material.

Analysis Area Surveys

California Spotted Owls are managed through the establishment of Protected Activity Centers (PACs) and Home Range Core Areas (HRCAs). The HRCAs on the Plumas National Forest are 1,000 acres in size, comprised of the 300-acre PAC and 700 acres of the best available habitat around or adjacent to the PAC (USDA 2001a; USDA 2004b). Spotted owl PACs and HRCAs were established for owl activity centers based on criteria described in the California Spotted Owl Technical Report (Verner et al. 1992), California Spotted Owl Sierran Province Interim Guidelines Environmental Assessment (USDA 1993), and the SNFPA (USDA 2001a, b; USDA 2004a, b).

There are 3 spotted owl PACs and their associated HRCAs within the Wildcat Analysis area (Figure 34). Project specific protocol level spotted owl surveys (3 visits to each station for each of two years) were completed within the analysis area (2012-2013). Despite historic detections (Table 46), there were no detections during this two year survey effort (MGW 2013a).

Table 46. Spotted Owl History of Wildcat area nesting territories

PAC Number	Most recent important observation	Other years with spotted owl observations
PLU0220	1992 Pair with young	None
PLU0230	2009 active nest	1990, 1993, 2002
PLU0301	2005 pair	1991 - 1993

Affected Environment – Northern Goshawk (*Accipiter gentilis*)

Population Status

The latest published information regarding the goshawk, in terms of Sierra Nevada distribution, population and habitat trends, and species requirements can be found within SNFPA FEIS (Chapter 3, Part 4.4.2.2), and in Chapter 3.2.2.4 of the SNFPA FSEIS 2004. A total of 588 northern goshawk-breeding territories have been reported from Sierra Nevada National Forests. In 2000, there were approximately 75 Northern Goshawk nesting territories or PACs on PNF (USDA 2001b), but by the end of 2014, this number had grown to 116 goshawk PACs on the Forest. These numbers represent goshawks that have been found as a result of both individual project inventories to standardized protocols, as well as nest locations found incidentally. The increase in the number of goshawk PACs from 2000 to 2014 is likely the result of increased survey effort during this period.

The PNF LRMP EIS stated that the PNF has the capacity for 100 goshawk pairs (USDA 1988b). The 1988 PNF LRMP calls for a network of 60 nesting territories to provide for the viability of the goshawk. It is uncertain as to whether this figure is accurate. The Forest began delineating goshawk territories prior to implementation of SNFPA, and currently establishes 200 acre PACs for all newly discovered goshawk breeding sites (USDA 2004b). The current number of goshawk PACs on the Forest (N=176) exceeds the minimum objectives in the PNF LRMP by more than double, and the predicted capacity of nesting territories by 76 (N=100). Thus, current density of goshawk territories on the Forest is appears adequate to maintain goshawk population viability. Population trends for Northern Goshawks in the Sierra Nevada are unknown, but data from several studies has raised concern that goshawk populations and reproduction may be declining in

California and throughout North America due to changes in the amount and distribution of habitat or reductions in habitat quality (Bloom et al., 1986, Reynolds et al. 1994, Kennedy 1997, Squires and Reynolds 1997, Smallwood 1998, DeStefano 1998). In-house surveys on the Mt. Hough RD (1998-2002) indicated that nesting occurred at approximately 36 percent of monitored sites annually (Natural Resources Information System (NRIS) wildlife database accessed 2014.). During 2004-2007, the mean number of offspring produced during 62 nesting attempts on the PNF ranged between 1.1-1.9 offspring/nest (Dunk et al. 2011). Considered as a whole, these data indicate that the goshawk population on PNF appears relatively stable.

Habitat Requirements

The Northern Goshawk is currently being managed under the PNF LRMP guidelines as amended by the SNFPA FSEIS ROD (USDA 2004b, pages 66-67). Habitat requirements for this species can be found within the SNFPA FEIS and is summarized below.

Northern Goshawks require mature conifer and deciduous forest with large trees, snags, downed logs and dense canopy cover for nesting, and appears to prefer more open habitats for foraging (forests with moderately open overstory, open understory interspersed with meadows, brush patches, other natural or artificial openings and riparian areas). Recent studies indicate that goshawks typically select for canopy cover levels greater than 60 percent for nesting (Hall 1984, Richter and Calls 1996, Keane 1997). For purposes of this analysis, the following affected CWHR types provide suitable nesting habitat: Aspen, Douglas-fir, Eastside Pine, Jeffrey Pine, Lodgepole Pine, Montane Hardwood-Conifer, Montane Hardwood, Montane Riparian, Ponderosa Pine, Red Fir, Sierra Mixed Conifer, White Fir, (6, 5D, 5M, 4D, 4M). For purposes of this analysis, the following affected CWHR types provide suitable foraging habitat: Aspen, Douglas-fir, Eastside Pine, Jeffrey Pine, Lodgepole Pine, Montane Hardwood-Conifer, Montane Hardwood, Montane Riparian, Ponderosa Pine, Red Fir, Sierra Mixed Conifer, White Fir, (5P, 4P, 3D, 3M) (SNFPA FEIS Vol3, Chap.3, part 4.4 pg. 116, USDA 2004a).

Analysis Area Surveys

Project specific protocol level Northern Goshawk surveys (two-year protocol, USDA 2000b) were conducted in apparently suitable Northern Goshawk habitat (delineated via Forest vegetation GIS data) within the Wildcat analysis area (2012-2013, MGW 2013b). There are three Northern Goshawk PACs within the analysis area. Goshawks detected were all in or immediately adjacent to existing goshawk PACs. Additional goshawk PAC visits were conducted in 2014 and nests were documented in both the Boulder and Upper Boulder PAC in 2014. No goshawks or nests were located in the Hallett Goshawk PAC in 2014.

Affected Environment – Townsend’s big-eared bat (Corynorhinus townsendii)

Population Status

Throughout California, Townsend’s big-eared bat (*Corynorhinus townsendii*) populations have declined over the last 40 to 60 years (USDA 2001b). Approximately 52 percent of historic maternity roosts are no longer occupied, and 40 percent of these sites have been destroyed or rendered unsuitable (USDA 2001b). Recent data used to estimate these trends were collected from a statewide effort (1987-1991) that unfortunately did not occur on PNF. Bat distribution data on 16 species has been collected (using mist nets, acoustic sampling, and visual inspection of suitable roosting sites) to address project specific needs for more than two decades across the PNF (1991-2013, 206 forest-wide survey locations with bat detections, Natural Resources Information System (NRIS) wildlife database accessed 2014. *C. townsendii* has been detected at multiple locations within each ranger district on the PNF, but our survey data are too patchily distributed, both spatially and temporally, to accurately estimate population size or trend for bat species on PNF.

Habitat Requirements

C. townsendii are usually found below 6,000 feet but have been found up to 10,000 feet elevation occupying a wide variety of habitats (older forest, desert, grasslands/plains, riparian, coastal; Philpott 1997, Pierson and Rainey 1998, Pierson et al. 1999). Roosting habitat requires caves, mines, abandoned human structures, and rock crevices; and access to drinking water (Philpott 1997, Pierson and Rainey 1998, Pierson et al. 1999). *C. townsendii* forages in a variety of habitats (riparian areas, old forests, mixed hardwood-conifer forest) feeding primarily on the wing for flying insects (specializing in moths) or by gleaning from foliage (Philpott 1997, Pierson and Rainey 1998, Pierson et al. 1999). *C. townsendii* appears to prefer mesic habitats, and often forage along habitat edges (Philpott 1997, Pierson and Rainey 1998, Pierson et al. 1999). Townsend's big-eared bats form maternity colonies of up to several hundred females. These colonies show a high degree of roost fidelity, and, if undisturbed, colonies may occupy the same roost indefinitely (Philpott 1997, Pierson and Rainey 1998, Pierson et al. 1999). Its colonial nature places this bat at high risk with a single disturbance causing detrimental harm to potentially large populations (Philpott 1997).

Analysis Area Surveys

A small portion (Lowe Flat area) of the analysis area was surveyed for bats using mist-netting and acoustical surveys during 1992 as part of an unrelated project. Project specific acoustic surveys (Pettersson D500X bat detectors) were conducted in 2014 at Hallett Meadow and several locations along Boulder Creek (USDA 2014c). Although *C. townsendii* was not detected during these surveys, surveys were limited to seven survey stations during two years. The nearest known *C. townsendii* is located 15.6 miles from the analysis area. Forest-wide bat distribution data collected (using mist nets, acoustic sampling, and visual inspection of suitable roosting sites) over the past couple decades (1991-2013, 206 forest-wide locations, NRIS wildlife observation database, accessed July 2014) show *C. townsendii* in at least 19 locations distributed across all three ranger districts. Based on these observations, the availability of suitable habitat, and the species apparently wide distribution on PNF, it is assumed that *C. townsendii* are present in the analysis area.

Affected Environment – Pallid bat (Antrozous pallidus)

Population Status

There is no indication that there has been a change in the distribution of the pallid bat (*Antrozous pallidus*, USDA 2001b). There is concern for the pallid bat because it is very sensitive to disturbance. Any disturbance, even hiking, can cause the bat to abandon a roosting area completely (Arroyo-Cabrales and Grammont 2008). Also, the use of pesticides has had a serious impact on *A. pallidus* populations (Weber 2009). Bat distribution data on 16 species has been collected (using mist nets, acoustic sampling, and visual inspection of suitable roosting sites) to address project specific needs for more than two decades across the PNF (1991-2013, 206 forest-wide survey locations with bat detections). *A. pallidus* has been detected at multiple locations within each ranger district on the PNF, but our survey data are too patchily distributed, both spatially and temporally, to accurately estimate population size or trend for bat species on PNF.

Habitat Requirements

A. pallidus occur in a wide variety of habitats, including grasslands, shrublands, and woodlands to mixed conifer forests (USDA 2001b). They are most abundant below 6,000 feet elevation, but have been recorded up to 10,000 feet in the Sierra Nevada (USDA 2001b). Bats commonly occupy open, dry habitats with rocky areas for roosting. They day roost in caves, crevices, mines, and occasionally in hollow trees/snags, crevices in oaks, and snags (USDA 2001b). Philpott (1997) emphasized the importance of oak woodlands for foraging in this species, and the 2001 SNFPA FEIS (USDA 2001b) emphasized protection and enhancement of oak habitat components (westside foothill and montane oaks) to provide and maintain *A. pallidus* foraging habitat.

Analysis Area Surveys

A small portion (Lowe Flat area) of the analysis area was surveyed for bats using mist-netting and acoustical surveys during 1992 as part of an unrelated project. Project specific acoustic surveys (Pettersson D500X bat detectors) were conducted in 2014 at Hallett Meadow and several locations along Boulder Creek (USDA 2014c). *A. pallidus* was detected during these surveys at two locations, both in Lowe Flat. Forest-wide bat distribution data collected (using mist nets, acoustic sampling, and visual inspection of suitable roosting sites) over the past couple decades (1991-2013, 206 forest-wide locations, NRIS wildlife database accessed July 2014) show *A. pallidus* at approximately 76 locations distributed across all three ranger districts. Based on these observations, the availability of suitable habitat, and its apparently wide distribution on PNF, it is assumed that *A. pallidus* are well distributed in the analysis area.

Affected Environment – Fringed myotis (Myotis thysanodes)

Population Status

There is little information on size and trend of fringed myotis (*Myotis thysanodes*) populations. Although it may be locally abundant, this widespread species (western North America from British Columbia south to Mexico) also may be locally rare (Keinath 2004). In California, *M. thysanodes* is distributed statewide except the Central Valley and the Colorado and Mojave Deserts (Mayer and Laudenslayer 1988). Like other California bat species, it appears there have been declines in numbers and colonies of *M. thysanodes* (Keinath 2004; USDA 2005a). No major threats have been identified throughout the species' range, but the Mexican sub species *aztecus* has experienced around a 40 percent reduction in habitat (Arroyo-Cabrales and Grammont 2008). Bat distribution data on 16 species has been collected (using mist nets, acoustic sampling, and visual inspection of suitable roosting sites) to address project specific needs for more than two decades across the PNF (1991-2013, 206 forest-wide survey locations with bat detections). *M. thysanodes* has been detected at multiple locations within each ranger district on the PNF, but our survey data are too patchily distributed, both spatially and temporally, to accurately estimate population size or trend for bat species on PNF.

Habitat Requirements

M. thysanodes most frequently is observed at middle elevations (3,900–7,050 feet) in desert, grassland, and woodland habitats, but ranges between coastal areas along the Pacific Ocean to 9,350 feet in spruce-fir habitat in New Mexico; (Keinath 2004). Oak and pinyon woodlands appear to be the most commonly used habitat, and bats roost in dead trees (Weller and Zabel 2001), caves, mines, rock crevices, buildings, and other protected sites with nearby access to drinking water (Keinath 2004). Nursery colonies occur in caves, mines, and sometimes buildings (Keinath 2004). Individuals are known to move up to five miles between roosting and foraging areas (Keinath 2004). Thermoregulatory requirements result in bats periodically shifting the specific roost site occupied within a colony to adapt to fluctuations in climatic conditions (e.g., clusters of bats move in response to temperature changes in different parts of the roost, (Keinath 2004). Fringed bats are known to migrate, but little is known about the magnitude of movements. Diet includes beetles and moths. *M. thysanodes* forages close to the vegetative canopy, and has relatively slow and highly maneuverable flight (Keinath 2004).

The likelihood of occurrence for *M. thysanodes* increases as the number of snags greater than 12 inches dbh increases and percent canopy cover decreases (Keinath 2004). *M. thysanodes* day and night roost under bark and in tree hollows, and bats exclusively used snags for day roost sites in Douglas-fir (*Pseudotsuga menziesii*) forest in Northwestern California (Six Rivers National Forest data, Weller and Zabel 2001). All roost trees were snags in early to medium stages of decay, and bats switched roosts often (number of bats exiting roosts varied from 1 to 88). The most important factor that discriminated roost sites from random sites at this study site was 5.4 or more snags ≥ 12 inches dbh at roost sites. Roost snags were 85 feet taller and had diameters 17 inches larger than random snags in the surrounding watershed, and roost sites had 11 percent less canopy cover and were 135 feet closer to stream channels than random sites (Weller and Zabel 2001).

Analysis Area Surveys

A small portion (Lowe Flat area) of the analysis area was surveyed for bats using mist-netting and acoustical surveys during 1992 as part of an unrelated project. Project specific acoustic surveys (Pettersson D500X bat detectors) were conducted in 2014 at Hallett Meadow and several locations along Boulder Creek (USDA 2014c). Although *M. thysanodes* was not confirmed during these surveys, surveys were limited to seven survey stations during two years. Forest-wide bat distribution data collected (using mist nets, acoustic sampling, and visual inspection of suitable roosting sites) over the past couple decades (1991-2013, 206 forest-wide locations) show *M. thysanodes* at greater than 110 locations distributed across all three ranger districts. Based on these observations, the availability of suitable habitat, and its apparently wide distribution on PNF, it is assumed that *M. thysanodes* are well distributed in the analysis area.

Affected Environment - Western bumble bee (*Bombus occidentalis*)

Population Status

Historically, *Bombus occidentalis* was one of the most broadly distributed bumble bee species in North America, distributed along the Pacific Coast and westward from Alaska to the Colorado Rocky Mountains (Thorp and Shepard 2005, Cameron et al. 2011, Koch et al. 2012). *B. occidentalis* currently occurs in California and all adjacent states, but is experiencing severe declines in distribution and abundance due to a variety of factors including diseases and loss of genetic diversity (Tommasi et al. 2004, Cameron et al. 2011, Koch et al. 2012). Collection records provide the best available data on *B. occidentalis* distribution in the Sierra Nevada, and 94 records (22 percent) from the Pacific Southwest Region were collected on the Plumas NF (Hatfield 2012). Although the general distribution trend is steeply downward, especially in the west coast states, some isolated populations in Oregon and the Rocky Mountains appear stable (Rao et al. 2011, Koch et al. 2012). The overall status of populations in the west is largely dependent on geographic region: populations west of the Cascade and Sierra Nevada mountains are experiencing dire circumstances with steeply declining numbers, while those to the east of this dividing line are more secure with relatively unchanged population sizes. The reasons for these differences are not known.

B. occidentalis populations and their habitats are threatened by diverse factors, including but not limited to habitat loss and fragmentation, contaminants, parasites, and habitat alteration resulting from fire suppression. Habitat alteration (e.g., agricultural and urban development) may fragment or reduce the availability of flowers that produce nectar and pollen bumble bees require, and habitat alteration also may decrease the number of abandoned rodent burrows that provide nest and hibernation sites for queens. Invasive species also are impacting *B. occidentalis*, as bumble bees introduced from Europe for commercial pollination apparently carried a microsporidian parasite, *Nosema bombi*, which has been introduced into and impacted native bumble bee populations (Cameron et al. 2011). Exposure to organophosphate, carbamate, pyrethroid and particularly neonicotinoid insecticides has recently been identified as a major contributor to the decline of many pollinating bees, including honey bees and bumble bees (Henry et al. 2012, Hopwood et al. 2012). Further, fire suppression in many systems has permitted native conifers to encroach upon meadows, which decreases foraging and nesting habitat.

Habitat Requirements

The western bumble bee is currently managed as a USDA Forest Service sensitive species in accordance with the proposed USFS Region 5 2013 update. Queens overwinter in the ground in abandoned rodent (i.e. mouse, chipmunk or vole) nests at depths from 6-18 inches and typically emerge about mid-March (Heinrich 1979). The queen then lays fertilized eggs and nurtures a new generation, and individuals emerging from fertilized eggs will become workers that reach peak abundance during July and August (Heinrich 1979). Foraging individuals are largely absent by the end of September, and those that emerge from unfertilized eggs become males, which do not forage and only serve the function of reproducing with newly emerged queens (Heinrich 1979). Queens produce between fifty to hundreds of individuals annually, depending on the quantity and quality of flowers available. When the colony no longer produces workers, the old queen will eventually die and newly emerged queens will mate with males and then disperse to found new colonies (Heinrich 1979). During these dispersal flights, which may last two weeks, new queens may make several stops to examine the ground for a suitable burrow. Mikkola (1984) reported that bumble bees may forage up to a distance of 80 km from the nest in search of food.

Unlike all other bees, bumble bees are large enough to be capable of thermoregulation, which allow them to maintain their foraging activities for longer periods of the day, but also to occupy regions with more extreme latitudes and temperatures compared to other bees (Heinrich 1979). Bumble bees may continue to forage when temperatures are below freezing even in inclement weather (Heinrich 1979). Queens end the year by locating a sheltering burrow, where they may spend the winter months under cover. Where nesting habitat is scarce, bumble bee species having queens that emerge early (mid-March) in the season like *B. vosnesenskii* which co-occurs with the later emerging *B. occidentalis*, may be able to monopolize available nest sites and reduce the chances of success for bumble bee species emerging later.

Western bumble bees have a short proboscis or tongue length relative to other co-occurring bumble bee species, which restricts nectar gathering to flowers with short corolla lengths and limits the variety of flower species it is able to exploit. Western bumble bees have been observed taking nectar from a variety of flowering plants, including: *Aster* spp., *Brassica* spp., *Centaurea* spp., *Cimicifuga arizonica, Corydalis caseana*, *Chrysothamnus* spp., *Cirsium* spp., *Cosmos* spp., *Dahlia* spp., *Delphinium nuttallianum*, *Erica carnea, Erythronium grandiflorum*, *Foeniculum* spp., *Gaultheria shallon*, *Geranium* spp., *Gladiolus* spp., *Grindelia* spp., *Haplopappus* spp., *Hedysarum alpinum*, *Hypochoeris* spp., *Ipomopsis aggregata*, *Lathyrus* spp., *Linaria vulgaris*, *Lotus* spp., *Lupinus monticola*, *Mentha* spp., *Medicago* spp., *Melilotus* spp., *Mertensia ciliata*, *Monardella* spp., *Nama* spp., *Origanum* spp., *Orthocarpus* spp., *Pedicularis capitata, P.*

groenlandica, P. kanei, and *P. langsdorfii, Penstemon procerus*, *Phacelia* spp., *Prunus* spp., *Raphanus* spp., *Rhododendron* spp., *Salix* spp., *Salvia* spp., *Solidago* spp., *Symphoricarpos* spp., *Tanacetum* spp., *Taraxacum* spp., *Trifolium dasyphyllum, Trichostema* spp., *Trifolium* spp. and *Zea* spp. (Evans et al. 2008).

Analysis Area Surveys

Surveys for *B. occidentalis* were conducted in July-August 2014. Although eight species of bumblebee were collected, no *B. occidentalis* were located (USDA 2014b). However, botanical surveys in the Wildcat area located numerous occurrences of flowering plant species (listed above) known to be used by *B. occidentalis*. Surveys on the Eagle Lake Ranger District to the north of the Wildcat project have documented *B.* occidentalis in similar habitats. One individual of *B. occidentalis* was detected by the Lassen National Forest wildlife crew at Bear Flat; this area is approximately 1 mile north of the Wildcat Project area. *B. occidentalis* is suspected to be present, but not documented. Surveys specifically targeted Canada thistle (*Cirsium arvense*) populations because the Wildcat project proposes to treat this species with herbicides.

Affected Environment – Sooty Grouse (Dendragapus obscurus)

Population Status and Habitat Requirements

The Sooty Grouse was selected as the MIS for late seral open canopy coniferous forest habitat in the Sierra Nevada. This habitat is primarily comprised of medium/large trees (equal to or greater than 24 inches dbh) with canopy closures less than 40 percent. Sooty Grouse occur in open, medium to mature-aged stands of red fir, white fir, Douglas-fir, and other conifer habitats, interspersed with medium to large openings, and available water, and occupies a mixture of mature habitat types, shrubs, forbs, grasses, and conifer stands (CDFG 2005). Sooty grouse often utilize meadow edges and aspen stands for young chick development. Empirical data from the Sierra Nevada indicate that sooty grouse hooting sites are located in open, mature, fir-dominated forest, where particularly large trees are present (Bland 2006). Within the analysis area, only 2 percent, or 324 acres, of the analysis area is considered suitable late seral open canopy coniferous forest habitat.

Analysis Area Surveys

Sooty grouse are well distributed within the Wildcat project area. Although no species specific surveys were conducted in the project area, detections have been made during project field work. Project specific surveys are not required for management indicator species.

Environmental Consequences

This section summarizes the biological environments of the affected project area and the potential changes to those environments due to implementation of the alternatives.

This section describes aspects of the environmental effects (direct, indirect, and cumulative) that would result from undertaking the proposed action or no action alternative. Together, these descriptions form the scientific and analytical basis for the comparison of effects in Chapter 2.

The following resource specialist analyses are incorporated by reference: Wildcat Fuels Reduction Project Biological Assessment/Biological Evaluation (Colin Dillingham USDA 2014a); Management Indicator Species Report for the Wildcat Project (Colin Dillingham and Mike Huhndorf , USDA 2014b); Wildcat Migratory Bird Report (Colin Dillingham and Mike Huhndorf, USDA 2014c).

Direct and Indirect Effects Common to Wildlife Species

The following generalized effects analyses for the Proposed Action and No-Action alternatives apply to all species considered in the Biological Assessment/Biological Evaluation (USDA 2014a), Management Indicator Species Report (USDA 2014b) and Migratory Bird Report (USDA 2014c). Additional analysis is provided for specific species in subsequent sections.

Alternative A – Proposed Action – Direct and Indirect Effects

All proposed treatments could result in disturbance from human presence and noise. The duration of disturbance, caused by the presence of people and machinery, may cause disturbance to wildlife accustomed to lower levels of activity. Mechanized equipment may generate noise sufficient to disturb nesting wildlife and could cause nest site abandonment if conducted without restrictions. Therefore, standard management requirements include limited operating periods (LOPs) when disturbance to wildlife is identified as a concern. The following Limited Operation Periods (LOPs) would be implemented within ¼ mile of known active nest sites: American Peregrine Falcon, February 1 – August 31; California Spotted Owl: March 1 – August 15, Northern goshawk: February 15 – September 15, Bald eagle: November 1 – August 31; Sierra Nevada yellow-legged frogs: no activity from October 1, or the first wetting rain (more than ¼ inch precipitation), until April 15th within a stream mile of SNYLF's detection (USDA 1988a, as amended by the SNFPA, USDA 2004a,b). Direct disturbance, including mortality to individual animals addressed in this report is unlikely, due to survey efforts for selected species, incorporation of LOPs where appropriate, and implementation of Forest standards and guidelines. If presently unknown wildlife are discovered prior to or during implementation, and species identified warrants a LOP, protections would be implemented.

Burnett and Roberts (2015) wrote a paper that evaluated the effect of managing habitat for spotted owls and how it affects migratory bird species. Burnett and Roberts (2015) discuss their findings that avian species richness in spotted owl designated core areas (late-successional forest) is lower than in areas outside core areas. Burnett and Roberts (2015) found that closed-canopy dependent species were more abundant in core areas (16 species had positive effects) whereas 65 of 81 species analyzed showed negative core area effects. Managing for both closed-canopy forest as well as early-successional habitats is important. For example, the Wildcat Project proposes management actions to restore and protect closed canopy forest as well as to enhance aspen habitat which is important for early successional forest species such as Chipping Sparrow and mountain bluebird. Campos and Burnett 2014 reported that 7 of 10 focal bird species in aspen stand increased and no species decreased after similar aspen habitat treatments.

The Wildcat Fuels Reduction and Vegetation Management Project Migratory Bird Species Report (USDA 2014d), which exists in the Wildcat electronic project record, includes an effects analysis of the project on migratory birds including acknowledgement of effects to bird habitats. Specific limited operating period restrictions to protect nesting birds are prescribed on page 9. The migratory bird species report references both the Wildcat Biological Evaluation (USDA 2014b) and the Wildcat MIS report (USDA 2014c) which include an analysis of how this project may affect migratory bird species habitat. MIS species are monitored at the regional level and discussions of effects are included, such as in the Fox Sparrow discussion, for example, which documents a stable, or slightly increasing population trend. A list of migratory bird species that were analyzed exists in Table 1 of the report.

A summary of project effects on wildlife habitat was completed for both the Proposed Action and the No-Action Alternative (Table 47). These beneficial and negative effects to wildlife species are described in the environmental consequences section below under

multiple species analyses. An approximation of the CWHR vegetation types grouped into wildlife habitat types is presented in

Table 48.

Table 47. Comparison of important project effects on wildlife habitat for each alternative

	Proposed Action(A) : Approximate Acres	No-Action (B) : Approximate Acres
Suitable acres of closed canopy old forest habitat (4M, 4D, 5M, 5D) following treatment	6,039	6,654
Negative effects on wildlife species		
Change suitable habitat for old forest species (4M, 4D, 5M, 5D) to unsuitable (to density class P) (467 acres conifer forest thinning and 178 acres aspen)	615 (20% of treated acres, 9% of existing acres)	0
Acres of habitat supporting medium and large snags negatively impacted by mechanical thinning and biomass removal	2,817 (20% of existing suitable acres in analysis area)	0
Positive effects on wildlife species		
Aspen habitat enhancement	316	0
Late-seral open canopy conifer habitat improved (Sooty Grouse) (5M/5D change to 5P)	139	0
Acres within analysis area meeting desired flame length (modeled) conditions	8,155 (63% of existing acres)	6,738 (52% of existing acres)
Acres of Spotted Owl PACs and ¼ mile buffers meeting desired conditions (modeled flame length)	654 (21% of existing acres)	407 (13% of existing acres)
Acres of Spotted Owl HRCAs meeting desired conditions(modeled flame length)	560 (26% of existing acres)	466 (21% of existing acres)
Acres of Goshawk PACs and ¼ mile buffers meeting desired fuel conditions(modeled flame length)	1,709 (73% of existing acres)	1,243 (53% of existing acres)
Acres of proposed SNYLF Critical Habitat meeting desired conditions (modeled flame length)	4,545 (68% of existing acres)	3,557 (53% of existing acres)
Acres of Critical Aquatic Refuge meeting desired conditions (modeled flame length)	7,240 (62% of existing acres)	5,823 (50% of existing acres)

Table 48. Summary of California Wildlife Habitat Relationships (CWHR) types within Wildcat Project analysis area (13,264 acres; all acres are approximate and National Forest System lands).

CWHR Vegetation, Size Class and Canopy Cover Density*	Existing Condition	Proposed Action	Acres of existing condition overlapping with Wildcat Treatment Units
Conifer Forest – closed canopy late seral (5D, 5M)	2315	2176 (decrease 139 acres)	343
Conifer Forest – open canopy late seral (5P, 5S)	324	463 (increase 139 acres)	16
Conifer Forest – mid seral, closed canopy (4M, 4D)	4045	3651 (decrease 394 acres)	721
Conifer Forest – mid seral, closed canopy (4P, 4S)	4224	4617	1688
Conifer Forest – early seral, size class 1-3	1072	1072	97
Hardwood Forest (D,M)	227	168 (decrease 59 acres)	93
Hardwood Forest (S,P,other)	36	94	5
Grassland	168	168	33
Shrub dominated	471	471	66
Non-vegetated	381	381	0
Total	13,264	13,264	3064

* **Conifer forest** includes EPN, JPN, PPN, SMC and WFR; **Hardwood Forest** includes ASP and MHC; **Grassland** includes AGS, PGS and WTM; **Shrub** dominated includes MCH, MRI, MCP and SGB; **Non-vegetated** includes BAR, LAC and WAT. **Size Class: 1 =** Seedling Tree <1" dbh, **2 =** Sapling Tree 1 - 6" dbh, **3 =** Pole Tree 6 - 11" dbh, **4 =** Small Tree 11 - 24"dbh, **5 =** Medium/Large Tree >24"dbh,**6 =** Multi-layered Tree. **Canopy Cover: D =** Dense Canopy Cover (> 60%), **M =** Moderate Canopy Cover (40 - 59%), **P =** Open Canopy Cover (25 – 39%), **S =** Sparse Canopy Cover (10 – 24%). **Vegetation Type: AGS =** Annual Grassland, **ASP =** Aspen, **BAR =** Barren, **EPN =** Eastside Pine, **PPN** = Ponderosa Pine, **JPN =** Jeffrey Pine, **LAC =** Lacustrine, **LPN =** Lodgepole Pine, **MCH =** Mixed Chaparral, **MCP =** Montane Chaparral, **MHC =** Montane Hardwood-Conifer, **MHW =** Montane Hardwood, **MRI =** Montane Riparian, **PGS =** Perennial Grassland, **PPN =** Ponderosa Pine, **SGB =** Sagebrush, **SMC =** Sierra Mixed Conifer, **WFR =** White Fir, **WTM =** Wet Meadow (Mayer and Laudenslayer 1988).

Direct and Indirect Effects of Mechanical and Biomass Thinning

Drafting water via pump trucks from four water sources would be undertaken to add water to haul roads to abate dust and stabilize the road surface. Water drafting sites would be reconstructed under the Proposed Action. Per BMP 2.5 (USDA 2012d), this work would occur so that water would be pumped outside of the normally flowing stream channel, preventing impacts to in-stream flow and assuring that disturbance associated with pumping or maintenance of the water source would not cause turbidity in the stream. Additionally, the short access routes to the water sources from NFS roads for water trucks would be reconstructed to improve drainage and prevent sediment delivery from the access route to the stream. These actions would improve long-term protection of water quality at these drafting sites.

Borax (Sporax or similar product) would be applied to all cut stumps greater than 14 inches in diameter to minimize the susceptibility to Heterobasidion root disease. In the most recent risk assessment for Borax (SERA 2006), Boron, the agent of toxicological concern in Borax, was further evaluated. The focus of the evaluation was wildlife's direct consumption from the stump and ingestion of contaminated water. The assessment concluded that the use of Borax on stumps does not present a significant risk to wildlife species under most conditions of normal use, even under the highest application rates. No adverse effects to terrestrial wildlife species are anticipated due to the use of Borax.

Direct and Indirect Effects of Hand Thinning

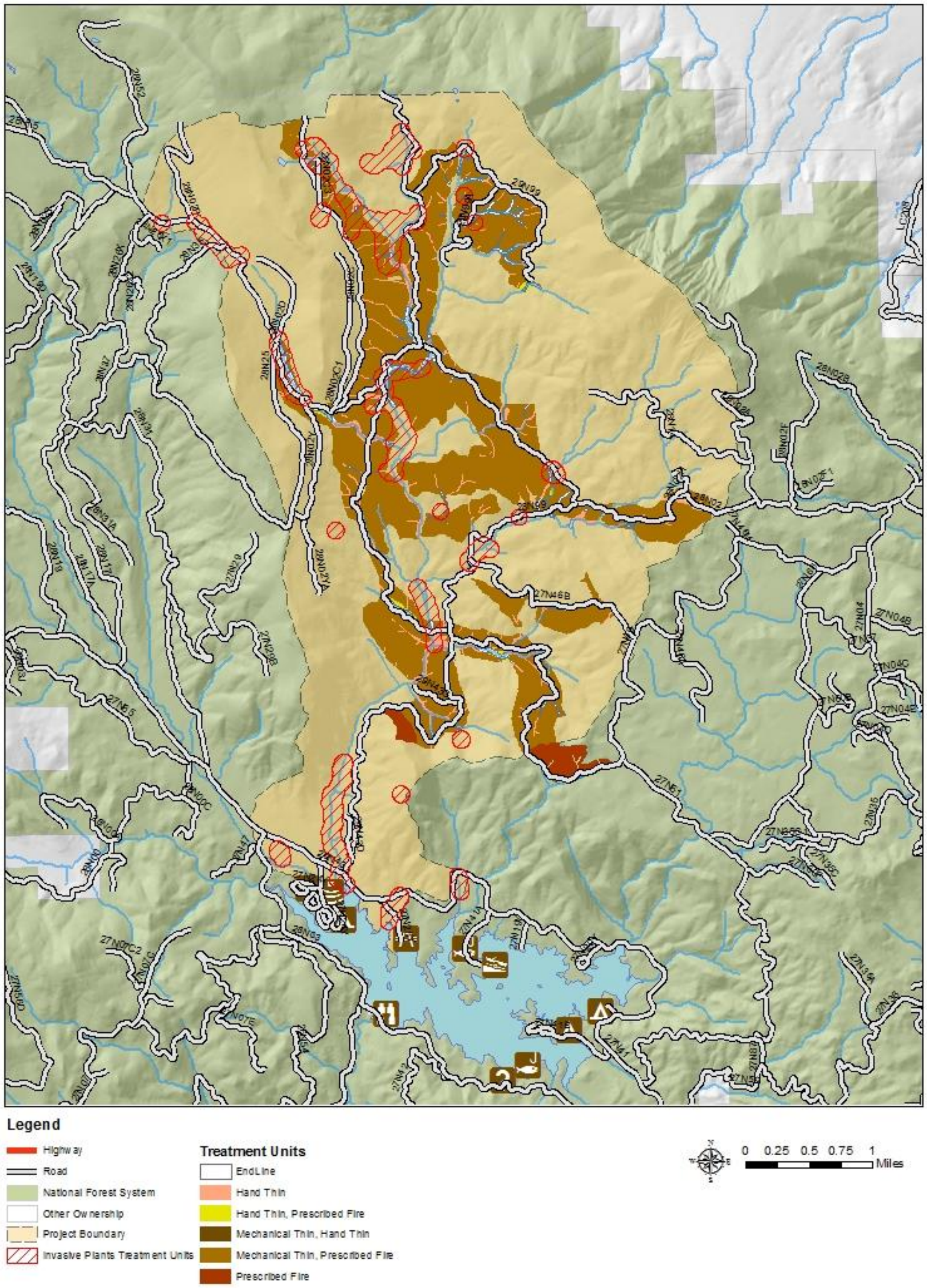
Approximately 360 acres would be treated by hand thinning (thinning small diameter trees with a chainsaw). This would have limited impacts to wildlife species in the short term, but may lessen fire hazard and potentially reduce the long-term negative effects of a high intensity wildfire to wildlife species dependent on green forest habitat.

Direct and Indirect Effects of Prescribed Burning

Approximately 2,700 acres would be treated by prescribed fire under the proposed action. Prescribed fire is generally considered beneficial to many wildlife species when conducted at low to moderate intensity. Prescribed fire regenerates forb and grassland communities which in turn provide forage for many wildlife species. There could be limited impacts to wildlife species in the short term, such as disturbance effects of fire and some mortality to individuals of slow moving species such as rodents and reptiles. However, species in the Sierra Nevada Mountains have evolved with fires as a natural part of the ecosystem and are resilient to low intensity fire. Prescribed fires lessen fire hazard by removing hazardous fuels buildup and potentially reduce the long-term negative effects of a high intensity wildfire to wildlife species dependent on green forest habitat.

Direct and Indirect Effects of Herbicide Treatments

Direct effects from herbicide treatments occur when animals are physically impacted or disturbed. Examples include crushing by vehicles or equipment, trampling, or disturbance to nesting or denning wildlife. These actions can result in death or reduced nesting success. Project design features (



Locations of proposed invasive plant treatment units.

Table 4) would protect wildlife species from potential negative impacts from associated impacts during herbicide treatments. Refer to Figure 4 for the location of proposed invasive plant treatment units.

Project design features will reduce risk of adverse effects to terrestrial and aquatic wildlife because they minimize or eliminate disturbance and herbicide exposure scenarios of concern. The types of treatments that are proposed, implemented according to project design features, have a low likelihood of contributing to cumulative effects from other projects on and off the Plumas National Forest. Invasive plant treatments are likely to have an overall beneficial impact to aquatic wildlife to the extent that invasive plants would be replaced with native vegetation post-implementation. All of the environmental standards, policies and laws related to wildlife would be met in the proposed action alternative.

The proposed surfactant (i.e. Competitor® or an equivalent formulation) is a modified vegetable oil, which is very unlikely to produce secondary breakdown products that would act as toxins to wildlife. In addition, the proposed marker dye (i.e. Hi-light® Blue or an equivalent formulation) is a water-soluble dye that contains no listed hazardous substances (SERA 1997) and is unlikely to cause adverse effects on terrestrial or aquatic wildlife species (Bakke 2007). For the remainder of this analysis, the discussion of effects resulting from herbicide application takes into consideration the effects of the herbicide's active and inert ingredients (the latter of which is water), metabolites, surfactant, and marker dye.

Direct and Indirect Effects of Watershed Condition Enhancement

Rehabilitation of road-related non-point source pollution (near stream erosion) by improving road drainage features within the existing road prism, decommissioning classified NFS roads and obliterating unclassified roads inside Riparian Conservation Areas (RCAs) to achieve desired Riparian Conservation Objectives (2004 SNFPA ROD, pp. 33-34) would generally benefit riparian dependent aquatic organisms. Watershed restoration projects, particularly road decommissioning, would reduce effects of erosion and sedimentation (Figure 39).

Direct and Indirect Effects of Aspen Stand Enhancement

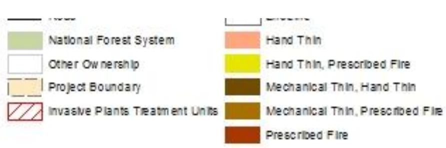
Project design features and standard management requirements have been incorporated into the proposed action to limit potential negative impacts to wildlife species. No heavy equipment allowed within 100 feet of streams that have frogs (includes harvest equipment, road building equipment, mastication equipment, etc.). End-lining would be allowed within aspen stands where excess logs greater than 10" DBH need to be removed to achieve resource objectives. End lining would only be allowed during the summer season (April 16 – Sept 30) when frogs are restricted to within 10 meters of streams. No end-lining would be allowed within 10 meters (33 feet) of live streams.

The project would restore approximately 316 acres of aspen stands which are beneficial to a variety of wildlife species. Restoration of aspen stands would benefit the landscape by increasing the diversity of stand structures within the project area by converting conifer-dominated areas to aspen. Aspen habitat has been shown to support abundant bird populations in the area and several species of bird (mountain bluebird, chipping sparrow and red-breasted sapsucker) appear to be more abundant in aspen habitat compared to the surrounding landscape (Burnett and Fogg 2011).

Alternative A – Proposed Action – Cumulative Effects

The existing condition reflects the landscape changes from all activities that have occurred in the past. The analysis of cumulative effects of the alternatives evaluates the impact on TES habitat from the existing condition within the terrestrial wildlife analysis areas. There are no interrelated or interdependent actions in the Wildcat Project. Under NEPA, cumulative effects represent the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. There are no connected actions in the Wildcat Project.

Present and future projects planned that overlap with the terrestrial wildlife analysis area may have cumulative impacts to wildlife, fisheries and amphibians. The analysis area is guided by direction described for the other Sierra Nevada National Forests (USDA 2004a). The PNF woodcutting and Christmas tree cutting programs are ongoing and are expected to continue. These programs allow the public to purchase a permit to remove firewood and Christmas trees (Sapling tree 1 - 6” dbh) from National Forest System lands. The Wildcat Project area, as well as the analysis area is open to woodcutting and, a large portion, to Christmas tree cutting. Snags and down logs would continue to be removed, resulting in the cumulative loss of these habitat components across the landscape. Loss of these habitat features may indirectly impact wildlife species. Uncontrolled public use, especially during the breeding season, also may cause disturbance to species nesting and denning nearby. However, snags are recruited annually from live trees through natural processes at a rate that is expected to sustain this loss within the analysis area. Further, snag and log removal is along, or within a short distance from, open roads. The past and future effect of these actions has and would maintain similar forest structure, with some loss of snags and natural recruitment.



Locations of proposed invasive plant treatment units.

Table 4) include prevention of direct mortality and prevention of noise disturbance to multiple species of wildlife.

Alternative B – No-Action – Direct and Indirect Effects All Species

Alternative B would pose no risk and uncertainty associated with the proposed actions, but it would maintain a high risk of potential habitat loss from wildfire, while the action alternatives would reduce this risk. No treatment to noxious weeds would increase the risk of weeds spreading. Watershed conditions would remain in the current quality. There would be no actions taken to benefit the watershed. A small incremental indirect effect of continuing to suppress wildfires and continuing to allow noxious weed species to expand would occur. The assortment of wildlife species supported by native habitats can be altered where non-native plants become established and displace native plants. Where non-native plants become abundant, they can result in highly detrimental effects on native wildlife species.

Alternative B – No-Action – Cumulative Effects All Species

The effects of the no action alternative are largely limited to the small incremental change of the increase in fire hazard and the increase in invasive plant hazard and risk.

The high risk of stand-replacing wildfire would continue to expand and the failure to act would exacerbate the problems with the existing condition. Late-successional forests are at particularly high risk from the no action alternative, because the existing conditions of high fuel loading and fuel ladders make them highly susceptible to stand replacing events. In addition, once lost on the landscape, they take a century or more to recover. All wildfire hazard analyses conducted in this wildlife analysis indicates a high risk of existing fire hazard risk conditions. The implementation of the No-Action alternative would cause the existing conditions to incrementally get worse over time as fuel loading continues to increase and ladder fuels continue to grow in both height and density (Figure 30, Figure 31, Figure 33, Figure 34 and Figure 36).

A number of activities contribute to the spread of invasive plants, perhaps none more so than stand replacing wildfire that creates an abundance of bare mineral soil for establishment of invasive plants (Turner et al. 1997, D'Antonio 2000). Post-fire weed surveys have documented a rapid spread in the adjacent Moonlight and Wheeler Fires. Although Forest Service Manual and Forest Land Management Plan direction requires preparation of a Noxious Weed Risk Assessment for all ground disturbing activities to ensure that projects with high or moderate risk of spreading weeds are designed to mitigate this risk (USDA 2004a, FSM 2900), on-going recreation activities (camping, hiking, cycling), road and trail use and maintenance, and livestock grazing all facilitate the spread of invasive plants. These activities, combined with the indirect effects of the no action alternative, have the potential to result in substantial spread of invasive plants in the Wildcat Analysis Area and associated impact to wildlife habitats and populations.

Federally Threatened and Endangered Species

Based on the list of TE species (Table 44), and information regarding range of species, presence of species or presence of species suitable habitat within project area, it is determined that the Wildcat Project may affect and is not likely to adversely affect the Sierra Nevada Yellow-legged Frog and would not affect two other Federally listed species present on the Plumas National Forest. There are no Federally Proposed species identified by the USFWS as occurring on the PNF. Table 49 displays Federally-listed species affects determinations.

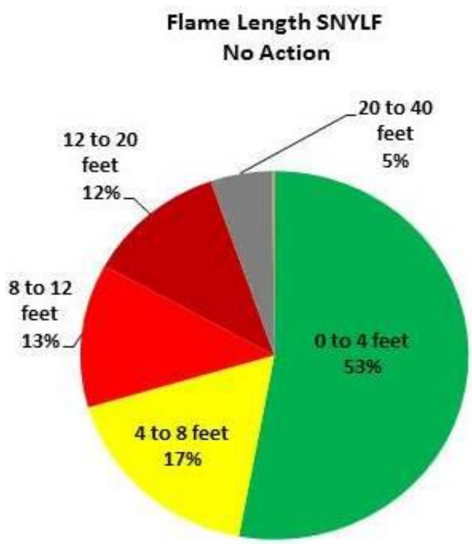
Table 49. Determination of effects for federally-listed species

Scientific Name	Common Name	Suitable Habitat in area	Observed in Project area (Y/N)	Finding
Desmoceras californicus dimorphus	Valley Elderberry Longhorn Beetle	No	No	No effect
Rana aurora draytonii	California Red-legged Frog	No	No	No effect
Rana sierrae	Sierra Nevada Yellow-legged Frog	Yes	Yes	MANLAA

Sierra Nevada Yellow-legged Frog

Alternative A – Proposed Action – Direct and Indirect Effects

One purpose of the Wildcat Project is to reduce threats to wildlife habitat from severe wildfires. An analysis of modeled wildfire hazard in proposed Sierra Nevada Yellow-legged frog Critical Habitat using flame length as the measurement indicator was completed (Figure 30). A major increase in the percentage of proposed critical habitat meeting desired conditions (modeled flame length of zero to four feet), from 53 percent to 68 percent of the proposed critical habitat in analysis area (approximately 1020 acres) would occur with the implementation of the proposed action. A similar analysis was completed to model wildfire hazard in the Critical Aquatic Refuge (Figure 31). Critical aquatic refuge would also benefit with the implementation of this proposed action, with an increase of approximately 1592 acres (from 50 percent to 62 percent of CAR) meeting desired conditions.



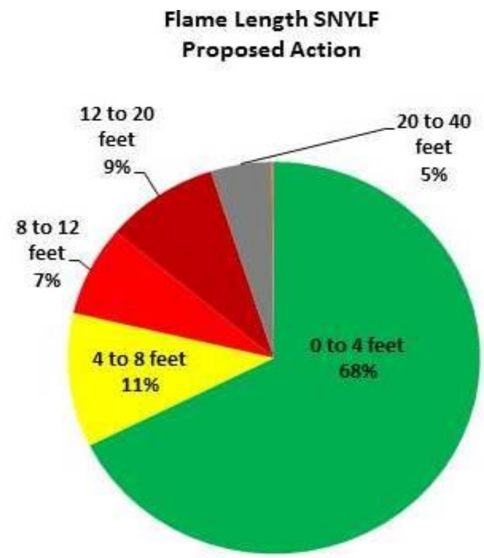
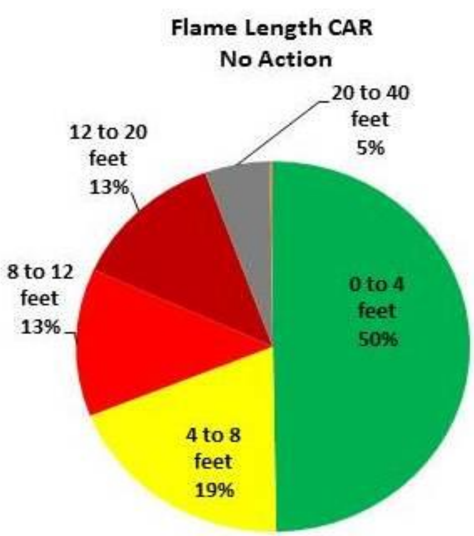


Figure 30. Potential Wildfire Hazard analysis in proposed Sierra Nevada yellow-legged frog critical habitat. The analysis used Flame Length as the measurement indicator to illustrate differences between the Proposed Action and the No-Action Alternative. The No-Action alternative is the same as the existing condition. Desired conditions of flame length are illustrated in green.



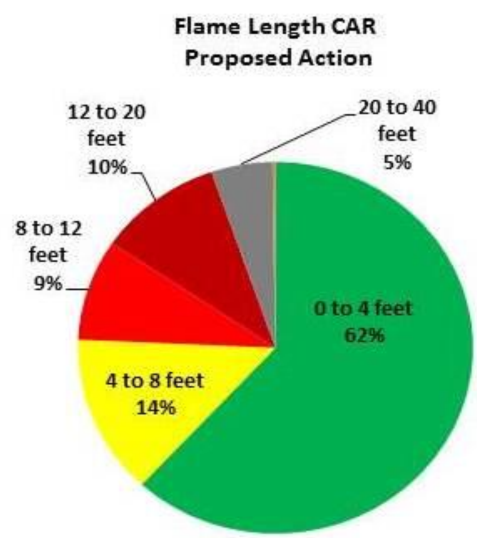


Figure 31. Potential Wildfire Hazard analysis in Critical Aquatic Refuge. The analysis used Flame Length as the measurement indicator to illustrate differences between the Proposed Action and the No-Action Alternative. The No-Action alternative is the same as the existing condition. Desired conditions of flame length are illustrated in green.

Direct and Indirect Effects of Mechanical and Biomass Thinning

Project design features and standard management requirements have been incorporated into the Wildcat project to mitigate potential direct and indirect effects of thinning. No heavy equipment would be allowed within 100 feet of streams (inner portion of Riparian Conservation Area) that have SNYLF suitable habitat. This includes harvest equipment, road building equipment and mastication equipment. Mechanical and biomass thinning would occur in the outer portion of the Riparian Conservation Areas (greater than 100 feet) when resource objectives can be met (see Table 50). The Wildcat project proposed to treat approximately 1000 acres of RCA with some mechanical (approximately 781 acres), end-lining (approximately 120 acres) or prescribed fire (approximately 99 acres) component. Wildcat has approximately 5,212 RCA acres total. Therefore 19.2 percent of the RCAs would be treated which is under the 25 percent threshold under the 2004 record of decision (USDA 2004) before peer review of the project is required.

Mechanical and biomass thinning would reduce fuel hazard within proposed critical habitat for the SNYLF (Table 50, Figure 30) which is expected to be beneficial. There are 18,199 acres in Boulder/Lowe CAR; and there are approximately 2,717 acres of ground disturbing activities. Therefore there would be 14.9% of the CAR affected, which is under the 15 percent threshold in the 2004 record of decision (USDA 2004) before peer review is required.

Mechanical and biomass thinning would reduce fuel hazard within critical aquatic refuge for the SNYLF (Table 50, Figure 31). The vast majority of ground disturbing wildcat treatments such as mechanical thinning, end-lining and prescribed fire are within the upland areas of proposed critical habitat and are outside areas included in the definition of suitable habitat.

Table 50. Acres of riparian habitat types and habitat designated to protect Sierra Nevada Yellow-legged Frog affected by the proposed project activities. Aspen treatment acres are either mechanical thin or hand thin and are not additive to those columns of acres treated. All acreages are approximate.

	Total Acres in Analysis Area	Mechanical and Biomass Thinning	Aspen Treat	Prescribe Fire	SNYLF Enhancement Basking sites	Herbicide Treatment of Weeds	Hand Thinning (includes end lining)
Riparian Conservation Areas	4807	861	275	20	1	23	350
Proposed Critical Habitat	6763	1954	250	24	1	19	269
Critical Aquatic Refuge	13264	2593	313	98	1	24	355
Suitable Habitat	1036	0	114	0	1	15	176
Occupied Suitable Habitat	224	0	44	0	1	11	41

There is a total of approximately 224 acres of riparian habitat along perennial and intermittent streams in the project area that are considered occupied habitat for the SNYLF. Occupied habitat includes areas where current and historical detections of SNYLF have occurred plus a one-mile buffer along adjacent perennial and intermittent stream habitat (25 meter buffer on streams and around the outer perimeter of wet meadows and springs.). Habitat with the greatest potential for SNYLF presence is within perennial streams and intermittent streams with perennial pools. There is a very low potential for a direct effect by the felling of trees or pile burning to individual SNYLF in treatment units due to the project design features to exclude both areal extent and seasonal periods when frogs might be present. SNYLF sheltering habitat could potentially be affected by removal of trees in aspen units or hand thinning in RCAs. Based on habitat analysis within the project area, it appears that open canopy sites (basking sites) along perennial streams are limited in the project area. Sheltering habitat would be created through the construction of wildlife leave piles of small tree boles in hand thin units within 100 feet of streams. These piles would not be burned. Another project design feature that will help ameliorate adverse effects on SNYLF and their habitat is that fine material associated with the trees that are thinned would be carried over 100 feet from the stream before being piled and burned. This is greater than the maximum distance SNYLF are known to move away from the stream (25 meters, or 82 feet). With the implementation of the project design features and Best Management Practices (BMPs), there would be minimal adverse direct and indirect effects to the SNYLF and its potential habitat within the Wildcat Project mechanical thinning and biomass removal treatment units.

Proposed Critical habitat primary habitat element includes the upland areas (catchment basins) where the majority of the Wildcat fuel treatments would occur. These would be treated to reduce wildfire hazard. This should provide for the maintenance of sufficient water quality to provide for the various life stages of the frog and its prey base. BMPs will be implemented would be implemented to maintain sufficient water quality.

Direct and Indirect Effects of Hand Thinning

Chainsaw thinning is allowed within 100-feet of the stream designated as "tractor keep out" or TKO (inner RCA). There would be no burning of piled material within 100 feet of streams to prevent frogs, which may hibernate in piles, from inadvertently being burned. Material to be burned would be piled outside of the 100 foot buffer. In areas where fuel loading allows, some lop and scatter of tops and limbs would be completed. Piles of small tree boles (up to 40 per acre) would be constructed within 100 feet of occupied streams, but these would not be burned, and instead are being created to provide sheltering habitat for SNYLF and other small animals. Chainsaw thinning would be restricted with a LOP to summer season (April 15 – Oct 31) when frogs are in streams, and not in uplands to prevent accidental crushing of frogs. Implementation of project design features and BMPs would significantly reduce the probability of any adverse effects on frogs. Removing ladder fuels and adding to ground fuels with this proposed action would be desirable to reduce potential wildfire intensity and therefore would be likely to produce beneficial long term effects to SNYLF.

Proposed Critical Habitat is composed of several major primary constituent habitat elements types. Aquatic breeding habitat, aquatic nonbreeding habitat and adjacent upland habitats within 82 feet would generally be enhanced through the basking site enhancement proposal, sheltering habitat enhancements, and chainsaw thinning to reduce ladder fuels to protect the habitat from high intensity wildfire.

Direct and Indirect Effects of Prescribed Burning

Project design features and standard management requirements have been incorporated into the Wildcat project to mitigate potential direct and indirect effects of prescribed burning. No prescribed fire would be initiated within 100 feet of occupied streams. No pile burning would occur within 100 feet of occupied streams. Current science, which is limited, indicates that SNYLF do not occur greater than 82 feet from streams. If frogs were to occur greater than 100 feet from streams, there is some possibility that individual frogs would be killed during burning operations. Therefore, with the incorporation of these design features, the effects of prescribed burning would be negligible.

Direct and Indirect Effects of Herbicide Treatments

Native frogs could be affected by herbicide treatments in the following ways:

- Direct contact with herbicides,
- Indirect contact through prey and sprayed vegetation, or contaminated water,
- Chemical spills or overspray,
- Disturbance from equipment and people walking through habitat.

Locations of proposed invasive plant treatment units.

Table 4). Treatment of invasive weeds with herbicides would be restricted within 500 feet of occupied streams. Select treatment methods, such as wicking herbicide directly onto plant leaves, would be required where overspray may enter water bodies and when amphibians may be present. Select methods would be required where and when direct spray of frogs is possible. Direct spray may would be allowed between 107 feet and 500 feet from occupied sites where site specific treatment is analyzed and determined to have no or negligible risk. Herbicide methods, restrictions and LOPs would be incorporated into site specific invasive plant treatment cards.

The possible routes by which herbicides may contaminate water would be direct application, drift into water bodies from spraying, runoff from a large rain storm soon after application, and leaching through soil into shallow ground water or into a stream. This section addresses each of these delivery routes.

No direct application of herbicide to water is proposed with the Wildcat Project. Two chemicals will be used, Aminopyralid and Imazapyr. Aminopyralid is likely to be non-persistent and relatively immobile in the field (SERA 2007). Aminopyralid breaks down rapidly, with the period of time required for chemical to break down (half-life) of 20 to 32 days. Minimal leaching during this half-life below the 15 to 30 cm soil depth would occur. Aminopyralid has been shown to be practically non-toxic to most organisms (SERA, 2007). Imazapyr has adsorption rates directly proportional to organic matter and clay content. Imazaypyr is moderately persistent in soil but resists leaching and hydrolysis. The half-life of imazapyr ranges from 25 to 145 days. Microbial degradation is the primary means of dissipation (SERA, 2011). The majority of the Wildcat Project area consists of well-drained soil. The concern with these soils is that there is potential for herbicide to move through the soil profile into ground water. Restricting treatment to avoid wetted soil profiles would alleviate this potential (

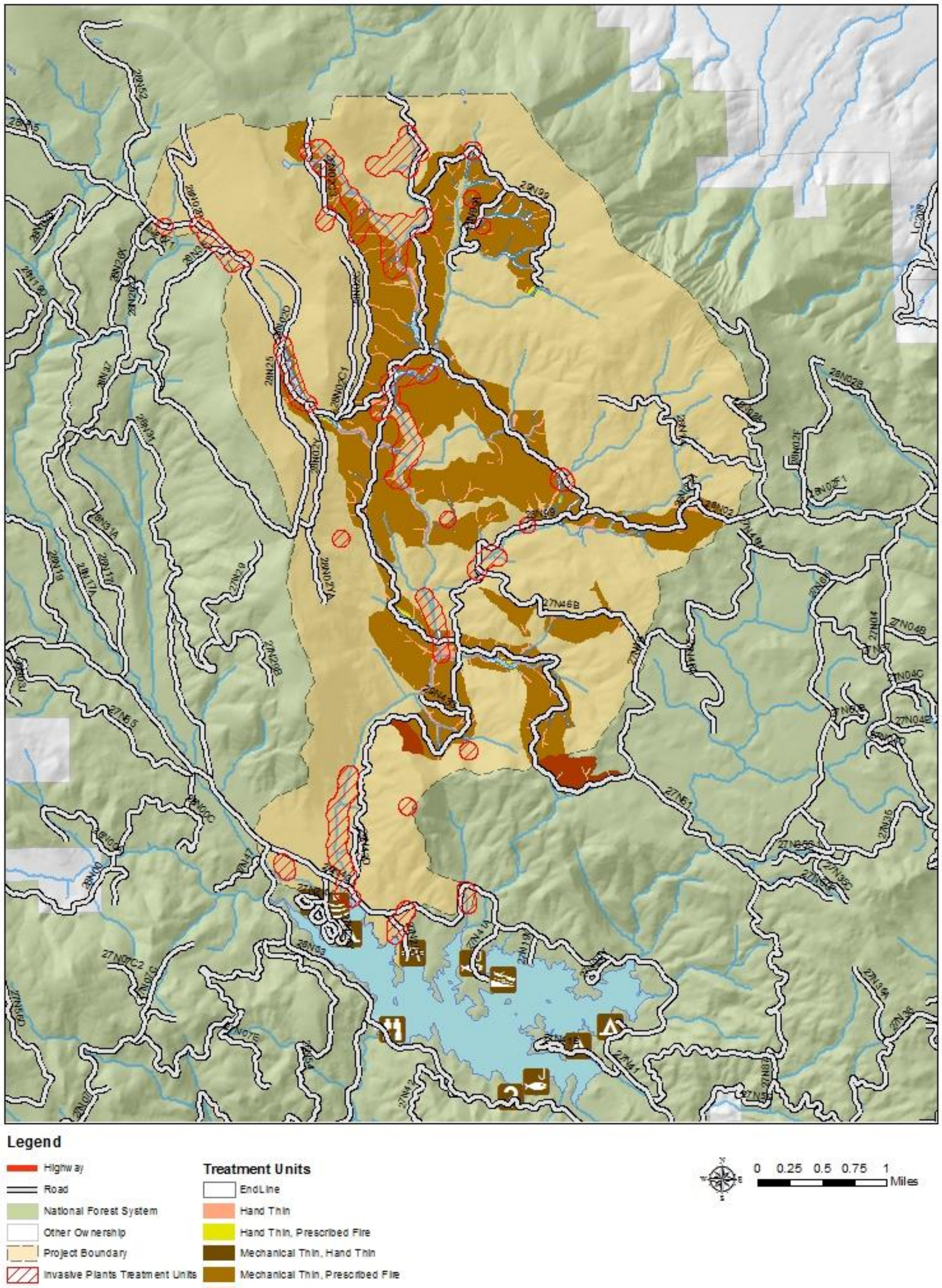


Figure 32. Locations of proposed invasive plant treatment units.

Table 4. The long dry summers typical of the project area lend themselves to dry soil conditions where precipitation entering soil is not readily connected to groundwater.

Soil type influences how herbicides move through the environment. In areas of finer textured, poorly drained soils, the concern would be direct runoff for herbicides that do not absorb to clay particles. The avoidance of implementing treatments during rainfall events and snowmelt periods would help ameliorate this potential problem. Although conduction of chemicals to ground water is a concern with well drained soils, the lack of precipitation in the summer would allow these soils to dry out. The herbicide would then have time to degrade before the arrival of the wet season and make any movement into ground water unlikely.

Wicking and targeted spray treatments proposed with this project would be far less likely to deliver herbicide to water than broadcast treatments because the herbicide is applied to individual plants, so drift, runoff, and leaching would be greatly minimized. Overall, the proposed herbicide types and application rates are low enough to facilitate decay by soil microbes. Therefore, there is no basis for asserting that direct, indirect, or cumulative adverse effects are likely. Water quality would be maintained by enforcing herbicide application BMPs including the designation of stream buffers, where the use and handling of chemicals would be prohibited.

Monitoring Studies

Although herbicide monitoring studies have not been conducted in the Wildcat analysis area, studies have been done on the Mt Hough Ranger District. PG&E has monitored their invasive plant projects occurring as part of the Rock Creek Cresta and Bucks Creek hydroelectric license settlements. These treatments have occurred on the western portion of the Mt Hough Ranger District in the North Fork Feather River Canyon. The contractors have never detected herbicide in water downstream of these invasive plant treatments (Garcia and Associates 2009, 2010; PG&E 2012, 2013).

Direct and Indirect Effects of Watershed Condition Enhancement

Proposed action activities would provide localized, but long-term, enhancements to water quality protection. Four water drafting sites in the project area would be reconstructed and brought up to best management practice standards. This may include installing permanent, underground, vault water containers or constructing ponds located off of active stream channels, installing bump logs, and surfacing and outsloping parking pads and access routes. Three degraded stream crossings would be armored with rock to dissipate erosive potential and minimize sediment mobilization. Additionally, 6.1 miles of unclassified road would be obliterated, which would restore soil productivity and hydrologic function. Short-term increases in sediment mobilization during road reconstruction would be minimized by BMPs and would be offset by long-term improvements to water quality. The total benefit of watershed condition enhancement would protect aquatic systems, particularly the suitable aquatic systems SNYLF are dependent upon. In stream work would be restricted with a LOP to winter season (Nov 1 - April 15) when frogs are in restricted to overwintering pools within streams, and not moving up and down stream reaches to prevent accidental crushing of frogs. Surveys immediately prior to project activities that do not detect frogs, eggs or tadpoles would allow the lifting of LOPs for site specific project work, such as a water hole improvement. Implementation of project design features and BMPs would significantly reduce the probability of any adverse effects on frogs. Water drafting site improvements would prevent potential direct effects to SNYLF during water drafting activities.

Direct and Indirect Effects of Aspen Stand Enhancement

Project design features and standard management requirements have been incorporated into the proposed action to limited negative impacts to wildlife species. No heavy equipment allowed within 100 feet of streams that have frogs (includes harvest equipment, road building equipment, mastication equipment, etc.). End-lining would be allowed within aspen stands where excess logs greater than 10" DBH need to be removed to achieve resource objectives. End lining would not be conducted within 10 meters (33 feet) of live streams and only permitted during the summer season (April 16 – Sept 30) when frogs are restricted to within 10 meters of streams.

Aspen restoration treatments within RCAs would indirectly increase the size of residual trees over time and improve growing conditions for riparian vegetation, especially aspen. The proposal to restore approximately 316 acres of aspen stands would improve riparian vegetation over time and initially may improve SNYLF basking sites. There may be short term negative impacts to proposed critical habitat caused by aspen restoration treatments that remove sheltering habitat (logs). The total benefit of aspen enhancement would have long term benefits to SNYLF.

Alternative A – Proposed Action – Cumulative Effects

The existing condition reflects the changes of all activities that have occurred in the past. The analysis of cumulative effects of the alternatives evaluates the impact on TES habitat from the existing condition within the Analysis Area. Cumulative effects on SNYLF could occur with the potential incremental loss of the quantity and/or quality of habitat for this species. Overall, increases in recreational use of National Forest System lands, and the utilization of natural resources on state, private (none occurs in Wildcat analysis area) and federal lands may contribute to habitat loss for this species. High intensity stand replacing fires have contributed and would continue to contribute to loss of habitat for this species as described in the master amphibian programmatic biological assessment (USDA 2014d).

Refer to hydrology section for a description of the Equivalent Roaded Area (ERA) method for cumulative watershed effects. Wildcat ERA values for each sub-watershed would remain well below the 12 percent threshold of concern after implementation of the proposed actions (Figure 39).The Middle Boulder Creek sub-watershed would experience the greatest project induced increase in cumulative watershed effects, rising from 2.1 to 7.2 percent ERA (though road decommissioning would reduce the ERA value down to 6.8 percent). Upper Boulder Creek is expected to have the largest cumulative ERA value, at 7.4 percent, due to extensive past land management activities between the years 1992-2000 (road decommissioning would reduce this sub-watersheds ERA value to 7.3 percent). A more thorough discussion of Wildcat ERA analysis located in the Hydrology and Soils Analysis section of this EA.

Based on relatively small areas of treatment, BMPs, and project design features protecting riparian areas, the risk of cumulative effects from chemical treatments would be very low.

Cumulative effects to water quality are not expected because of the following factors:

- Water quality sampling conducted in the NFFR and EBNFFR have not shown any contamination from sites treated with these chemicals by PG&E.
- These chemicals decay in soil and water in a matter of days to months.
- Project design features are in place to both limit chemical use in buffers around water features and adjacent to SNYLF suitable habitat.

The riparian buffers are based on SERA risk assessment modeling scenarios and ensure that herbicide concentration would be equal to or less than modeled amounts. This project design feature, coupled with no broadcast buffers, provides strong assurance that herbicide use would not result in herbicides reaching streams in concentrations likely to harm fish or amphibians, people or any other beneficial uses of surface water.

Alternative B – No-Action – Direct and Indirect Effects

See direct and indirect effects common to wildlife species section above. Existing conditions would continue within the analysis period. There would be no change in the percentage of proposed critical habitat meeting desired conditions. Desired conditions would remain unchanged with 53 percent meeting desired conditions and the remaining 47 percent at moderate (17 percent) to high (30 percent) risk of stand replacing wildfire (Figure 30No additional direct or indirect effects would occur. Zero acres of RCA would be treated. Basking sites would not be improved. Erosion and sediment sources would not be repaired. There is no potential of directly affecting the SNYLF through crushing, changes in microclimate, and loss of recruitment of LWD and CWD within the project area. There would be high fuels concerns and the potential for another high intensity wildfire in the area would not be reduced.

Alternative B – No-Action – Cumulative Effects

See cumulative effects common to wildlife species section above. No additional cumulative effects would occur.

Determinations for Proposed Action – Sierra Nevada Yellow-Legged Frog

The Wildcat Project Proposed Action (Alternative A) may affect, not likely to adversely affect the Sierra Nevada yellow-legged frog and is not likely to destroy or adversely modify proposed critical habitat. Project design features have reduced the potential to directly affect the SNYLF through crushing a frog during harvest activities to a negligible risk. There is potential to indirectly affect their habitat by adding sediment to stream reaches. Project design features, such as equipment exclusion zones (TKO - tractor keep out), limited operating periods in riparian conservation areas, herbicide buffers and restrictions, and prescribed burning restrictions would mediate potential effects to Sierra Nevada yellow-legged frogs. Two acres of basking sites would be created to improve frog habitat. Implementation of a limited operating period near all historical occupied sites would further mitigate potential adverse impacts to the frog.

There may be short term negative impacts caused by aspen restoration treatments that remove sheltering habitat within the upland portion adjacent to aquatic breeding and non-breeding habitats. Aspen and basking site enhancement treatments would also simultaneously improve basking sites for SNYLF. Upland treatments would reduce future wildfire potential and allow for maintenance of sufficient water quality to provide for the various life states of the frog and its prey base.

Determinations for No-Action Alternative– Sierra Nevada Yellow-Legged Frog

The Wildcat Project No-Action Alternative (Alternative B) would not affect Sierra Nevada yellow-legged frogs and is not likely to destroy or adversely modify proposed critical habitat.

California Spotted Owl

Alternative A – Proposed Action – Direct and Indirect Effects

One purpose of the Wildcat Project is to reduce threats to wildlife habitat from severe wildfires. An analysis of modeled wildfire hazard in spotted owl PACs and ¼ mile buffers around the PACs using flame length as the measurement indicator was completed Figure 33). A similar analysis of modeled wildfire hazard was completed for spotted owl HRCAs (Figure 34). Desired conditions of flame length are 0-4 feet: under these conditions wildfires generally do not cause mortality to the larger trees in the forest and wildfires can be more easily managed (Table 8). To the west of Wildcat Project Area, the Moonlight wildfire burned in 2007 and the area was studied by owl researchers (Keane et al. 2011). Keane et al. (2011) reported “The high-severity fires that burned in the Moonlight Antelope Complex Fire Area resulted in significant changes to the vegetation. The amount of suitable California Spotted Owl (CSO) habitat (CWHR classes 4M, 4D, 5M, 5D) within the 88,000 acre Moonlight Antelope Complex Fire Area decreased from 70.1% of the pre-fire landscape to 5.8% of the landscape following the fires. In our two years of work we were able to document significant changes to the vegetation and amounts and distribution of CSO habitat within the Moonlight Antelope Complex Fire Area as a result of the high-severity wildfires. Our CSO survey work suggests that the immediate post-fire landscape may not support territorial CSO sites as evidenced by the single confirmed pair of owls that we documented in 2008. In 2009 we did not document any single male CSOs across the burned landscape, suggesting that the apparently non-territorial single males observed in 2008 may have been present because of previous site fidelity or were perhaps opportunistically utilizing a flush of prey in the first year following the fire. In both years, territorial CSOs were present in similar numbers and distributed at expected spacing within the buffer area surrounding the fire. Thus, our results from our two years of work suggest that the primarily high-severity Moonlight Antelope Complex Fire Area does not support CSOs other than a single pair that is using the landscape.” Two years of surveys were completed in the Moonlight Fire landscape (Keane et al. 2011) and, based on survey results, 17 PACs without suitable habitat or spotted owls were removed from the system consistent with the 2004 Sierra Nevada Forest Plan Amendment.

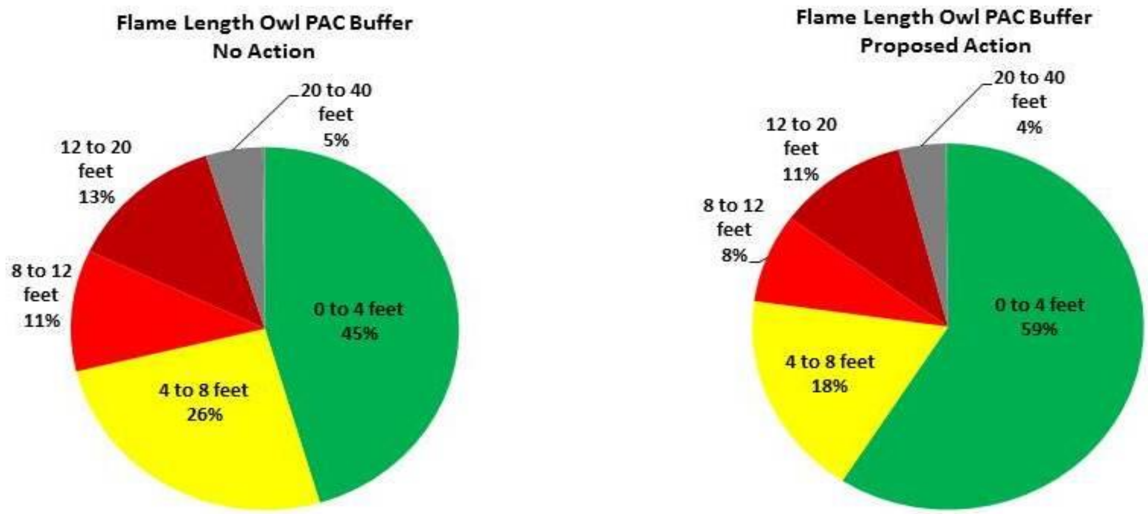


Figure 33. Potential Wildfire Hazard analysis in Spotted Owl Protected Activity Centers (PAC) and ¼ mile buffer surround the PAC. The analysis used Flame Length as the measurement indicator to illustrate differences between the Proposed Action and the No-Action Alternative. The No-Action alternative is the same as the existing condition. Desired conditions of flame length are illustrated in green.

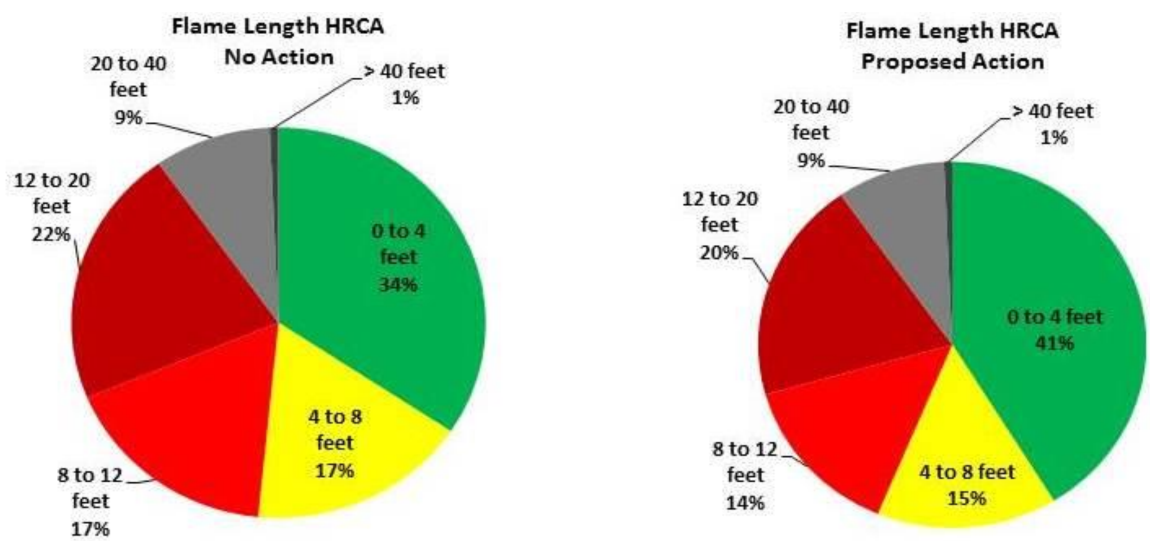


Figure 34. Potential Wildfire Hazard analysis in Spotted Owl Home Range Core Areas (HRCA). The analysis used Flame Length as the measurement indicator to illustrate differences between the Proposed Action and the No-Action Alternative. The No-Action alternative is the same as the existing condition. Desired conditions of flame length are illustrated in green.

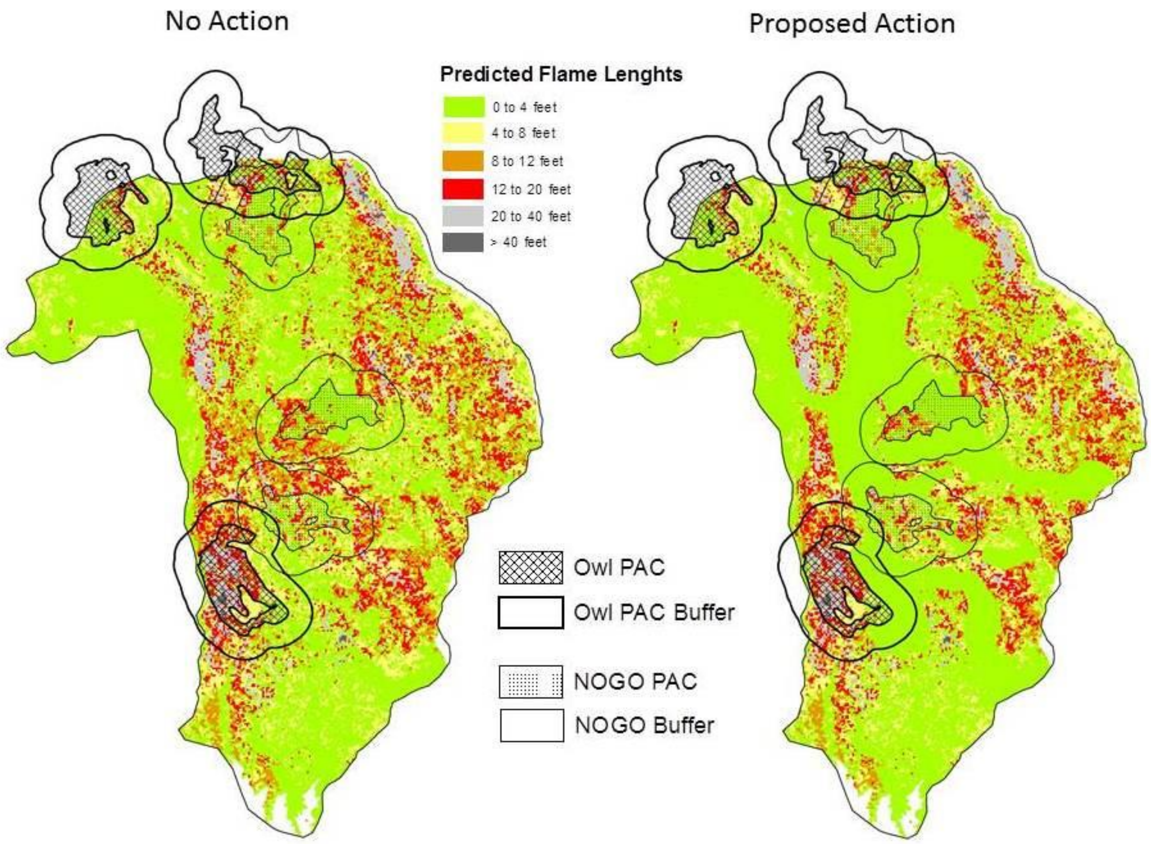


Figure 35. These two maps of the Wildcat Analysis area show the difference between the No-Action (Existing Condition) and the Proposed Action relative to modeled wildfire behavior. The analysis used Flame Length as the measurement indicator.

Direct and Indirect Effects of Mechanical and Biomass Thinning (includes aspen treatment)

Potential direct effects on spotted owl may result from the modification or loss of habitat or habitat components, and rarely from direct mortality if nest trees are felled. The proposed action would not cut or remove nest trees. Limited Operating Periods (LOPs) would be implemented within 0.25 mile of an active nest from March 1 to August 15. No heavy equipment operations or tree felling would be allowed during the LOP. The LOPs are expected to eliminate effects from increased human activity and equipment noise.

There is general agreement that mechanical thinning may have negative effects to spotted owl habitat as proposed in Blakesley et al. 2005, Gallagher 2010, Keane et al. 2012, and Stephens et al. 2014. Critical nesting core habitat (300 acres per pair of spotted owls) was excluded from all mechanical thinning in the proposed action. Specific guidelines from the 2004 ROD which prescribe at least 50% canopy cover, higher than average levels of snags and down woody material, at least 24 inches dbh in dominant and co-dominant trees were followed where appropriate. In some areas of south facing slopes, canopy cover was reduced to 40% to better align with the natural range of variation and to balance forest health needs with spotted owl habitat needs as described in GTR-237 (North 2012).

Proposed Wildcat Project treatments would occur on approximately 9 percent of potential spotted owl habitat in the analysis areas (

Table 48). No treatment would occur within any spotted owl PACs. Of treatments occurring on potential spotted owl habitat (approximately 615 acres), 29 percent are occurring in aspen restoration treatment units and 71percent are mechanical thinning units (Table 47). Eleven percent (approximately 159 acres, Table 52) of spotted owl HRCA acres (approximately 1423 acres in analysis area) would be treated with mechanical and biomass thinning, but prescriptions were written to maintain a minimum of 40 percent canopy cover as well as maintain critical overstory trees, snags and large downed logs, with the exception of 7 acres of aspen restoration. There would be a 7 acre reduction in foraging habitat as a result of the mechanical thinning to render habitat unsuitable, as a result of aspen thinning prescriptions. Disturbance associated with logging, temporary road construction, or other associated activities within or adjacent to occupied habitat may disrupt nesting, fledging, and foraging activities; however, implementation of appropriate LOPs around spotted owl activity centers would partially ameliorate any potentially disturbing effects associated with project activities.

There is no proposed treatment within the Spotted Owl PACs and consequently there would be no change to the PACs themselves (Figure 35). The ¼ mile buffers surrounding the PACs do have some fuel treatments proposed and Figure 35 illustrates the lowered predicted flame length.

Approximately 46 percent of suitable California Spotted owl PACs are at high risk for stand replacing wildfire at 90th percentile wildfire conditions within the Wildcat Analysis Area. The proposed action does not propose to complete treatments within the Spotted Owl PAC, so there would be no realized change in existing risk if they do burn (Table 51). There would be considerable indirect benefit in providing increased ability of firefighters to prevent wildfires from spreading into the PACs by treating the surrounding Wildcat landscape (increase of approximately 1,417 acres meeting desired condition, Table 47).

Table 51. Existing condition of wildfire risk to spotted owl Protected Activity Centers (PACs) within the Wildcat Analysis Area. Wildfire risk was modeled using flame length at 90th percentile weather conditions as the measurement indicator.

Spotted Owl PAC	Approximate Acres of High Risk (percentage)	Approximate Acres Moderate Risk (percentage)	Approximate Acres of Low Risk (percentage)
PLU0220	82 (27%)	50 (17%)	167 (56%)
PLU0230	234 (73%)	45 (14%)	42 (13%)
PLU0301*	55 (30%)	23 (13%)	103 (57%)
Total	371 (46%)	118 (14%)	312 (39%)

*181 acres of the 316 acres of PLU0301 are within analysis area. Portion of PAC outside analysis area was excluded from analysis.

In summary, using CWHR criteria, implementation of the proposed action would result in a seven acre reduction of spotted owl foraging habitat. Lee and Irwin (2005) suggest that modest fuel reduction treatments in the Sierra Nevada would not be expected to reduce canopy cover sufficiently to have measureable effects on owl reproduction. In contrast, Lee and Irwin (2005) found that lethal fire simulations produced a pronounced and lasting negative effect. The long-term effects of the Proposed Alternative would be beneficial to individuals and their habitat as prevention of stand-replacing wildfire would help to maintain habitat conditions in the Wildcat landscape (Table 51).

Table 52. Spotted Owl Home Range Core Area analysis. Table shows the three spotted owl territory potential effects of Alternative A, the proposed action, on acres within the analysis area. Analysis was completed on portion of HRCA within the analysis area. All acreages are approximate.

Owl HRCA	Total HRCA acres	HRCA acres in Analysis Area	Existing suitable* acres in Analysis Area	Total treated acres	Acres of suitable reduced to unsuitable by mechanical thinning (% reduction)
PL163	818	384	258	128	6 (2.3%)
PL230	652	597	461	1	1 (0.2%)
PL301	731	442	335	30	0 (0%)

*Suitable includes CWHR size and density classes 4/5 M/D. Suitable reduced to unsuitable includes density changed to classes S/P.

Direct and Indirect Effects of Hand Thinning (includes aspen treatment)

Limited direct impacts of hand thinning would be expected due to the general lack of suitable habitat provided by small diameter trees. Some noise disturbance associated with human presence and chainsaw use would occur, but this would be limited to 190 acres of hand thinning occurring in suitable spotted owl habitat. No suitable habitat would be reduced to unsuitable. Hand thinning would contribute to lowered fire risk in both the short- and long-term (Figure 34).

Direct and Indirect Effects of Prescribed Burning

Prescribed burns would consume logs and snags on approximately 1,031 acres within the analysis area that provide potentially suitable habitat. However, these same acres would likely recruit both snags and downed logs through the prescribed burning process so both the short- and long-term effects would be negligible. Prescribed burning would contribute to lower fire risk in both the short- and long-term (Figure 34).

Direct and Indirect Effects of Herbicide Treatments

All 3 California spotted owl PACs in the project area were evaluated for known locations of invasive plants. No invasive plant treatments are proposed within the boundaries of the spotted owl protected activity center boundaries. Owls are not expected to occur or forage extensively in the immediate vicinity of noxious weed treatments because the weeds generally occur in microsites with past disturbance and limited canopy cover. No effects are anticipated to spotted owl.

Direct and Indirect Effects of Watershed Condition Enhancement

There would be no direct or indirect impacts to spotted owl through watershed condition enhancement projects. No treatments are planned within spotted owl protected activity centers or nest site buffers. No habitat would be modified or removed.

Direct and Indirect Effects of Aspen Stand Enhancement

Effects of aspen treatment were included in the direct and indirect effects of mechanical and biomass thinning and hand thinning sections above.

Alternative A – Proposed Action – Cumulative Effects

The existing condition reflects habitat changes from all activities that have occurred in the past. The analysis of cumulative effects of the alternatives evaluates the impact on spotted owl habitat from the existing condition within the analysis area.

The Moonlight Fire which burned the habitat connection to the west and eliminated 17 spotted owl PACs and the Wheeler Fire, which burned the habitat connection to the southwest and eliminated 6 spotted owls PACs has drastically altered the capability of the Wildcat analysis area to support a population of spotted owls. If a wildfire were to burn the spotted owl PACs in the Wildcat analysis area, this area may not support spotted owls for 100-150 years, if ever.

The woodcutting and Christmas tree cutting programs on the PNF are ongoing programs that have been in existence for years and are expected to continue. The past and future effect of the woodcutting program has and would be to reduce snags, in all forest types, along roadsides throughout much of the analysis area.

Most of the recreation use within the wildlife analysis area consists of dispersed camping, hiking, horseback riding, hunting, mining, mountain biking, OHV use, pleasure driving, and wildlife watching. Such use is expected to continue at the current rate. These activities would have no effect on late seral habitat in the analysis area.

Thinning treatments would have an overall indirect negative impact to the suitability of spotted owl habitat. However, the short- and long-term benefits of fuel reduction are anticipated to outweigh the short-term negative impacts of forest thinning.

Alternative B – No-Action – Direct and Indirect Effects

There would be no direct effects of the no action alternative on the spotted owl because none of the proposed activities would occur. The indirect effects of no action would include an increased risk for future wildfire and related impacts on habitat development and recovery (Figure 33 and Figure 34). The fuel loads that would be left by this alternative would incrementally increase over time and potential wildfires in the area would continue to become more difficult to suppress. Stand replacing wildfires in the future would likely eliminate spotted owl habitat from the analysis area in the long-term. Increased rates of spread would result incrementally as fuel conditions worsen over time. Thus, under alternative B, suitable habitat for productive owl sites as a result of fire could become more fragmented or completely eliminated over time, and the abundance of owls in the wildlife analysis area could decline.

Alternative B – No-Action – Cumulative Effects

The Moonlight Fire which burned the habitat connection to the west and eliminated 17 spotted owl PACs and the Wheeler Fire, which burned the habitat connection to the southwest and eliminated 6 spotted owls PACs has drastically altered the capability of the Wildcat analysis area to support a population of spotted owls. If a wildfire were to burn the spotted owl PACs in the Wildcat analysis area, this area may not support spotted owls for 100-150 years, if ever.

See cumulative effects common to wildlife species section above. No additional cumulative effects would occur.

Determinations for All Alternatives – California Spotted Owl

Action Alternative

It is our determination that the proposed action may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the California Spotted Owl. This determination is based on: 1) Long-term beneficial effects of fuel reductions in the landscape; 2) No treatments occurring in PACs, 3) implementation of a limited operating period around known nests, 4) no treatment occurring on 91 percent of available spotted owl habitat in the analysis area; and 5) less than 11 percent of HRCAs treated with fuel reduction activities.

No-Action Alternative

It is our determination that the no action alternative will not affect the California Spotted Owl. This is based on the fact that there will be no direct and indirect effects to spotted owls or owl habitat. However, the no action alternative is not without risk as there will be: 1) Long-term incremental increase in fuel loading and associated wildfire hazard would occur in the landscape; 2) existing habitat, PACs and HRCAs remain vulnerable to large scale loss and fragmentation as a result of wildfire.

Northern Goshawk

Alternative A – Proposed Action – Direct and Indirect Effects

One purpose of the Wildcat Project is to reduce threats to wildlife habitat from severe wildfires. An analysis of modeled wildfire hazard in goshawk PACs and ¼ mile buffers around the PACs using flame length as the measurement indicator was completed (Figure 36)

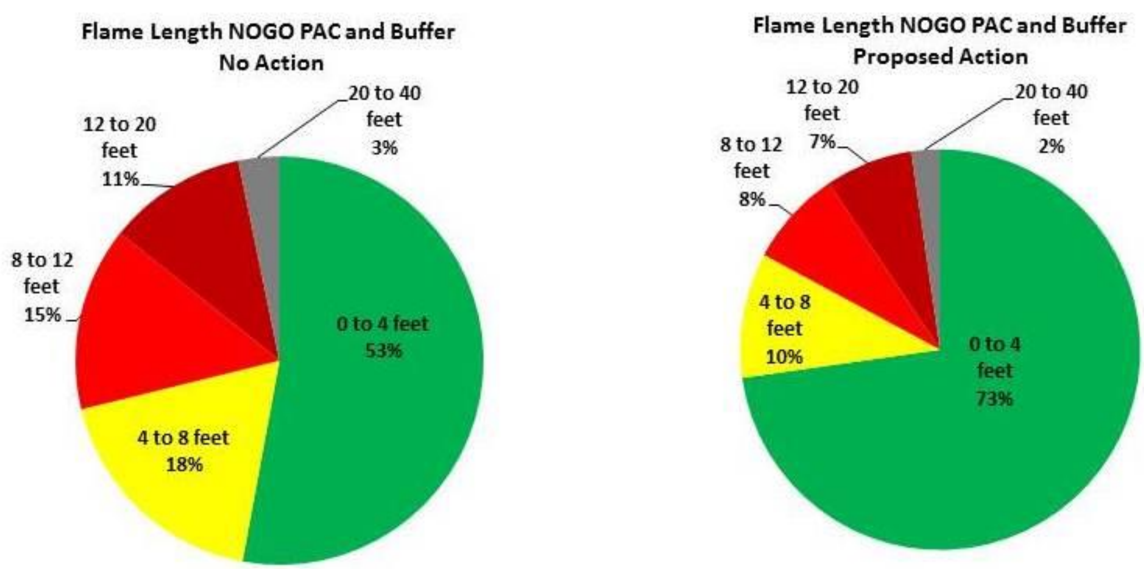


Figure 36. Potential Wildfire Hazard analysis in Northern Goshawk Protected Activity Centers (PAC) and ¼ mile buffer surround the PAC. The analysis used Flame Length as the measurement indicator to illustrate differences between the Proposed Action and the No-Action Alternative. The No-Action alternative is the same as the existing condition. Desired conditions of flame length are illustrated in green.

Direct and Indirect Effects of Mechanical and Biomass Thinning

Potential direct effects on northern goshawk may result from the modification or loss of habitat or habitat components, and rarely from direct mortality if nest trees are felled. The proposed action would not cut or remove nest trees. Limited Operating Periods (LOPs) would be implemented to prevent disturbance within 0.25 mile of active nest sites from February 15 to September 15. No heavy equipment operations or tree felling would be allowed during the LOP. The LOPs are expected to eliminate effects from increased human activity and equipment noise.

There is limited treatment within the Goshawk PACs, and consequently there is limited change in the PACs themselves (Figure 35, Figure 36). The ¼ mile buffers surrounding the PACs have considerable fuel treatments proposed and Figure 36 illustrates the lowered predicted flame length. Approximately 29 percent of Northern goshawk PACs are at high risk for stand replacing wildfire at 90th percentile wildfire conditions within the Wildcat Analysis Area. There would be considerable indirect benefit in providing increased ability of firefighters to prevent wildfires from spreading into the PACs by treating the surrounding Wildcat landscape (increase of approximately 466 acres meeting desired condition, Table 47). Without fuel reduction treatment, portions of each PAC are at high risk of stand replacing wildfire.

Table 53. Existing condition of wildfire risk to Northern Goshawk Protected Activity Centers (PACs) within the Wildcat Analysis Area. Wildfire risk was modeled using flame length at 90th percentile weather conditions as the measurement indicator. All acreages are approximate.

Northern Goshawk PAC	Acres of High Risk (percentage)	Acres Moderate Risk (percentage)	Acres of Low Risk (percentage)
30	49 (24%)	13 (6%)	143 (70%)
45	59 (29%)	43 (21%)	98 (49%)
47	41 (20%)	29 (14%)	139 (67%)
Total	149 (24%)	85 (14%)	381 (62%)

Based on the vegetation layer and the CWHR model, about 50 percent (approximately 6,654 acres) of the analysis area may be considered suitable goshawk nesting habitat goshawk nesting habitat (4M, 4D, 5M, 5D); The Wildcat project proposes to treat approximately 1157 acres of suitable goshawk habitat and the proposed action would render approximately 467 acres unsuitable post-treatment.

Direct and Indirect Effects of Hand Thinning

Limited direct impacts of hand thinning would be expected due to the general lack of suitable habitat provided by small diameter trees. Some noise disturbance associated with human presence and chainsaw use would occur, but this would be limited to approximately 190 acres of hand thinning occurring in suitable goshawk habitat.

Direct and Indirect Effects of Prescribed Burning

Prescribed burns would consume logs and snags on approximately 1031 acres within the analysis area that provide potential suitable habitat. However, these same acres would likely recruit both snags and downed logs through the prescribed burning process so both the short- and long-term effects would be negligible. Prescribed burning would not remove any suitable habitat or cause it to become unsuitable for goshawks.

Direct and Indirect Effects of Herbicide Treatments

All 3 Northern goshawk PACs in the project area were evaluated for known locations of invasive plants. Invasive plant treatments are proposed within the boundaries of two of these protected activity center boundaries (PACs). There are 3 sites in the Hallett PAC, 8 in the Upper Boulder PAC and none in the Boulder PAC. There would be no direct effects to goshawks or habitat through direct or select application of herbicide spray to invasive weeds because no habitat elements would be removed or modified. There could be indirect impacts to northern goshawk through herbicide treatments through disturbance associated with human presence during spray operations. Spraying with backpacks does not have as great a potential to disturb goshawks as other activities such as timber harvest due to the lack of loud noise and lack of tree felling. However, Limited Operating Period buffers would be required when spraying within ¼ mile of active nest sites as human presence can still cause nest abandonment early in the nesting season. Five sites would require LOP buffers: CIAR4-0411, CIAR4-0441, CIAR4-0524, CIAR4-0570 and CIAR4-0810. Due to the limited disturbance potential of spraying with backpack sprayers, the LOP period would apply from the beginning of the nest site courtship (Feb 15) through the end of the nestling period (July 15 fledge date). Invasive plant treatment during the fledgling period (July 15-Sept 15) is not expected to cause adverse effects to northern goshawk. If goshawks are within sight or sound of herbicide application sites, application would be delayed until September 15.

Direct and Indirect Effects of Watershed Condition Enhancement

There would be no direct or indirect impacts to northern goshawk through watershed condition enhancement projects. No treatments are planned within goshawk protected activity centers or nest site buffers. No habitat would be modified or removed.

Direct and Indirect Effects of Aspen Stand Enhancement

Aspen stands are known to be important for Northern goshawks, both for foraging and nesting habitat. However, the short term effect caused by thinning dense forest conditions would cause a decrease in habitat quality until the aspen stands recolonized the restored acreage. The proposed activity would reduce 178 acres of closed canopy forest down to less than 40 percent canopy cover, which would render the habitat unsuitable for goshawks until the canopy cover becomes denser over time.

Alternative A – Proposed Action – Cumulative Effects

The existing condition reflects habitat changes from all activities that have occurred in the past. The analysis of cumulative effects of the alternatives evaluates the impact on northern goshawk habitat from the existing condition within the analysis area.

The Moonlight Fire burned to the west of the analysis area and eliminated 7 goshawk PACs. The Wheeler Fire burned habitat to the southwest of the analysis area. These two fires, in combination with other smaller fires such as Boulder, Stream and Cateyes wildfires have altered the capability of the Wildcat analysis area and surrounding landscapes to support Northern goshawks. Good occupied habitat to the north on the Lassen National Forest exists that has not been affected by wildfires. Seventy-three percent of goshawk PAC acres would be expected to be retained in the event of a high severity wildfire (Figure 36) due to the combined effects of the proposed treatments and existing conditions and topography.

The woodcutting and Christmas tree cutting programs on the PNF are ongoing programs that have been in existence for years and are expected to continue. Uncontrolled public use within the areas used by Northern Goshawks, especially during the nesting season, could cause disturbance that could disrupt and preclude successful nesting as well as the continued removal of current and future snags. The past and future effect of the woodcutting program has and would be to reduce snags, in all forest types, along roadsides throughout much of the analysis area.

Most of the recreation use within the wildlife analysis area consists of dispersed camping, hiking, horseback riding, hunting, mining, mountain biking, OHV use, pleasure driving, and wildlife watching. Such use is expected to continue at the current rate. These activities would have no effect on late seral habitat in the analysis area.

Thinning treatments would have an overall indirect negative impact to the suitability of goshawk habitat. However, the short- and long-term benefits of fuel reduction are anticipated to outweigh the short-term negative impacts of forest thinning.

Alternative B – No-Action – Direct and Indirect Effects

There would be no direct effects of the no action alternative on the goshawk because none of the proposed activities would occur. The indirect effects of no action would include an incremental increase in the risk for future wildfire and related impacts on habitat development and recovery (Figure 36). The fuel loads that would be left by this alternative would incrementally increase over time and potential wildfires in the area would continue to become more difficult to suppress. Stand replacing wildfires in the future would likely eliminate nearly 50 percent of the existing habitat from the analysis area in the long-term. Increased rates of spread would result incrementally as fuel conditions worsen over time. Thus, under alternative B, suitable habitat for productive goshawk sites as a result of fire could become more fragmented over time, and the abundance of goshawks in the wildlife analysis area could decline.

Alternative B – No-Action – Cumulative Effects

The Moonlight Fire burned to the west of the analysis area and eliminated 7 goshawk PACs. The Wheeler Fire burned habitat to the southwest of the analysis area. These two fires, in combination with other smaller fires such as Boulder, Stream and Cateyes wildfires have altered the capability of the Wildcat analysis area and surrounding landscapes to support Northern goshawks. If (“when” might be a more appropriate word) a wildfire burns in this landscape, the incremental increase in fuel loading and rate of spread may cause 47 percent of the landscape to burn at moderate to high severity. This impact, in combination with past wildfire impacts, would be substantial. See cumulative effects common to wildlife species section above. No additional cumulative effects would occur.

Determinations for All Alternatives – Northern Goshawk

Action Alternative

It is our determination that the Wildcat Project may affect individuals, but not likely to trend towards listing for the Northern goshawk. This determination is based on: 1) treatments largely avoiding PACs and only limited, specially designed treatments designed to enhance PACs being implemented within PAC boundaries; 2) limited operating periods would prevent disturbance around known nests; 3) 91 percent of available nesting and foraging habitat in the analysis area would be retained; 4) beneficial effect through reduction in both the long- and short-term threat of stand replacing wildfire in goshawk PACs.

No-Action Alternative

It is our determination that the no action alternative would not affect the Northern Goshawk. This is based on the fact that there will be no direct and indirect effects to northern goshawks or goshawk habitat. The no action alternative is not without risk as the Wildcat area will continue to have: 1) Long-term incremental increase in fuel loading and associated wildfire hazard would occur in the landscape; 2) existing habitat and PACs remain vulnerable to large scale loss and fragmentation as a result of wildfire.

Townsend's big-eared bat, Pallid bat, and Fringed myotis

Alternative A – Proposed Action – Direct and Indirect Effects

The implementation of Management Area direction and habitat prescriptions and allocations for species such as California spotted owl and northern goshawk, including the retention of large trees, retention of hardwoods, snags and large logs and maintaining aquatic/riparian ecosystem processes, would provide many of the habitat attributes necessary to support sensitive bat species. Potentially suitable habitat likely exists in the project area for all three of these bat species (*M. thysanodes, C. townsendii, A. pallidus*).

Direct and Indirect Effects of Mechanical and Biomass Thinning

Direct effects from the Action Alternatives are possible if any of these species occur in the project area, and we assume presence for all three bat species (*M. thysanodes, C. townsendii, A. pallidus*). Destruction of active roosts through felling or removal of trees with hollows could displace or harm individual bats. The Wildcat proposed action would likely reduce snag density on 2,817 acres (9 percent of acres in the analysis area). Chain saw activity or the use of heavy equipment causing ground vibrations may cause noise and tremor disturbance significant enough to cause temporary or permanent roost abandonment. These effects may be especially detrimental to the population during the breeding season (May 20 to August 15) when the potential exists for disturbance to lactating females and maternity colonies. If any of these sensitive bat species breed in the area, project activities during the breeding season could affect individual bats, including direct mortality. The proposed action may reduce the long-term threat of high severity wildfire, which may prevent the destruction of roosting habitat. However, Buchalski et al. (2013) found no evidence of negative effect of fire on foraging site selection and suggested that bats are resilient to landscape-scale fire and may even benefit from increased post-fire availability of prey and roosts.

The three sensitive bat species exhibit a continuum of roost site requires. *C. townsendii* is colonial and roosts in caves, mines, and abandoned human structures (hanging in open areas from a wall or the ceiling. *M. thysanodes* and *A. pallidus* also roost in caves, crevices, and mines, but these species also utilize live trees and snags for roosting. Further, *M. thysanodes* may exhibit site specific roosting patters as this species was found to exclusively use snags for day roost sites on the Six Rivers National Forest. Although the Wildcat Project is not likely to physically alter roosting habitat for *C. townsendii* (caves, mines, abandoned buildings), project activities could disturb or cause abandonment of colonies if present. Its colonial nature places *C. townsendii* at high risk for a single disturbance event to impact the entire population (e.g., tractor operations). The single most important non-structural requirement for roost sites for this species is absence of human disturbance (USDA 2001b). *A. pallidus* also is very sensitive to disturbance; even hiking past a roosting site can cause the bat to abandon the area completely, but unlike *C. townsendii*, *A. pallidus* does use live and dead trees for roosting. Thus *A. pallidus* roost sites could potentially be destroyed during the Wildcat Project, and any roost sites in the areas that are not physically altered could be abandoned as a result of disturbance. *M. thysanodes*, like many bat species, also is very sensitive to disturbance at or modification of roost and the surrounding environment.

Thinning would remove trees and damage shrubs and other vegetation that provides habitat for prey species consumed by bats. The project may cause limited short term negative effects to associated prey species and foraging quality for bat species. The effect is expected to be minor, but unquantifiable. The long term effects of forest thinning would be expected to increase quantity and diversity of understory forb and shrub species and would allow for a concomitant increase in prey species that would improve bat foraging in the project area.

Direct and Indirect Effects of Hand Thinning

Limited direct impacts of hand thinning would be expected due to the general lack of suitable habitat provided by small diameter trees. Some noise disturbance associated with human presence and chainsaw use would occur, but this would be limited to approximately 291 acres of hand thinning in habitat capable of supporting roosting bats. Prey base and related bat foraging effects would be similar to mechanical and biomass thinning effects.

Direct and Indirect Effects of Prescribed Burning

Prescribed burns would consume logs and snags on approximately 2,710 acres within the analysis area that provide potential roost sites. However, these same acres would likely recruit both snags and downed logs through the prescribed burning process so both the short- and long-term effects would be negligible. Prescribed fire effects to prey base and related bat foraging effects would be similar to mechanical and biomass thinning effects.

Direct and Indirect Effects of Herbicide Treatments

There would be no direct impacts to bats through invasive plant treatments. There is some minimal potential for prey species of bats to come into contact with herbicides. It is unlikely for any individual bats to consume sufficient quantities of contaminated prey. However, there is a low likelihood that herbicide treatment could reduce prey abundance by reducing host plant abundance (Hayes and Loeb 2007). Herbicide treatment may affect up to 0.3% of acreage in the analysis area. The long term benefits to the riparian vegetation community are expected to increase prey availability which would benefit bats. No snag or roosting habitats would be impacted by the direct spray of invasive plants.

Direct and Indirect Effects of Watershed Condition Enhancement

There would be no direct or indirect impacts to bats through watershed condition enhancement projects. Watershed enhancement projects would not affect any important habitat elements of bats. Water quality improvements may lead to improvements in aquatic invertebrate populations, which would improve prey base when invertebrates are flying during their adult life stage.

Direct and Indirect Effects of Aspen Stand Enhancement

These effects would be similar to Direct and Indirect Effects of Mechanical and Biomass Thinning listed above, but on a smaller scale: Approximately 316 acres in the analysis area. Restored aspen stands may provide an increase in insect prey due to the increase in primary productivity on restored acreage.

Alternative A – Proposed Action – Cumulative Effects

The existing condition reflects the changes of all activities that have occurred in the past. The analysis of cumulative effects of the action alternative evaluates the impact on bats from the existing condition within the analysis area.

We assume presence for all three sensitive bat species (*M. thysanodes, C. townsendii, A. pallidus*). Cumulative effects on bats could occur with the incremental loss of the quantity and/or quality of habitat for these species. Overall, increases in recreational use of NFS, and the utilization of natural resources on state, private and federal lands may contribute to habitat loss for these species.

The woodcutting and Christmas tree cutting programs on the PNF are ongoing programs that have been in existence for years and are expected to continue. The past and future effect of the woodcutting program has and would be to reduce snags, in all forest types, along roadsides throughout much of the analysis area. If any of these sensitive bat species breed or roost in the project area, snag removal activities could affect individual bats, including direct mortality. However, snag and log removal through the woodcutting program has a limited spatial impact across the PNF as woodcutting is only permitted along open roads (within 100 feet). If any of these sensitive bat species breed or roost in the project area, project activities could affect individual bats through disturbance and direct mortality.

With the current PNF woodcutting program, the terrestrial wildlife analysis area would be open to public woodcutting 12 months a year, limited only by available access. Uncontrolled public use within the areas used by bats, especially during the breeding season (maternity roosts), could cause disturbance that could disrupt and preclude successful recruitment of young as well as remove roost trees.

Alternative B – No-Action – Direct and Indirect Effects

None of the proposed activities would occur. There would be no direct effects on bats or bat habitat, as no activities would occur that would cause disturbance to denning bats, nor any impacts to the existing habitat conditions.

Indirect effects of no action include the potential for future wildfire and its impact on habitat development and recovery. The fuel loads that would be left by this alternative would make potential wildfires in the area difficult to suppress and create a more intense burn, which could lead to increased rates of spread resulting in potential modification of suitable bat habitat including the loss of large trees, large snags and down woody material.

Alternative B – No-Action – Cumulative Effects

The No-Action Alternative for the Wildcat Project would not provide long-term protection of bat habitat from being greatly altered by a large stand-replacing fire. There would be no actions designed to reduce the risk of high intensity wildfire. See cumulative effects common to wildlife species section above. No additional cumulative effects would occur.

Determinations for All Alternatives – Bats

Action Alternative

It is our determination that the Wildcat Project may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for sensitive bat species (*M. thysanodes, C. townsendii, A. pallidus*).

No-Action Alternative

It is our determination that not implementing the Wildcat Project would not affect sensitive bat species (*M. thysanodes, C. townsendii, A. pallidus*). The no action alternative is not without risk to bats, as no action is taken to reduce existing fuel levels, nor create areas that could allow for better and more efficient fire suppression efforts, and leaves existing bat habitat vulnerable to large scale fragmentation as a result of wildfire.

Western bumble bee

Alternative A - Proposed Action

Direct and Indirect Effects of Mechanical, Biomass and Hand Thinning, Prescribed Burning, Herbicide Treatments, Watershed Condition Enhancement and Aspen Enhancement

Indicator Measure 1: Acres of suitable habitat modified, lost or fragmented. Although potential direct effects on B. occidentalis include mortality of individuals or entire nesting colonies, it is difficult to precisely quantify the risk of and occurrence of such events for this species. We therefore focused on three management questions regarding *B. occidentalis* while designing and evaluating potential environmental consequences of the Wildcat Project:

Do bumble bees have continuous access to flowering plants from spring through autumn?

Does adequate habitat for nesting and overwintering sites exist (undisturbed areas with logs and clumps of grass)?

Are floral resources and nesting habitat fragmented or isolated in distribution? (e.g., is nesting habitat in close proximity to foraging habitat?).

Flowering plant species (nectar sources) known to be used by *B. occidentalis* occur throughout the analysis area (see Wildcat Project botany specialist report). Ground disturbing activities associated with the Wildcat Project likely will reduce foraging opportunities for *B. occidentalis* in the project footprint (treatment units) in the short-term; however, this reduction in foraging habitat likely will be ephemeral as flowering plants will sprout and regenerate post-project. Ground disturbing activities also may destroy suitable nesting and overwintering sites for *B. occidentalis* within treatment units. The opening up of the forest canopy, combined with the effects of prescribed fire, is expected to enhance flowering plant density, and therefore increase the ability of the landscape to support western bumblebee.

Herbicide use is planned primarily for use late in the summer season when Canada thistle is in bloom (August-September). Western bumblebees utilize the forest primarily in May through July (Robbin Thorp, pers. comm). Surveys in 2014 found no bumblebees utilizing Canada thistle through the end of July, primarily because it had not started blooming. Because there would be little seasonal overlap with western bumblebee use and Canada thistle flowering period in the project area, therefore the effects are anticipated to be non-measurable. Project design features incorporated would help mitigate potential impacts. Invasive species would be treated prior to flowering to ensure that Western bumblebees are not present on plants during herbicide application. Because there would be no flowers during treatment, there would be no attraction for western bumblebees to occur on Canada thistle during the non-flowering period of treatment. Treatment of invasive species with herbicides would be limited to select methods within 82 feet

(25 meters) of stream reaches. Herbicide methods, restrictions and LOPs would be incorporated into site specific invasive plant treatment cards.

Throughout the project, both spatially and temporally, there will be habitat refugia for *B. occidentalis* via untreated areas and RCA equipment exclusion zones. RCA equipment exclusion zones will receive minimal disturbance during the project. As neither untreated nor RCA equipment exclusion zones area will experience significant ground disturbing activity, we expect suitable nesting and overwintering sites to persist throughout the length of the project. Further, given the linear nature of RCAs, equipment exclusion zones within RCAs also serve as habitat corridors for *B. occidentalis,* providing habitat connectivity between and among foraging and nesting habitat.

Cumulative Effects

The existing condition reflects the changes of all activities that have occurred in the past. The analysis of cumulative effects of the action alternative evaluates the impact on bees from the existing condition within the analysis area.

Cumulative effects on *B. occidentalis* could occur with the incremental loss of the quantity and/or quality of habitat for this species. Overall, increases in recreational use of Forest Service system lands, and the utilization of natural resources on state, private and federal lands may contribute to habitat loss for this species.

The woodcutting and Christmas tree cutting programs on the PNF are ongoing programs that have been in existence for years and are expected to continue. The past and future effect of the woodcutting program has and would be to reduce snags, in all forest types, along roadsides throughout much of the analysis area. However, snag and log removal through the woodcutting program has a limited spatial impact across the PNF as woodcutting is only permitted along open roads (within 100 feet). With the current PNF woodcutting program, the terrestrial wildlife analysis area would be open to public woodcutting 12 months a year, limited only by available access. Loss of these habitat features may indirectly impact nesting and wintering site availability (i.e., rodent burrows). Uncontrolled public use, especially during the nesting season, may cause disturbance to nesting colonies. However, *B. occidentalis* colonies are capable of deterring people and other animals from trampling the nest by repeatedly stinging them.

Most recreation use in the wildlife analysis areas consists of camping, hiking, aquatic activities, horseback riding, hunting, fishing, mining, mountain biking, OHV use, pleasure driving, and wildlife watching. Recreational use is expected to continue at the current rate. These activities are expected to have a nominal effect on *B. occidentalis*.

No-Action Alternative (Alternative B)

Direct, Indirect and Cumulative Effects of No-Action Alternative

There would be no direct effects on *B. occidentalis* or its habitat, as no activities would occur that would cause disturbance to nesting or foraging bees, nor any impacts to the existing habitat conditions. Therefore, there would be no cumulative effects.

Determinations for All Alternatives – Western bumble bee

Action Alternative

It is our determination that the Wildcat project may affect individuals but is not likely to result in a trend toward Federal listing or loss of viability for *B. occidentalis*.

No-Action Alternative

It is our determination that not implementing the Wildcat Project (Alternative B) will not affect *B. occidentalis*.

Table 54. Determinations of effects on threatened, endangered, proposed, and sensitive animal species that potentially occur on the Plumas National Forest.

Threatened, Endangered and Sensitive Species (Scientific Name)	Species Status*	Determination Proposed Action (Alternative A)	Determination No-Action Alternative (Alternative B)**
Invertebrates			
Valley elderberry longhorn beetle (Desmocerus californicus dimorphus)	FT	WNA	WNA
Western bumble bee (Bombus occidentalis)	USFS : S	MAI	WNA
Fish			
Hardhead minnow (Mylopharodon conocephalus)	USFS : S, DFG : SSC	WNA	WNA
Amphibians			
California red-legged frog (Rana aurora draytonii)	FT	WNA	WNA
Foothill yellow-legged frog (Rana boylii)	USFS : S, DFG : SSC	WNA	WNA
Sierra Nevada yellow-legged frog (Rana sierrae)	FE, USFS : S, DFG : SSC	MANLA	WNA
Reptiles			
Western pond turtle (Actinemys marmorata)	USFS : S, DFG : SSC	MAI	WNA
Birds			
Bald eagle (Haliaeetus leucocephalus)	USFS : S, SE, USFWS : BCC	WNA	WNA
California spotted owl (Strix occidentalis occidentalis)	USFS : S, USFS : MIS, DFG : SSC, USFWS : BCC	MAI	WNA
Greater sandhill crane (Grus canadensis tabida)	USFS : S, ST	WNA	WNA

Threatened, Endangered and Sensitive Species (Scientific Name)	Species Status*	Determination Proposed Action (Alternative A)	Determination No-Action Alternative (Alternative B)**
Great gray owl (Strix nebulosa)	USFS : S, SE	WNA	WNA
Northern goshawk (Accipiter gentilis)	USFS : S, DFG : SSC	MAI	WNA
Willow flycatcher (Empidonax trailii brewsteri)	USFS : S, SE, USFWS : BCC	WNA	WNA
Mammals			
American marten (Martes americana)	USFS : S	WNA	WNA
California wolverine (Gulo gulo luteus)	FP, USFS : S, ST	WNA	WNA
Pacific fisher (Martes pennanti pacifica)	FP, USFS : S, DFG : SSC	WNA	WNA
Gray wolf (Canis lupus)	FE	WNA	WNA
Pallid bat (Antrozous pallidus)	USFS : S, DFG : SSC	MAI	WNA
Townsend's big-eared bat (Corynorhinus townsendii)	USFS : S, DFG : SSC	MAI	WNA
Fringed myotis (Myotis thysanodes)	USFS : S	MAI	WNA

*__Species Status: FE__ = Federal Endangered, **FT** = Federal Threatened, **FP** = Federal Proposed, **FC** = Federal Candidate, **USFS : S** = U.S. Forest Service - Sensitive, **USFS : MIS** = U.S. Forest Service – Management Indicator Species, **SE** = State Endangered, **ST** = State Threatened, **DFG : FP** = State Fully Protected, **DFG : SSC** = State Species of Special Concern, **USFWS : BCC** = U. S. Fish and Wildlife Service Birds of Conservation Concern, **SOI** = Species of Interest.

__Determinations: T, E & P Species: WNA__ = Will Not Affect, **MANLA = May Affect, Not Likely to Adversely Affect Individuals or their designated critical habitat, **MALAA** = May Affect and Is Likely to Adversely Affect Individuals or their designated or proposed critical habitat. **FS Sensitive Species: WNA** = Will Not Affect, **MAI** = May Affect Individuals, but is not likely to result in a trend toward Federal listing or loss of viability, **MAILRTFL** = May Affect Individuals, and is Likely to Result in a Trend toward Federal Listing or loss of viability.

These project level effects determinations are consistent with the determinations reached in the SNFPA 2004 ROD by meeting the following three conditions:

- The project is designed in accordance with all Forest Plan design criteria as analyzed in the SNFPA FSEIS 2004 ROD (USDA 2004b);
- The spatial location and timing of this project, when considered cumulatively with all other projects affecting TES species and TES habitat in the area, have been displayed and analyzed, and analysis results indicate a determination consistent with that reached in the SNFPA FSEIS 2004 ROD (USDA 2004b);
- Available new information that was not available in the SNFPA FSEIS 2004 ROD has been included in this project level analysis and this new information leads to the same conclusion as that within the SNFPA FSEIS 2004 ROD (USDA 2004b).

Sooty Grouse – late-seral open canopy coniferous forest

Alternative A – Proposed Action – Direct and Indirect Effects

Project-level Effects Analysis - Late Seral Open Canopy Coniferous Forest

Habitat Factor(s) for the Analysis

- Acres of late seral open canopy coniferous forest habitat, tree size 5, canopy closure S and P.
- Acres with changes in tree canopy closure class.

Current Condition of the Habitat Factor(s) in the Analysis Area

Based on the vegetation layer and the CWHR model, only 2 percent, or approximately 324 acres, of the analysis area (

Table 48) is considered suitable late seral open canopy coniferous forest habitat.

Effects of Mechanical and Biomass Thinning

The Wildcat Project proposes to mechanically thin approximately 299 acres in late-seral closed canopy forest conditions. An additional 11 acres of late-seral open canopy forest would be thinned, but this would not change the habitat suitability for sooty grouse. While most of the prescriptions have been written to maintain greater than 40 percent canopy, approximately 139 acres in eastside pine conditions would be opened to approximately 30 percent canopy and would increase habitat for sooty grouse from approximately 324 to 463 acres (Table 55). All mechanical thinning when the largest overstory trees are retained, regardless of final canopy cover, is expected to be beneficial to sooty grouse.

Table 55. Summary of California Wildlife Habitat Relationships (CWHR) types within Wildcat Project analysis area by treatment type. Include primary treatment types for the thinning, but both primary and secondary for Rx Fire. All acreages are approximate.

CWHR Vegetation, Size Class and Canopy Type	Acres overlap Wildcat Units	Mechanical Thinning	Hand Thinning (includes End-lining)	Rx Fire Primary treatment	Rx Fire follow-up treatment	Aspen Treatment
Conifer Forest – closed canopy late seral (5D, 5M)	343	299	35	7	301	37
Conifer Forest – open canopy late seral (5P, 5S)	16	11	0	6	11	0
Conifer Forest – mid seral, closed canopy (4M, 4D)	721	616	96	5	619	66
Conifer Forest – mid seral, closed canopy (4P, 4S)	1688	1510	98	72	1515	112
Conifer Forest – early seral, size class 1-3	97	88	8	0	88	7
Hardwood Forest (D,M)	93	33	60	0	39	52
Hardwood Forest (S,P,other)	5	3	2	0	3	5
Grassland	33	8	25	0	8	13
Shrub dominated	66	27	30	8	27	23
Non-vegetated	0	0	0	0	0	0
Total	3062	2595	354	99	2611	316

* **Conifer forest** includes EPN, JPN, PPN, SMC and WFR; **Hardwood Forest** includes ASP and MHC; **Grassland** includes AGS, PGS and WTM; **Shrub** dominated includes MCH, MRI, MCP and SGB; **Non-vegetated** includes BAR, LAC and WAT. **Size Class: 1 =** Seedling Tree <1" dbh, **2 =** Sapling Tree 1 - 6" dbh, **3 =** Pole Tree 6 - 11" dbh, **4 =** Small Tree 11 - 24"dbh, **5 =** Medium/Large Tree >24"dbh,**6 =** Multi-layered Tree. **Canopy Cover: D =** Dense Canopy Cover (> 60%), **M =** Moderate Canopy Cover (40 - 59%), **P =** Open Canopy Cover (25 – 39%), **S =** Sparse Canopy Cover (10 – 24%). **Vegetation Type: AGS =** Annual Grassland, **ASP =** Aspen, **BAR =** Barren, **EPN =** Eastside Pine, **PPN** = Ponderosa Pine, **JPN =** Jeffrey Pine, **LAC =** Lacustrine, **LPN =** Lodgepole Pine, **MCH =** Mixed Chaparral, **MCP =** Montane Chaparral, **MHC =** Montane Hardwood-Conifer, **MHW =** Montane Hardwood, **MRI =**

Montane Riparian, **PGS =** Perennial Grassland, **PPN =** Ponderosa Pine, **SGB =** Sagebrush, **SMC =** Sierra Mixed Conifer, **WFR =** White Fir, **WTM =** Wet Meadow (Mayer and Laudenslayer 1988).

Direct and Indirect Effects of Hand Thinning

The Wildcat Project proposes to hand thin approximately 35 acres in late-seral forest conditions. While the thinning would open up the understory and allow for the increased production of forbs, the model does not indicate that these acres would become "suitable" for sooty grouse. Therefore, the direct and indirect effects to sooty grouse are minimal.

Direct and Indirect Effects of Prescribed Burning

The Wildcat Project proposes to burn approximately 17 acres in open canopy late-seral forest conditions. This would improve forage and reduce fire hazard, both of which are desirable for sooty grouse. In addition approximately 308 acres of closed-canopy forest would be burned which would improve forage quality, but not change these acres into habitat meeting the CWHR habitat definitions. Therefore, the direct and indirect effects to sooty grouse are minimal.

Direct and Indirect Effects of Herbicide Treatments

The proposed treatment of Canada thistle in important chick-rearing meadow habitat would benefit sooty grouse. Up to 26 acres of weeds treated would prevent the continued expansion of noxious weeds into suitable sooty grouse habitat.

Direct and Indirect Effects of Watershed Condition Enhancement

There would be no direct or indirect impacts to sooty grouse through watershed condition enhancement projects.

Direct and Indirect Effects of Aspen Stand Enhancement

Sooty grouse are known to use meadow and aspen stand habitats for early chick rearing habitat. Fire exclusion has permitted conifers to encroach into aspen stands, thereby competing with existing aspen and creating shady conditions unfavorable for forb production and aspen regeneration. Aspen stands would be mechanically thinned and chainsaw thinned per the design criteria described in Chapter 2. This would have a major beneficial effect on both sooty grouse habitat as well as aspen regeneration by creating open light conditions in the aspen stands. The proposed action would regenerate approximately 316 acres of aspen stands which would be directly beneficial to sooty grouse.

Alternative A – Proposed Action – Cumulative Effects

The existing condition reflects habitat changes from all activities that have occurred in the past. The analysis of cumulative effects of the alternatives evaluates the impact on MIS habitat from the existing condition within the analysis area. Recreational use, such as hunting sooty grouse, would have minimal additional impacts.

The Wildcat project would reduce fuel hazard on approximately 2694 including approximately 156 acres that would be suitable habitat for sooty grouse. This would prevent the future loss of late-seral open canopy coniferous forest which would have long term beneficial effects to sooty grouse. The combination of the increased beneficial changes associated with the prescribed burning, herbicide and aspen stand habitat treatments would enhance habitat quality and quantity for sooty grouse.

Woodcutting and Christmas tree cutting programs on the PNF are ongoing programs that have been in existence for years and are expected to continue. The past and future effect of these actions would generally retaining continuous forest cover which would have a nominal effect on the late seral open canopy forest habitat.

It is anticipated that implementation of the proposed action, in combination with present and reasonably foreseeable future actions would maintain and slightly increase the amount of late seral open canopy coniferous forest habitat within the analysis area. These changes would not alter the existing trend in sooty grouse or late seral open canopy coniferous forest habitat.

Alternative B – No-Action – Direct and Indirect Effects

There would be no direct effects on late seral open canopy coniferous forest habitat, as no activities would occur that would impact the existing habitat conditions. Hazardous fuel conditions would not be reduced by the no action alternative. There would be a continued long term trend of incrementally increasing hazardous fuel conditions.

Alternative B – No-Action – Cumulative Effects

See cumulative effects common to wildlife species section above. No additional cumulative effects would occur.

Compliance with the Forest Plan and Other Direction

Forest Management Direction

- Plumas National Forest Land and Resource Management Plan (PNF LRMP, USDA 1988a)
- Regional Forester (Region 5) policy and management direction
- Regional Forester (Region 5) Sensitive Plant and Animal Species List (June 10, 1998), as appended October 15, 2007; updated list July 8, 2013.
- Sierra Nevada Forest Plan Amendment (SNFPA) and its implementing Final Environmental Impact Statement (FEIS), Record of Decision (ROD), January 2001 (USDA 2001 a,b)
- Sierra Nevada Forest Plan Amendment (SNFPA) and its implementing Final Supplemental Environmental Impact Statement (FSEIS), Record of Decision (ROD), January 2004 (USDA 2004 a,b)
- Sierra Nevada Forests Management Indicator Species Amendment FEIS, December 2007 (USDA 2007a)
- USDA Forest Service Region 5 Best Management Practices
- Clean Water Act of 1948 (as amended in 1972 and 1987)

The Plumas National Forest Land and Resource Management Plan (PNF LRMP) provides Forest specific information on how TES species will be managed (USDA 1988a). These include forest wide goals and policies for Wildlife, Fish and Sensitive Plants (p. 4-4) and Riparian Areas (p. 4-7), Wildlife objectives (p. 4-14, 4-15, and 4-19), forest wide direction and standards and guidelines for Wildlife, Fish and Sensitive Plants (p. 4-29 through 4-32). Management Area specific and species-specific direction and prescriptions will be included in the species discussions below. Direction also is found under other areas (e.g., timber management) that directly or indirectly affect animal species and/or their habitats. This direction is incorporated by reference. The PNF LRMP provides management guidelines that incorporate Regional direction for each species. Current direction for TES species and other wildlife species and their habitats can be found in the PNF LRMP, as amended by Sierra Nevada Forest Plan Amendment (SNFPA) and its implementing Final Supplemental Environmental Impact Statement (FSEIS), Record of Decision (ROD), for Wildlife, Fish, Riparian Ecosystems and riparian-dependent wildlife species (USDA 2004a,b).

Sierra Nevada Forest Plan Amendment: Final Supplemental Environmental Impact Statement Record of Decision: Forest-wide Standards and Guidelines

Appendix B of the Wildcat Biological Assessment/Evaluation (USDA 2014b) provides a list of standards and guidelines, that are a subset of all applicable Land and Resource Management Plan direction, and this project is being analyzed for consistency to all applicable Forest Plan standards and guidelines for terrestrial and aquatic wildlife, including Aquatic Management Strategy (AMS) Goals and Riparian Conservation Objectives (RCOs, USDA 2004a,b).

Hydrology and Soils

Introduction

A cumulative impact, as defined in 40 CFR 1508.7, is: *the impact on the environment which results from the incremental impact of the action when added to other past, present, and foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time* (CEQ, 1971).

Cumulative impacts may occur off-site and, in the case of the water resource, may affect downstream beneficial uses of water. Effects can be either beneficial or adverse and result from the synergistic or additive effects of multiple management activities within a watershed (USDA, 1988c).

Cumulative watershed effects (CWE) analyses have traditionally focused on impacts to downstream beneficial uses. These include aquatic habitat, hydroelectric power generation, and domestic water supplies. Near-stream disturbances, when compared with upslope disturbances, are more likely to cause site-specific biological effects, as well as downstream physical effects (Menning, 1996) (McGurk & Fong, 1995).

For the purpose of this CWE analysis, the effects of past, present, and reasonably foreseeable future actions were assessed using the Region Five Cumulative Off-site Effects Analysis (USDA, 1988c). Areas of land manipulated by past management activities were converted to a theoretical area of road surface, resulting in a measure of Equivalent Roaded Acres (ERA). Dividing the total ERA by the size (acres) of the watershed yields the percent of the watershed in a hypothetically roaded condition. As the amount of land use increases within a watershed, the susceptibility of that watershed to cumulative watershed effects increases.

There is a point where additive or synergistic effects of the land use activities will cause the watershed to become highly susceptible to CWE. Upper limits of watershed “tolerance” to land use are estimated for the ERA model and this upper limit is called the threshold of concern (TOC). Natural watershed sensitivity is an estimation of a watershed’s natural ability to absorb land use impacts without increasing CWE to unacceptably high levels. The TOC for this Wildcat Project was conservatively chosen to be 12 percent of the area of each analysis sub-watershed. This TOC was based upon guidelines in the Forest Service Handbook (USDA, 1988c) and upon the watershed sensitivities calculated for the Herger-Feinstein Quincy Library Group Forest

Recovery Act (USDA, 1999). Variables considered for that watershed sensitivity analysis included soil erosion hazard rating, rain-on-snow potential, vegetation recovery potential, and the slope of the watersheds. A linear recovery curve is used in the ERA model and reflects the landscape's ability to recover from land management associated disturbances (Figure 37).

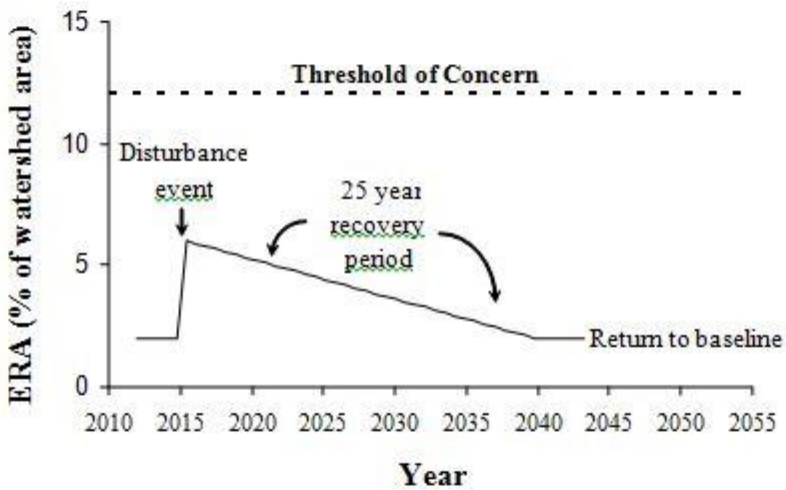


Figure 37. Conceptual disturbance and recovery model

Soil quality measurement indicators analyzed are *soil productivity* and *soil hydrologic function*. Several soil quality measures have been developed to support analysis of these indicators:

- **Effective soil cover** – This measure consists of low-growing vegetation (grasses, forbs and prostrate shrubs), plant and tree litter (fine organic matter), surface rock fragments, and may also include applied mulches (straw or wood chips). Without effective soil cover, an intense storm can generate large quantities of sediment from hill-slopes (Cawley, 1990). Vegetative cover mitigates accelerated soil erosion by dissipating the energy of falling raindrops through interception. Effective soil cover was measured in field surveys, and the Erosion Hazard Rating (EHR) system was used to quantify the amount of soil cover necessary to prevent detrimental accelerated soil erosion.
- **Soil porosity and compaction** - Soil porosity is the volume of pores in a soil that can be occupied by air, gas, or water and varies depending on the size and distribution of the particles and their arrangement with respect to each other. Soil monitoring utilizes a tile-spade sample test that is correlated with measured changes in soil bulk density samples and soil porosity, with a 10 percent reduction in total soil porosity indicating detrimental soil compaction (USDA, 2008a). For the Wildcat Project, this same field survey methodology was used to assess the existing areal extent of detrimental soil compaction at a depth of 4 to 8 inches.
- The degree and extent of susceptibility to compaction is primarily influenced by soil texture, soil moisture, coarse fragments, depth of surface organic matter, ground pressure weight of the equipment, and whether the load is applied in a static or dynamic fashion. Soil compaction can cause slowed plant growth, poor water infiltration leading to increased overland flow during high precipitation events, and can cause plant nutrients to be relatively immobile or inaccessible (Poff, 1996). Research suggests that the effect of severe compaction on biomass productivity is highly dependent upon soil texture (Powers et al., 2005).

- **Surface organic matter -** Organic matter consists of living biomass (plant roots, microorganisms, invertebrates, and vertebrate fauna) and dead biomass (bark, large woody debris, litter, duff, and humus materials). Soil organic matter is the primary source of plant-available nitrogen, phosphorous, and sulfur; provides habitat for the diverse soil biota that carry out energy transformation and nutrient cycles; contributes to soil structure and porosity of soils; protects soils from erosion; and enhances infiltration and hydrologic function (Neary et al., 1999).
- Two measures of surface organic matter are analyzed for the Wildcat Project: *fine organic matter* and *large down wood*. Fine organic matter consists of plant litter, duff, and woody material less than 3 inches in diameter. Large woody material consists of down logs that are at least 12 inches in diameter and 10 feet long.

The geographic scope of the soil quality analysis is generally limited to the footprint of the proposed treatment units. To a limited extent, effects associated with changes to soil hydrologic function could potentially extend outside of the units.

Affected Environment

Watershed and Soil Analysis Areas

The geographic region defining the watershed analysis area (Figure 38) encompasses nine Wildcat Project sub-watersheds, seven of which are contained by the Boulder Creek HUC 6 (Hydrologic Unit Code) watershed. The watershed analysis boundary follows Wildcat Ridge north from Antelope Lake up to Wheeler Sheep Camp, east through Bear Flat and southeast along Thompson Peak Ridge. The watershed boundary then follows the Mt. Hough Ranger District boundary south past Wimp mountain and back to Antelope Lake, totaling approximately 13,376 acres.

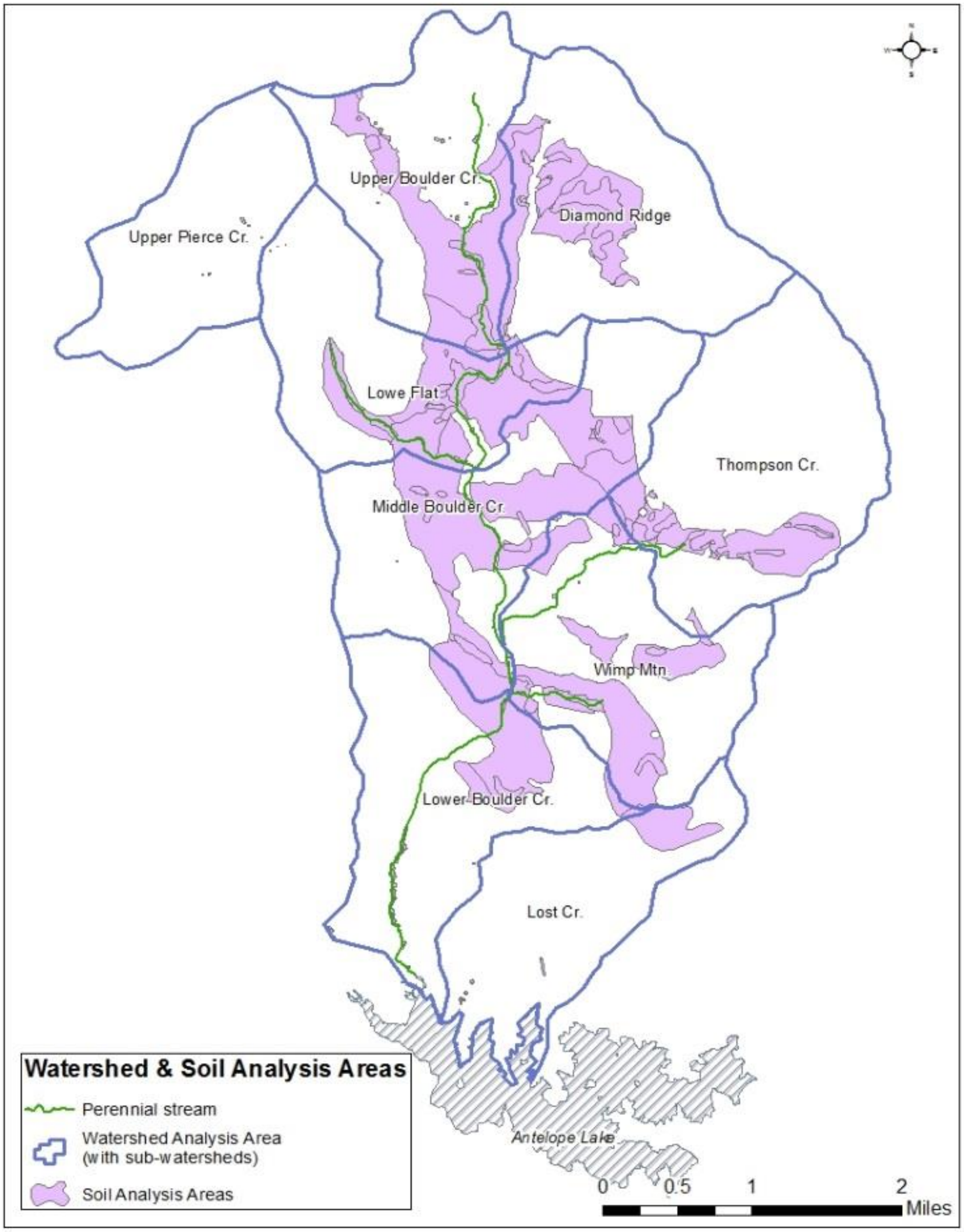


Figure 38. Analysis areas

The scope of the analysis for direct, indirect, and cumulative effects to the soil productivity and soil hydrology[1] indicators for all proposed activities is limited to the proposed treatment units. The soil analysis area is made up of the greatest footprint of all proposed treatment units and totals approximately 3,070 acres.

Existing Watershed Condition

The existing conditions reflect the aggregate impact of prior human actions and natural events such as wildfire that have affected the environment and might contribute to cumulative effects. The current conditions in the analysis watersheds have been impacted by many actions over the last century—specifically timber harvest, wildfire, livestock grazing, and mining.

Tractor logging during the 20th century has left noticeable effects on the composition of the timber stands remaining today; including effects on tree species composition, age, and diameter classes. Timber stand management prescriptions included clear cutting, overstory removal, group selection, sanitation, shelterwood removal, and area thinning, as well as associated activity fuel burning.

There are approximately 5,464 acres in the watershed analysis area that were burned by wildfires between 1917 and 2007. Some of these acres experienced multiple fires during the 90 years of record keeping; cumulatively, 6,799 acres have been burned. Recent fires include the Boulder complex of 2006 that burned 1,075 acres and the Moonlight fire of 2007 that burned 1,004 acres of the watershed analysis area.

Historically, livestock grazing occurred throughout most of the Diamond Mountains. The active Antelope grazing allotment overlaps with nearly the entire Wildcat watershed analysis area. Lowe Flat, located along the middle reach of Boulder Creek, receives a significant amount of grazing pressure during the summer months.

A legacy of historic logging, mining, and grazing effects are common to many of California's forested watersheds (Cafferata et al., 2007). More recent forest activities, including fire suppression and development of the transportation system, continue to affect the watershed conditions in this area. Unpaved roads are often considered the primary source of sediment to stream channels (MacDonald & Coe, 2007). Legacy road designs often possess in-sloped road surfaces that concentrate road runoff in the inside ditch—most were constructed prior to the Clean Water Act amendment of 1972—and did not include sufficient frequency of drainage structures to disperse road runoff and prevent the ditches from delivering sediment to streams at road crossings. Total road density in the watershed analysis area is calculated to be 2.5 miles per square mile of terrestrial land.

Generally, recreational activities occur throughout the entire Wildcat Fuels Reduction and Vegetation Management Project area, with concentrated use around and on Antelope Lake and the neighboring recreation area. Dispersed recreational impacts of undeveloped camping areas, firewood cutting, and user-created roads and trails are evident. Off-highway vehicle (OHV) use may contribute to compacted soil conditions where these activities occur. The locations of many user-created features have recently come to light under the national OHV route designation process. The selection of alternative 5 of the Travel Management EIS allows many of these routes

[1] Cumulative effects to the soil hydrology indicator extend beyond the treatment unit boundaries, as soil hydrologic function is also analyzed by the cumulative watershed effects analysis

to be incorporated into the ERA assessment for future projects, with actions planned to improve and maintain selected trails (USDA, 2010c). Other recreational activities such as Christmas tree cutting, hiking, and hunting have negligible effects on the soils or ERA assessment.

There are roughly 53 miles of existing roads within the watershed analysis area. Although the road network is generally in good condition, a number of poorly located roads contribute to substantial resource damage. These roads generally run parallel to and extremely close to stream channels. Rainfall can run off of road surfaces, carrying sediment into the stream network thus reducing water quality.

Beneficial Uses

Existing beneficial uses of surface waters in the Wildcat Project area are found in the Central Valley Region Water Quality Control Plan (SWRCB, 1998). The Wildcat Project is almost completely encompassed by the Boulder Creek watershed which flows into Antelope Lake – one of the highest-elevation reservoirs managed by the Department of Water Resources (DWR) in the Feather River Watershed. Beneficial uses include municipal and domestic water supply, hydropower generation, recreation, freshwater habitat, habitat suitable for fish reproduction and early development, and wildlife habitat.

Stream Condition

According to the PNF corporate GIS stream layer, there are 147.4 miles of stream channel within the hydrology analysis area; 108.4 miles are ephemeral, 25.5 miles are intermittent and 13.5 miles are perennial. Ephemeral and intermittent streams are seasonal—surface water is present during some portion of the year but are typically dry by late summer. Ephemeral streams only flow in response to storm events or snowmelt, and do not necessarily flow every year. Intermittent streams are seasonally connected to the underlying water table and may flow during all but the driest months, whereas perennial streams typically flow year round. Streams are further classified by their slope—response reaches have low-gradient (less than three percent slope) alluvial conditions. The morphology of response channels reflects depositional processes associated with flowing water. Transport reaches have higher gradient (3 to 12 percent slope), non-alluvial conditions and the morphology of transport channels is generally resilient to change partly due to the presence of exposed bedrock.

Historic land management activities have noticeably impacted the landscape; this is evident in many of the stream channels that drain the Wildcat Project area. Both Boulder and Thompson Creeks show signs of degradation likely associated with historic–and to a lesser extent, present day–grazing practices. Isolated peat accumulations supported by springs or seeps, known as fens, are present along the middle reach of Boulder Creek and support several obligate wetland species, some of which are considered to be rare plants. These special aquatic features, compared to upland forest habitat, are much more susceptible to cattle grazing related impacts.

Wildcat project riparian vegetation is fairly well established and has good diversity: willow, black cottonwood, aspen, and alder are all present. Steep, head-water, tributaries support dense thickets of low-growing alder that are interspersed between exposed boulder concentrations where stream flow often disappears beneath the surface. These high gradient turbulent tributaries are an excellent source of dissolved oxygen–essential to downstream aquatic flora and fauna. Low gradient wetlands supporting aspen and willow exist in the valley bottoms along perennial streams and on perched terraces created by impermeable bedrock outcrops.

Groundwater

Groundwater and surface water resources on Forest Service lands are managed as being hydraulically connected in all planning activities (USDA, 2014). All water that is below the soil surface is considered groundwater – a key component of the hydrologic cycle that supplies cold, clean water to trees, springs, streams, and fens found within the Wildcat project area. A densely forested canopy may intercept 20 percent of the precipitation that would otherwise be available to recharge local groundwater (Bales, 2011). This same overstocked forest will further deplete groundwater supplies through a process known as transpiration – the evaporation of water from the needles or leaves. The ever present, shade tolerant, white fir have been documented to transpire up to three times as much water as a shade-intolerant ponderosa pine (Helms & Rutter, 1979).

Precipitation

Average annual precipitation data from the Antelope Lake weather station, located at an elevation of 4,960 feet, averaged 18.45 inches of rain between 2004 and 2013 (DWR, 2014). Precipitation falls primarily as snow above 6,500 feet and as a combination of snow and rain below that elevation. The majority of annual rainfall is characteristic of a Mediterranean climate, with most precipitation occurring between October and May with isolated thunderstorms common during the summer months. Surface runoff depends upon the snowmelt regime, which normally extends into late spring and early summer.

Soil Condition

Proposed treatment units were surveyed by conducting linear transects that roughly traversed the slope–a minimum of 25 points were sampled–with intensive data (soil structure/texture, LWD, canopy cover, and coarse fragments) gathered at every fifth point. Transects commonly spanned several treatment units when existing soil conditions were homogeneous. All soil type and stand structure condition combinations were surveyed, results are displayed in Table 56.

Forest soil productivity in the soil analysis area ranges from moderately productive to non-productive sites (USDA, 1988b). Forest survey site class (FSSC) is a measure of site productivity in cubic feet of wood per acre per year. Site class 1 is the most productive, while FSSC 7 is the least. Site classes 4 and 5 dominate the northern half (1,275 acres) of the project, with another isolated 120 acre patch at the southwest end of the proposed Wildcat treatment units. The remaining 1,630 acres are primarily rated as site class 6.

Soils in the analysis area are calculated to have a moderate maximum erosion hazard rating (EHR). This rating predicts the potential for sheet, rill, and gully erosion if vegetation and litter are removed (CA Soil Survey Committee, 1989).

Wildcat soils are primarily derived from igneous parent materials. Igneous rock can be formed in two ways; below ground as an intrusive or plutonic occurrence, or at the earth's surface as an extrusive or volcanic formation. Quartz diorite and granodiorite bedrock are both quite common in the Boulder Creek watershed and are responsible for the abundance of well-drained sandy loams—as the two aforementioned rock types contain at least 20 percent quartz (by volume). Andesitic tuff breccia, formed from volcanic ash deposits, is present in the northwestern most portion of the project area. These tuffs have weathered to form loam soil textures with a large component of cobble-sized rock throughout the soil profile.

Effective Soil Cover

Effective soil cover is necessary to prevent accelerated soil erosion. Soil cover ranges from 67 to 97 percent for the surveyed units. PNF LRMP standards and guidelines for effective ground cover vary by the soil erosion hazard rating–for the Wildcat project, ground cover shall be maintained at, or above, 50 percent soil cover for moderate EHR.

Table 56. Soil survey results

Unit	Average percent soil cover	Average percent detrimental compaction	Average number of large down logs/acre	Average percent cover of fine organic matter
1,2,3,4	97	7	48	83
11,13	67	17	48	50
9,10,56	80	13	32	70
14-18,65,93	97	10	50	90
20,21(west),23	73	10	67	63
21(east),24	87	13	42	83
25-29,31-35,91	90	10	32	90
36~39,78,80	67	10	52	63
40, 71(north)	83	10	30	73
71(south)	67	3	32	60
41-45,51,53,77,96,97	83	13	27	77
47,76	67	7	27	63
48-50	67	13	25	67
52	93	13	32	87
54	77	10	27	60
59,60,63	80	13	17	67
12,88	83	13	48	80
55,56	73	3	55	67
64,92	87	7	20	83
67-70	97	10	40	93
21(southwest)	87	3	72	83
71(east)	80	10	30	80
74,75	80	13	33	80
72	74	14	35	72

Soil Compaction

The extent of detrimental soil compaction should not be of a size or pattern that would result in a significant change in production potential for the activity area and should not result in common occurrences of overland flow and erosion within treated units (indicating that the infiltration and permeability capacity of the soil has been exceeded for the local climate).

For the 24 soil transects, the average existing spatial extent of detrimental compaction ranges from 3 to 17 percent (Table 56), with the mean and median both being 10 percent. The area of detrimentally compacted ground is primarily occupied by skid trails and landings, although not all skids and landings were deemed compacted.

Down Woody Material

The applicable standard for large down wood is in the PNF LRMP as amended, which states that large down woody material retention levels should be determined on an individual project basis. For the Wildcat Project, 10-15 tons per acre of the largest down logs, where they exist, would be retained. The existing number of large down logs per acre in the surveyed units ranged from 17 to 72, with an average of 38 logs per acre. A recently fallen 40 foot long white fir log with a small-end diameter of 14 inches would likely weigh 1 ton; a 30 inch diameter tree may weigh upwards of 3 tons (USDA 2000b)

Fine Organic Matter

Organic cover helps maintain site fertility and prevent soil loss from erosion. Fine organic matter consists of plant litter, duff, and woody material less than three inches in diameter. The desired condition for this project area is at least 50 percent fine organic matter well distributed over the unit, with less than 30 percent areal extent of fine organic matter representing a poor condition. Cover consisting of fine organic matter ranged from 50 to 100 percent in surveyed units, which equates to an average of 74.3 percent and a median of 75 percent.

Environmental Consequences

Hydrology & Soil Analysis

Alternative A—Direct and Indirect Effects

Actions proposed under the Wildcat project include tree harvest, chainsaw thinning, piling and burning trees, prescribed fire, noxious weed, and road treatments. Harvest activities may have a local effect on soil moisture regimes, canopy cover, and subsequent water yield due to altered interception and evapo-transpiration rates. Vegetative treatments within RCAs would consequently increase the size of residual trees and improve growing conditions for riparian vegetation, especially aspen. By removing conifers from RCAs, short-term decreases in channel shading may occur that could locally affect stream temperature until riparian vegetation fills these voids. The main objective is to reduce the potential for catastrophic wildfire, and thus, retain the RCA's desired riparian and aquatic habitats, effective stream channel function, and the ability to route flood discharges. In order to help maintain favorable microclimates in RCAs, hardwoods would be retained in all units.

Direct and Indirect Effects of Mechanical Thinning

Harvest operations (forest product removal) would cause associated disturbances from skid trails, landings, and temporary roads – many of which already exist on the landscape and would be re-used. These ground disturbances would render harvested areas more susceptible to erosion and sediment mobilization. HFQLG soil monitoring of mechanical fuel treatments has documented an 8 percent reduction in effective soil cover, on average; Wildcat soil cover standards are expected to be met in all units. This project proposes to treat the excessive amounts of large down wood present to reduce fuel loading while meeting the general forest standard of 10-15 tons per acre (USDA, 2004). Reductions in large woody material would cause minor, localized changes to soil microhabitat. Removal of canopy cover may result in increased temperatures at the forest floor as well as reduced moisture content of forest floor materials (Erickson et al., 1985); however, more precipitation would pass through the canopy layer and be available for groundwater recharge.

Pile and under-burning; two commonly prescribed secondary treatments, would result in reduced ground cover and increased exposure of bare soil – increased nutrient availability in the form of ash would also be realized. The remaining canopy and vegetative recovery would contribute to the reestablishment of fine organic matter.

Recent results of BMP monitoring on the Plumas National Forest demonstrate that these water quality protection measures are effective at preventing erosion and sedimentation from the aforementioned land management activities (USDA, 2012a). The 2012 report summarized results from over 320 BMP evaluations (skid trails, landings, streamside zone protection, prescribed burning, and road drainage) completed between 2007 and 2012. BMPs were rated as effective for 91 percent of these evaluations. For the BMPs rated as non-effective, none of the sites evaluated exhibited significant and long-term impacts to water quality and beneficial uses.

If road BMP evaluations are not considered, BMPs were rated as effective for 96 percent of the 222 evaluations. The BMP deficiencies observed were predominantly due to legacy effects associated with the original design or location of system haul roads. In-sloped road designs concentrate road runoff in the inside ditch and the legacy design roads—most constructed prior to the Clean Water Act amendment of 1972—often did not include sufficient frequency of drainage structures to disperse road runoff and prevent the ditches from delivering sediment to streams at road crossings. Road treatments are proposed to address priority legacy design issues where insufficient drainage occurs. See analysis of proposed road treatments below.

Alternative A—Cumulative Effects of Mechanical Thinning

Wildcat ERA values for each sub-watershed would remain well below the 12 percent threshold of concern after implementation of the proposed actions (Figure 39).The Middle Boulder Creek sub-watershed would experience the greatest project induced increase in cumulative watershed effects, rising from 2.1 to 7.2 percent ERA (though road decommissioning would reduce the ERA value down to 6.8 percent). Upper Boulder Creek is expected to have the largest cumulative ERA value, at 7.4 percent, due to extensive past land management activities between the years 1992-2000 (road decommissioning would reduce this sub-watersheds ERA value to 7.3 percent). Upper Pierce Creek owes its elevated ERA values to the high proportion of roads found within it and the 82 acres of salvage logging that occurred there as a result of the Moonlight Fire; only noxious weed treatments are proposed in this sub-watershed. Implementation of project BMPs and design features would assure that significant impacts to water quality and beneficial uses would not occur in these sub-watersheds.

Proposed mechanical treatments are generally expected to reduce effective soil cover, fine organic matter, and large woody debris in the short term, though compliance with the PNF LRMP standards would still be achieved. In the event of a high severity wildfire in the project area, the proposed actions would decrease the likelihood of Wildcat units experiencing high soil burn severity capable of adversely affecting hydrologic function and soil productivity. The areal extent of soil compaction would increase after implementation; data from the HFQLG soil monitoring study suggest that each harvest entry into an area will add a little bit of compaction (USDA, 2006). The expected extent of detrimental soil compaction for the action alternative would not be of a size or pattern that would result in a significant change in production potential for the activity area.

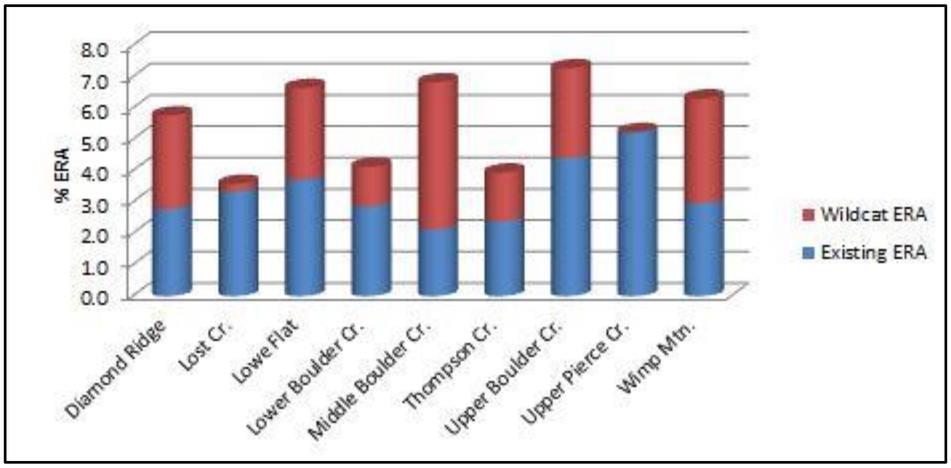


Figure 39. Percent ERA per sub-watershed

Direct, Indirect, and Cumulative Effects of Herbicide Treatments

Herbicide treatments may affect soil directly via short-term adverse impacts on certain soil microbes and experience indirect effects resulting from losses in vegetative cover. Applied chemicals would likely experience: leaching; hydrolysis; adsorption on to, and desorption from soil particles; and biological degradation during the period of time that the particular herbicide remains present in the soil profile. Soil characteristics affect the herbicide residency time through drainage and cation exchange capacities.

Two different herbicides and one fungicide are proposed for use: 1) Imazapyr, which is weakly bound to soil, with adsorption rates directly proportional to organic matter and clay content. Imazaypyr is moderately persistent in soil but resists leaching and hydrolysis. The half-life of imazapyr ranges from 25 to 145 days. Microbial degradation is the primary means of dissipation (SERA, 2004). 2) Aminopyralid, likely to be non-persistent and relatively immobile in the field. Half-lives of 20 and 32 days were determined with minimal leaching below the 15 to 30 cm soil depth. Aminopyralid has been shown to be practically non-toxic to most organisms (SERA, 2007). 3) Borax, which is persistent in soil, transforms rapidly into borates when exposed to water and is deleterious to soil microorganisms (SERA, 2006).

Overall, the proposed herbicide types and application rates are low enough to facilitate decay by soil microbes, in some cases increasing microbial activity. Therefore, there is no basis for asserting that direct, indirect, or cumulative adverse effects on soil productivity are plausible. Water quality would be maintained by enforcing herbicide application BMPs including the designation of stream buffers, where the use and handling of chemicals would be prohibited.

Direct, Indirect, and Cumulative Effects of Road Improvements & Decommissioning

Road treatments would consist of measures to improve road drainage, reduce erosion caused by concentrated road runoff, and reduce sedimentation from roads into the stream network. The road treatments largely include obliterating the ditch, where possible, and reshaping the roadbed so that it is out-sloped (Figure 5). This would allow for dispersed road drainage that is not concentrated by culverts. Where ditch obliteration is not possible, armored rolling dips will be constructed to somewhat disconnect the inside ditch from stream crossings. Four water drafting sites in the project area would be reconstructed and brought up to best management practice standards. This may include installing permanent, underground vault water containers or constructing ponds located off of active stream channels, installing bump logs, and surfacing and outsloping parking pads and access routes. Short-term increases in sediment mobilization during road reconstruction would be minimized by BMPs and would be offset by long-term improvements to water quality as a result of amelioration of hydrologically connected road segments.

Road decommissioning would entail culvert removal, sub-soiling of the roadbed, fully re-contouring the hillslope, installing barriers to discourage vehicle traffic, and/or seeding the affected area. Road decommissioning would promote vegetative recovery, which can decrease compaction, increase infiltration into the roadbed, and increase soil stability and limit concentrated flow as well as surface erosion. Over time, decommissioned roads would produce less sediment and surface runoff to adjacent watercourses. Re-contouring of hillslopes significantly reduced soil compaction, surface runoff, and sediment production compared to sub-soiling or cover cropping alone (Kolka & Smidt, 2004). Road decommissioning would reduce ERA values in the Diamond, Lowe, Middle and Upper Boulder Creeks, and Wimp Mtn. sub-watersheds by a total of 14.7 acres, and is expected to result in long-term beneficial effects on water quality. Forest Service system road 28N99 would be decommissioned but not obliterated and would therefore not reduce ERA values.

Alternative B—Direct, Indirect, and Cumulative Effects

Under the No-Action alternative, effective soil cover in the form of fine organic matter and large woody debris can be expected to increase as organic materials accumulate on the forest floor; consequently, erosion potential is currently very low and would continue to be so in the absence of a high severity fire.

The extent and degree of soil compaction is expected to decline slowly over time. This process may take several decades in forested environments (Grigal, 2000). Root penetration, extension, and decay, along with the burrowing action of soil dwelling animals would contribute to an increase in soil porosity and decrease compaction.

Under the No-Action alternative, ERA values would slowly decline to a baseline level over time. Surface, ladder, and crown fuels would not be treated on upslope areas or in RCAs. Road drainage improvements and decommissioning activities would not occur, so watershed benefits and reductions in ERA values due to road decommissioning would not be realized. Fuel treatment activities would not occur, leaving sub-watersheds at a greater risk of wildfire. A future severe wildfire could greatly increase ERA values within and across sub-watersheds.

Compliance with the Forest Plan and Other Direction

National Forest Management Act (NFMA) of 1976 (which amended The Forest and Rangeland Renewable Resources Planning Act of 1974)

As described in Forest Service Manual Chapter 2550 (USDA, 2009b), this authority requires the maintenance of productivity and protection of the land and, where appropriate, the improvement of the quality of soil and water resources. NFMA specifies that substantial and permanent impairment of productivity must be avoided.

Plumas National Forest Land and Resource Management Plan (LRMP)

Forest Plan standards and guidelines provide the relevant substantive standards to comply with NFMA. The 1988 LRMP (USDA, 1988a) establishes standards and guidelines to prevent significant or permanent impairment of soil productivity, including:

- During project activities, minimize excessive loss of organic matter and limit soil disturbance according to Erosion Hazard Rating (EHR): for low to moderate EHR, conduct normal activities; for high EHR, minimize or modify use of soil disturbing activities; for very high EHR, severely limit soil-disturbing activities.
- Determine adequate ground cover for disturbed sites during project planning on a case-by-case basis. Suggested levels of minimum effective cover are: for low EHR, 40 percent; for moderate EHR, 50 percent; for high EHR, 60 percent; and for very high EHR, 70 percent. These suggested levels are adopted as the LRMP ground cover standards for the Wildcat Project.
- To avoid land base productivity loss due to soil compaction, dedicate no more than 15 percent of timber stands to landings and permanent skid trails. Permanent landings and skid trails do not exist within the project area and the Wildcat Project does not propose such permanent features.
- Implementation of BMPs.
- Establishment of Streamside Management Zones (SMZs) per guidelines in Appendix M of the LRMP. Recommended SMZ widths for ephemeral swales that lack annual scour range from 0 to 50 feet, depending upon the stability of the swale channel and side-slope. The SMZ plan for this project is included in Appendix C of the Hydrology and Soils Report of this report.

Sierra Nevada Forest Plan Amendment (SNFPA) Record of Decision (ROD)

The SNFPA ROD (USDA, 2004) amends the Plumas National Forest LRMP and includes a standard and guideline for large down wood and snags:

- Determine retention levels of large down woody material on an individual project basis. Within westside vegetation types, generally retain an average over the treatment unit of 10-15 tons of large wood per acre. Within eastside vegetation types, generally retain an average of three large down logs per acre. For the Wildcat Project, the retention level of large down woody material is three large down logs per acre.

National Forest Service Manual for Soil Management

Forest Service Manual 2550 (USDA, 2010a) establishes the management framework for sustaining soil quality and hydrologic function while providing goods and services outlined in Forest land and resource management plans. Primary objectives of this framework are to inform mangers of the effects of land management activities on soil quality and to determine if adjustments to activities and practices are necessary to sustain and restore soil quality. Soil quality analysis and monitoring processes are to be used to determine if soil quality conditions and objectives have been achieved. Generally, soil management standards and guidelines are not applied to administrative sites or dedicated use areas such as roads and campgrounds. Per Forest Service Manual 2550, soil filtering and buffering function is the function of immobilizing, degrading, or detoxifying chemical compounds or excess nutrients.

State Water Quality Management Plan

Non-point source pollution on Plumas National Forest has been managed for the past 14 years through the water quality management program contained in Water Quality Management for Forest System Lands in California (USDA, 2011a). The Best Management Practices (BMPs) contained in that document have recently been improved and replaced by the BMPs presented in a Region 5 amendment to the Forest Service Handbook (USDA, 2011a). The 2000 State Water Quality Management Plan contains the 1981 Management Agency Agreement (MAA) between the California State Water Resources Control Board and the USDA, Forest Service. The State Board has designated the Forest Service as the management agency for all activities on National Forest lands and the MAA constitutes the basis of regional waivers for non-point source pollution.

California Regional Water Quality Control Board Conditional Waiver of Waste Discharge

In 2010, the California Regional Water Quality Control Board (CRWQCB)—Central Valley Region adopted Resolution No. R5-2010-0022 that provides for a conditional waiver of the requirement to file a report of waste discharge and obtain waste discharge requirements for timber harvest activities on National Forest System lands within the Central Valley Region. This resolution was a continuation of a timber harvest waiver program that began in 2003. The Wildcat Project would comply with CRWQCB waiver requirements per Resolution R5-2010-0022.

Botanical Resources and Invasive Species

Introduction

The purpose of this section is to present a summary of the effects of the proposed project on botanical resources and invasive plant species within the Botany Analysis Area. Botanical resources include Federally Threatened or Endangered plant species as well as species designated as Sensitive by Forest Service Region 5 (USDA 2013). The Plumas National Forest also maintains a “watch list” of species that have not been designated as Sensitive by the Region, but should be considered during project planning (USDA 2006). The Plumas National Forest Land and Resource Management Plan provides standards and guidelines to protect watch list plant species as needed to maintain viability (USDA 1988a,b).

The United States Forest Service has identified invasive species as one of four critical threats to the nation’s ecosystems (USDA, 2004d). Invasive plant species cause disruptions in ecosystem functions by outcompeting and displacing native species, altering fire and nutrient cycles, decreasing forage available for wildlife, and degrading soil structure (Bossard et al., 2000). Invasive species can also reduce the recreational or aesthetic value of native habitats. Forest Service management activities, such as those associated with timber harvest and road maintenance, can contribute to the introduction and spread of invasive species by acting as vectors for spread and creating disturbed conditions suitable for colonization. The Plumas National Forest maintains a list of priority invasive plant species that are of high management concern.

Effects Analysis Methodology

Floristic botanical surveys were performed in project areas between 2000 and 2008 (Taylor 2000; Buck and Clifton 2001; Belsher-Howe and Dillingham 2002; Lubin and Gross 2002; Shohet and Frost 2005; Coppoletta and Rowe 2008), and were timed so that threatened, endangered, sensitive, special interest, and invasive plant species (collectively: “listed” species) would be present and identifiable. These surveys produced lists of vascular plant species present in the area, which were reviewed for listed species. Location, abundance, site characteristics, and phenology data were compiled for listed species and imported into a GIS database. These GIS data were used to identify direct and indirect effects and develop treatment and mitigation measures.

No Federally Threatened or Endangered or Region 5 Sensitive plant species have been detected in the Wildcat Project area. There are 125 known locations of three invasive species, and eight known locations of three watch list species. More information about these two groups of species is detailed in the Invasive Species Risk Assessment and the Botanical Report on Special Interest Species; these were completed by Japhia Huhndorf in July 2014. These reports are incorporated by reference and are available in the project record (USDA 2014a; 2014b).

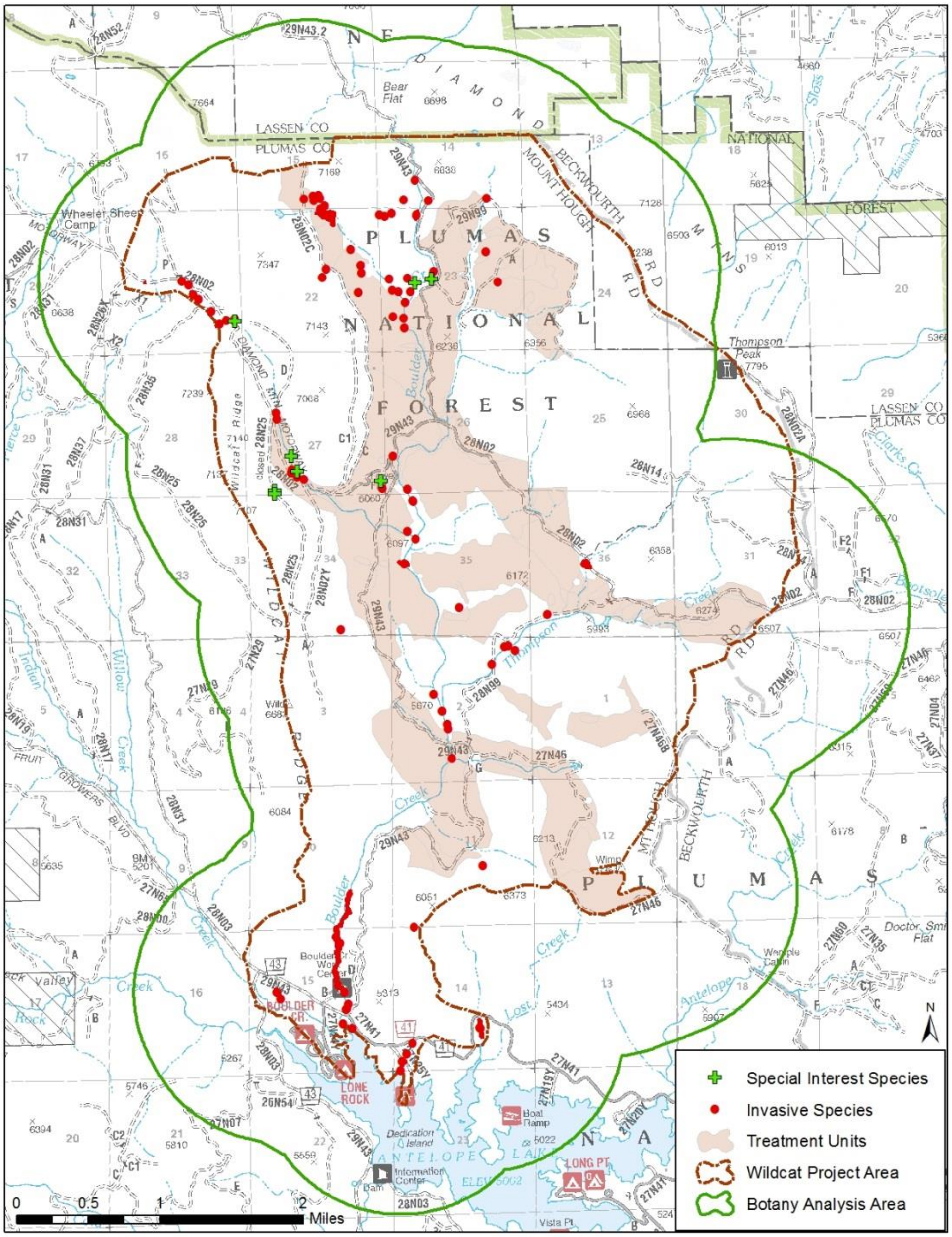


Figure 40. Botany Analysis Area for the Wildcat Project

Affected Environment

The Botany Analysis Area, which comprises approximately 21,200 acres, was used to assess the effects of the proposed project on rare and sensitive botanical resources and invasive plant species

(Figure 40). This area contains all of the proposed treatment units, the proposed herbicide units within the Wildcat Project area, and a one-mile buffer around all units. The buffer was included to capture potential suitable habitat for listed species outside the project units, and include nearby plants that could act as seed and other propagule sources. The analysis area is designed to be large enough to encompass all direct, indirect, and cumulative effects of project activities on listed sensitive botanical resources and invasive plant species.

Because no federally Threatened or Endangered or Region 5-listed Sensitive plant species have been detected in the Wildcat Botany Analysis Area, there would be no effects to these species by the proposed actions of the Wildcat project. The effects to the watch list species present in the project area are discussed in a separate botanical report for those species (USDA 2014a). The remainder of this effects analysis will focus on invasive species found in the Wildcat project. Measurement indicators used to evaluate project effects on invasive species were: amount and location of ground disturbance; number of acres of invasive species sites treated, and overall risk of introduction and spread of invasive species.

Known Invasive Species

Three invasive plant species of high management concern have been documented in the Botany Analysis Area. These species are known from approximately 125 locations, 86 of which are within the Wildcat Project area and targeted for herbicide treatment. Thirty-six of the sites are within proposed vegetation and fuels treatment units. All but two of these occurrences are the species *Cirsium arvense* (Canada thistle). The remaining two species co-occur in a site near the north shore of Antelope Lake. The occurrences of these species are summarized in Table 57.

Table 57. Invasive plant species in areas of the Wildcat project. Acreages are approximate.

Species	CDFA rating[1]	Cal-IPC rating[2]	Botany Analysis Area	Project Area	Veg/Fuels Treatment Units
***Cirsium arvense* (Canada thistle)**	B	moderate	123 sites; 28.1 acres	84 sites; 23.9 acres	25 sites; 7.4 acres
***Aegilops cylindrica* (jointed goatgrass)**	B	none	1 site; 0.8 acres	1 site; 0.8 acres	0 sites
***Elymus caput-medusae* (medusahead)**	C	high	1 site; 0.8 acres	1 site; 0.8 acres	0 sites

[1]The California Department of Food and Agriculture (CDFA) maintains a noxious weed list with the following ratings: A: eradication or containment is required at the state or county level; B: eradication or containment is at the discretion of the County Agricultural Commissioner; C: eradication or containment is required only when found in a nursery or at the discretion of the County Agricultural Commissioner (CDFA 2009).

[2]The California Invasive Plant Council (Cal-IPC) assigns a threat ranking to invasive species of high, moderate, or limited (Cal-IPC 2006). High indicates severe ecological impacts and high rates of dispersal and establishment; moderate indicates moderate impacts and moderate to high rates of dispersal and establishment; limited indicates minor or localized impacts and low to moderate rates of dispersal and establishment.

***Cirsium arvense* (Canada thistle) –** Due to its ecological impacts, distribution and abundance in the Wildcat Project area, Canada thistle is of high management concern. This perennial thistle spreads rapidly by producing extensive horizontal underground root systems that give rise to aerial shoots and is considered particularly difficult to eradicate (Bossard et al. 2000). Mechanical methods, such as hand pulling or mowing, are generally not recommended because they may exacerbate the problem by spreading root fragments to new locations, and it is nearly impossible to remove the entire root of the plant during manual treatment (Bossard et al. 2000). The most effective method of Canada thistle control is herbicide treatment. The herbicide aminopyralid has been shown to provide excellent control of Canada thistle, with little impact on the native plant community (Almquist and Lym 2010). Forest Service direction recommends that Canada thistle is best controlled with herbicide, specifically aminopyralid (USDA 2012). No Canada thistle occurrences within the Wildcat Project area are currently being treated.

Aegilops cylindrica **(jointed goatgrass) –** This annual grass species is a serious and persistent problem in wheat-growing areas of the United States, but is also spreading in the American West and is a state-listed noxious weed in several states (Donald and Ogg 1991). Like many invasive species, long-distance dispersal is often due to human activities, vehicles, and grazing animals. The presence of jointed goatgrass in the Wildcat Project area can be traced to contaminated straw bales used in post-fire stream restoration efforts after the Boulder Fire in 2006 (Belsher-Howe 2013, personal communication). The single infestation was treated manually for several years following detection, but it has expanded to a size where manual treatment is no longer feasible. Because this species was introduced to the area by Forest Service activities and it represents a highly disjunct location (the other known PNF locations are 23 or more miles away, along the Highway 70 corridor), it is of high treatment concern and priority. The herbicide imazapyr has been shown to provide effective control of goatgrass and other annual grasses (Monaco et al. 2005).

Elymus caput-medusae **(medusahead) –** This annual grass species is considered a serious invasive species in many western states, and often forms near-monocultures that prevent growth of desirable native species (Davies et al. 2011). The species spreads primarily by seed, and long-distance dispersal is often facilitated by grazing animals, vehicles, and other human activities. The presence of medusahead in the Wildcat Project area can be traced to the same post-fire stream rehabilitation efforts as the jointed goatgrass; the infestations co-occur (Belsher-Howe 2013, personal communication). This species was also treated manually for several years following detection, but it has expanded to an even greater extent than the jointed goatgrass, and manual treatment is no longer feasible. Because this species was introduced to the area by Forest Service activities and is highly aggressive, it is of high treatment concern and priority. The herbicide imazapyr has been shown to provide effective control of medusahead and other annual grasses (Kyser et al. 2007; Monaco et al. 2005).

Habitat Vulnerability

Risk factors and disturbance levels (high, moderate, and low) in this and the following sections are drawn from the Invasive Plant Species Risk Assessment that is included in the project record (USDA 2014b)

Existing roads and OHV (off-highway vehicle) routes provide excellent corridors and conditions for the spread of non-native invasive plants. There are several heavily used camping and day-use sites around the shore of Antelope Lake that provide opportunities for transporting invasive species. Further, the Wildcat Project area is within three grazing allotments (Antelope, Antelope Lake, and Lone Rock), and grazing animals both transport propagules of invasive species and create local disturbances that facilitates invasive species establishment.

Canada thistle within the Botany Analysis Area occurs within relatively undisturbed riparian areas and also is associated with disturbed site such as roads and landings. The amount of anthropogenic disturbance currently in the Wildcat area is considered moderate. Given dispersal capacity of the invasive species present as well as the level of current disturbance, habitat vulnerability to the introduction and spread of invasive species is considered moderate.

Non-Project Dependent Vectors

Vectors are the means and routes by which invasive species are transported to an area. Non-project dependent vectors include roads, recreational activities, and ongoing land management activities such as grazing, OHV use, and road maintenance. Roads, whether for recreational or land management activities, contribute to dispersal of invasive species. Within the Botany Analysis Area, 29 locations of invasive species are within 50 feet of an existing road, which contributes to a moderate vector risk. (An area in which all or most of the invasive species are adjacent to roads would have a high vector risk.) Grazing allotments encompass the entire Botany Analysis Area, and grazing primarily occurs in meadows, forest openings, and along creeks and roads. Within the Wildcat Project area, the site containing medusahead and jointed goatgrass is both heavily grazed and near a road, and thus has a high vector risk.

Types and Duration of Effects

Direct effects occur when plants are physically impacted. Examples of proposed treatment activities that have the potential to directly affect invasive plants include construction of roads and landings, driving vehicles or equipment through infestations, prescribed fire treatments, and application of herbicides. Although these actions may damage and even eradicate local populations of invasive species, these actions also increase the risk of transporting and facilitating the spread of invasive species (high risk).

Indirect effects of the Wildcat Project are separated from the action in either time or space. These effects may include changes in the amount of habitat disturbance, vegetation distribution, abundance, successional patterns, and fire regimes. Indirect effects have the potential to increase or decrease invasive plant species infestations.

Cumulative effects can result from the incremental effect of the current action when added to the effects of past, present, and reasonably foreseeable future actions. An individual action when considered alone may not have a significant effect, but when considered with past, present, and reasonably foreseeable future actions, the effects may be significant.

The duration of short term effects for invasive species is the time frame in which infestations caused by project activities would be detected: typically 1-2 years after project implementation. Because of biological characteristics that encourage persistence and spread, invasive species rarely disappear from an infested area without some sort of intervention or treatment. The duration of long-term effects for introduction and spread of invasive species is essentially indefinite. However, it cannot be assumed that invasive species treatment, even if successful in eradication, is an indefinite effect. Treated areas must periodically be monitored (every 10-15 years) for (re)introductions due to non-project related activities and vectors.

Environmental Consequences

Invasive Plant Species

Alternative A – Proposed Action – Direct and Indirect Effects

Disturbance often creates ideal conditions for the introduction and spread of non-native invasive species, and the proposed project treatments would greatly increase the amount of disturbance in the Wildcat Project area. Proposed activities with a high potential to alter existing habitat conditions include: timber harvest and removal; landing construction; pile burning and underburning; and the construction, reconstruction, and decommissioning of roads.

The proposed invasive species treatments are expected to eliminate or greatly reduce infestations of Canada thistle, medusahead, and jointed goatgrass within the Wildcat Project area. The proposed action would meet the purpose and need of controlling, containing, or eradicating infestations of invasive species in the Wildcat Project Area.

Direct and Indirect Effects of Fuels and Vegetation Treatments

There should be no direct effects of fuels and vegetation treatments on invasive species because the infestations within treatment units will be flagged for avoidance during project implementation. There are no invasive species locations within 50 feet of any proposed temporary roads, so construction and use of these roads should not cause direct effects. Two of the proposed landing locations are within known infestations; use of these landings would create an unacceptably high risk of spread of invasive species. These invasive species locations would be treated for 1-2 years prior to project implementation to ensure no direct effects; if the implementation timeline does not allow this treatment schedule, the infestations will be flagged for avoidance (this may require the landing location to be altered). Use of Standard Management Requirements and Project Design Features for invasive species should substantially reduce the risk of ground disturbing activities spreading invasive species in the project area.

Indirect effects of fuels and vegetation treatments would include an increase in disturbed habitat and removal of native vegetation, both of which increase the risk of invasive species spread and establishment in the short term. However, fuels reduction treatments would reduce the long-term risk of high severity wildfire, another potential source of disturbance and vegetation removal within the project area. In a comparison of high- and low-severity fires, Turner et al. (1997) found that the density of Canada thistle was up to four times greater after severe fires than after light surface fires.

At the site-specific level, the risk of spread and establishment of invasive species is largely dependent upon the type and frequency of disturbance associated with each treatment type. The risk of spreading invasive species is greater within mechanical-thin units than hand-thin units, because tractors and heavy equipment cause a higher level of ground disturbance than foot travel. The level of disturbance associated with mechanical thinning causes a high risk for invasive species spread by providing disturbed habitat, even if the infestations themselves are avoided during thinning operations. Five invasive species infestations occur within hand-thin project units, and 23 infestations overlap mechanical thin units.

Direct and Indirect Effects of Watershed Enhancement Treatments

Repair and reconstruction of roads and water drafting sites should have no direct effects on invasive species because none of these activities are near a known invasive species infestation. However, ground disturbing activities may indirectly effect the distribution of invasive species within the project area by providing more disturbed habitat in which the invasive species could establish and spread in both the short and long term. Several invasive species locations are near roads proposed for decommissioning; these sites will be flagged for avoidance and/or treated for 1-2 seasons prior to implementation to ensure no direct effects.

One large Canada thistle infestation (CIAR4_0445) overlaps two proposed Sierra Nevada Yellow-Legged Frog (SNYLF) habitat restoration treatment locations (creation of basking sites). The proposed hand thinning of the shrub canopy should have virtually no direct effects on the Canada thistle at the site, but the increased light available post-thinning may indirectly benefit Canada thistle. This species is relatively shade-intolerant, and opening the canopy would release it from the effects of shading (Beck 2013). Treatment of this invasive species site would be carefully treated with direct application methods to prevent potential impacts to SNYLF.

Direct and Indirect Effects of Herbicide Treatments

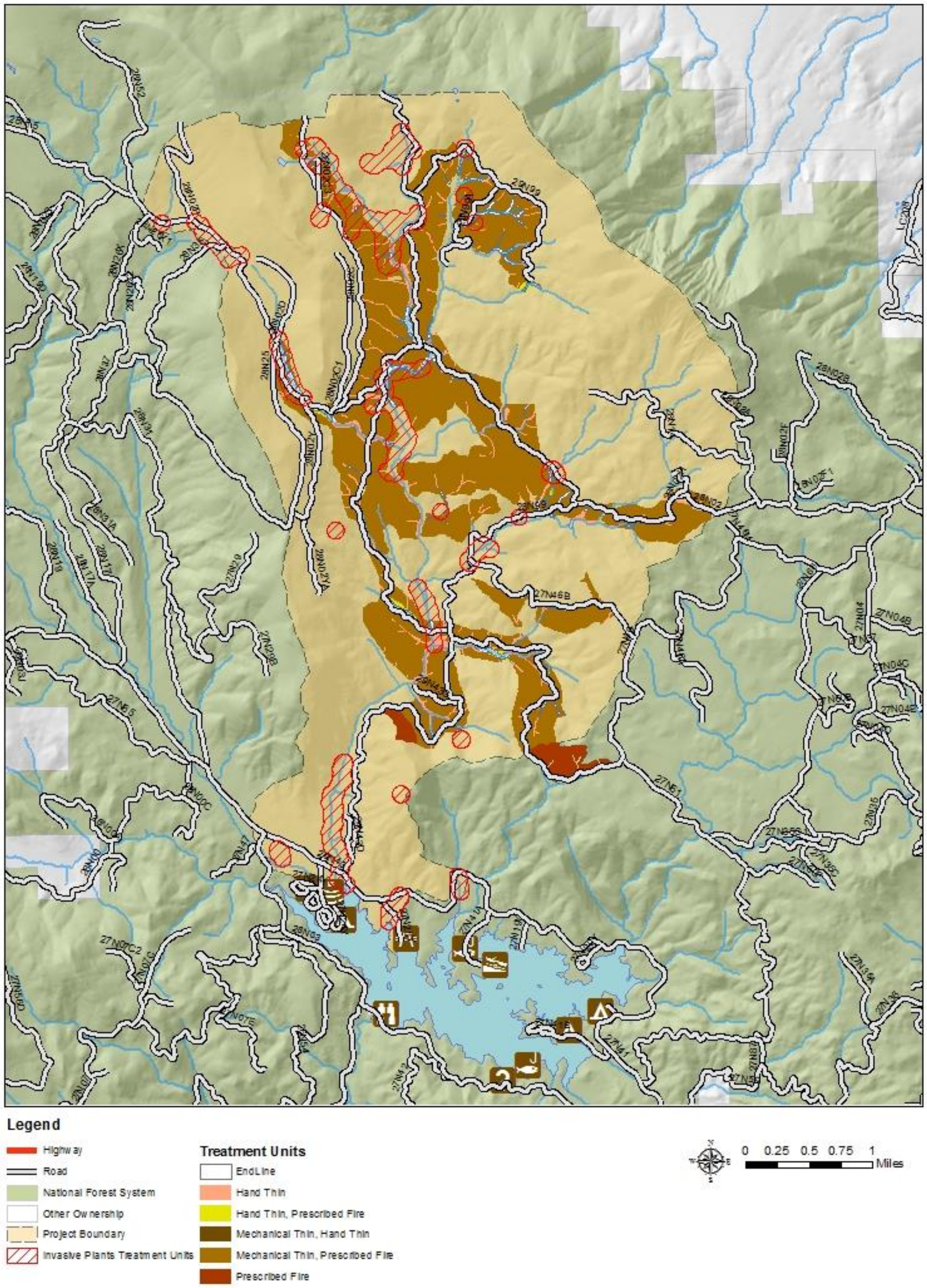
The proposed invasive species treatments, including herbicide and follow-up manual removal, are expected to eliminate or greatly reduce infestations of Canada thistle, medusahead, and jointed goatgrass within the Wildcat Project area. Indirect effects of invasive species treatment include a reduced risk of spread due to the decrease of available propagules within the Wildcat Project Area. Although the proposed herbicide treatments reduce the risk of spread of invasive species, the overall risk remains moderate – rather than low – due to the abundance of vectors and propagule sources outside the project area. Non-project related vectors include road use and maintenance, recreation, and grazing, all of which could spread invasive species to a previously-treated or previously un-infested area within the Wildcat area. In addition to the numerous vectors, there are also many invasive species locations outside the treatment area, especially in the Moonlight Fire footprint to the immediate west of the Wildcat Project area.

Alternative A – Proposed Action – Cumulative Effects

The effects of past forest management activities on invasive species in the Wildcat Project area is largely unknown. Targeted surveys for invasive species did not begin until relatively recently, and with the exception of two sites documented in 2001, all of the known infestations in the area were documented in 2005 or later. One well documented exception is the combined infestation of medusahead and jointed goatgrass near the outflow of Lost Creek into Antelope Lake, which was caused by past Forest Service activities. In addition, numerous Canada thistle infestations along roads and in old landings indicate that past land management activities had a significant effect on the distribution and abundance of invasive species in the Wildcat Project area.

As discussed above, proposed fuels, vegetation, and watershed improvement projects would indirectly increase the risk of spread and establishment of invasive species in the Botany Analysis Area via increased disturbance, reduced competition, and increased resource availability (sunlight). Ongoing (non-project related) activities in the project area such as recreation, grazing, OHV use, and road maintenance provide opportunity for dispersal and establishment of invasive species. However, adverse effects of ongoing activities would be mitigated by implementing the Standard Management Requirements listed in Table 4.

Implementing the proposed invasive species treatments also would reduce the risk of spreading invasive species by reducing or eliminating infestations that would act as propagule sources for further spread. The proposed action would overall create a lower risk of introduction and spread of invasive species than the no action alternative.


Legend
Highway
Road
National Forest System
Other Ownership
Project Boundary
Invasive Plants Treatment Units
Treatment Units
EndLine
Hand Thin
Hand Thin, Prescribed Fire
Mechanical Thin, Hand Thin
Mechanical Thin, Prescribed Fire
Prescribed Fire
0 0.25 0.5 0.75 1
Miles

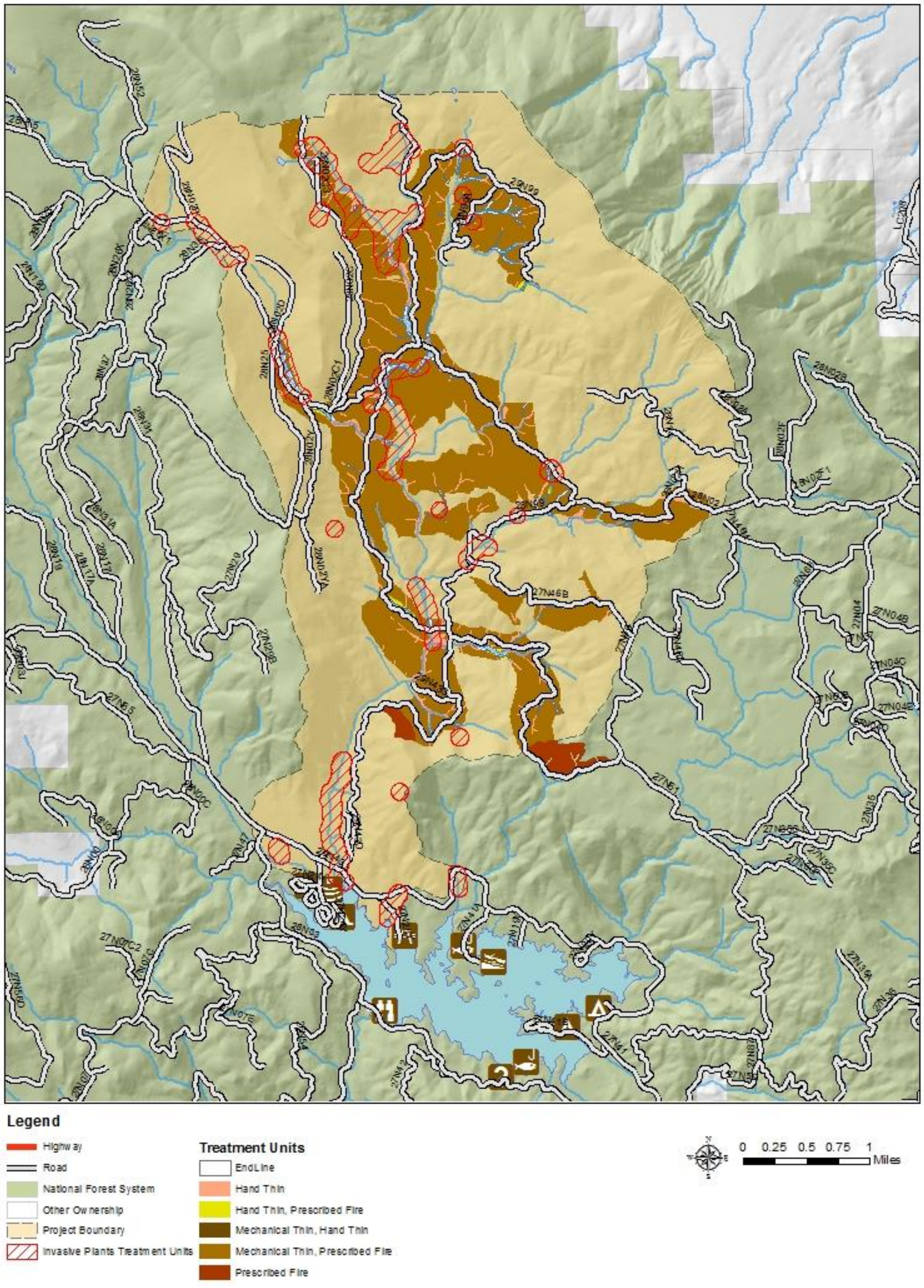


Figure 41. Locations of proposed invasive plant treatment units.

Figure 42. Table 4

Alternative B – No-Action – Direct and Indirect Effects

Under the No-Action alternative, the Plumas National Forest would continue limited manual invasive plant treatments on the medusahead and jointed goatgrass infestations to attempt to control the spread of these species further into the Wildcat Project area and surroundings. These efforts are not likely to eradicate these infestations. The numerous Canada thistle infestations will not be treated, and will thus continue to spread.

Because no project-related ground-disturbing activities will occur under the No-Action alternative, project activities will not directly spread invasive species, and no new disturbed habitat will be created for invasive species to colonize.

The indirect effects of the No-Action alternative will likely be an increase in the total infested acres as the size of each infestation increases and the species disperse to new areas. In addition, the lack of fuels and vegetation treatments will not reduce the potential risk of high severity wildfire. Fire-related disturbances are associated with increased risk of introduction and spread of invasive species, as well as decreased competition from native species. Roads that would be decommissioned or closed under the Proposed Action will remain open and serve as vectors for invasive species dispersal.

Alternative B – No-Action – Cumulative Effects

The effects of past forest management activities on invasive species in the Wildcat Project area is largely unknown. Targeted surveys for invasive species did not begin until relatively recently, and virtually all of the known infestations in the area were documented in 2005 or later. Past manual treatments of medusahead and jointed goatgrass have been moderately effective at containing those infestations, but these infestations are likely to persist and spread.

The No-Action alternative would not cause an increase in disturbed habitats available for invasive species colonization within the project area. Ongoing activities in the area (recreation, grazing, and road maintenance) would continue to create a high risk for invasive species introduction and spread in the project area. Road use and maintenance, recreational activities, and grazing all contribute to dispersal of invasive species even in the absence of project activities. Canada thistle, medusahead, and jointed goatgrass infestations within the project area will likely expand their current distributions, spreading to currently un-infested areas without treatment. Overall, the no action alternative would create a higher risk of introduction and spread of invasive species than the proposed action.

Compliance with the Forest Plan and Other Direction

The proposed action is consistent with the Forest Plan and other direction. An invasive plant species risk assessment has been completed for the project alternatives as required by the SNFPA ROD (USDA 2004), and the public will be informed of the potential risk and effects from the proposed project. The proposed action contains measures to prevent the introduction of invasive species, and contain, reduce, and eradicate established infestations; these measures meet the strategic objectives of the Forest Service Manual section 2900, Invasive Species Management (USDA 2011).

Cultural Resources

Introduction

This section provides an overview of cultural resources, description of cultural resources, and an introduction to programmatic agreement regarding cultural resources. In accordance with the National Historic Preservation Act of 1966, as amended, and the Programmatic Agreement (PA) among the USDA Forest Service, Pacific Southwest Region (Region 5), California State Historic Preservation Officer, Nevada State Historic Preservation Officer, and the Advisory Council On Historic Preservation, Regarding the Processes for Compliance with Section 106 of the National Historic Preservation Act for Management of Historic Properties by the National Forests of the Pacific Southwest Region (USFS 2013), a literature review, files search, and heritage resource inventory were conducted for the Wildcat Fuels Reduction and Vegetation Management Project (Wildcat Project) area.

The standard protection measures (SPMs) for cultural resource sites, located in Appendix E of the 2013 Region 5 Programmatic Agreement (USFS 2013), shall be implemented as appropriate for all subject undertakings managed under this PA. When these protection measures are effectively applied, the Forest will have taken into account the effect of these undertakings on historic properties. Isolated finds are by definition, not cultural resource sites, and therefore, do not require protection.

Effects Analysis Methodology

After an exhaustive existing literature review including historic General Land Office (GLO), mineral survey, homestead entry, and hard-copy atlas maps, Archaeological Reconnaissance Reports (ARR), and Archaeological Site Reports (ASR), it was determined that the prior cultural resource surveys in several areas of the Wildcat project were inadequate and these areas were re-surveyed.

While re-surveying the project area for cultural resources, a complete survey strategy was utilized. Transects were walked by individual surveyors at a spacing of 0-20 meters apart. Areas were selected for resurvey based upon the expected cultural sensitivity of the area. Sensitivity was inferred based on degree of slope, distance to water sources, and previously recorded cultural resources. The Plumas National Forest – Mt. Hough Ranger District Heritage Resources cultural resource site database, the Plumas National Forest slope layer, and the Antelope Lake, Diamond Mountain, and Kettle Rock topographic quad maps in ArcGIS were used to determine these resurvey areas. During this project a total of 105 acres within project unit boundaries were resurveyed for cultural resources in October, 2012 and November, 2013. Inventory was conducted between October 2, 2012 and October 10, 2012 by Miguel Jeffrey (Archaeological Technician, Mt. Hough Ranger District) and November 4 and 5, 2013 by Douglas Baughman (Assistant District Archaeologist, Mt. Hough Ranger District). Much of the survey area followed what was once Clark's Trail (05-11-52-150). The trail needed to be analyzed through the project area to determine if there would be any negative impacts caused by the proposed project.

An archaeological reconnaissance report was completed in July 2013, with an addendum to this report in February 2014 by Douglas Baughman . These reports are incorporated by reference, but are excluded from the public project record. The entire 3,057 acres of treatment units within the project area have been adequately surveyed. Five previously recorded sites were identified in the project area (05-11-52-150, 05-11-52-363, 05-11-52-470, 05-11-52-472, and 05-11-52-480). One cultural resource site was identified and recorded during the Wildcat field survey. This was 05-11-52-758, a Basque shepherd's camp with aspen carvings.

Affected Environment

Analysis Area

The cultural resource analysis area is the same geographic extent as the Wildcat Project area. The Area of Potential Effects (APE) for cultural resources is within the treatment units and within a 150-foot buffer of all project haul routes.

In addition to the previously mentioned Clark's Trail, fiveadditional sites exist within the Wildcat project treatment units. These are two prehistoric lithic scatters, a bedrock milling station, a historic Basque shepherd's camp with aspen carvings, and the remains of the historic Hallett Cabin. All of these cultural resources have been flagged for avoidance and will not be affected by the proposed project.

There are 100 proposed log landings within the Wildcat project area. Many of these proposed landings are on the edges of treatment unit boundaries. Cultural resource surveys were only completed within treatment unit boundaries and a 150-foot buffer on haul routes. At the time of the pre-operations meeting any proposed landing that will in whole or in part fall outside of the Wildcat project treatment units must be coordinated with Mt. Hough Ranger District Heritage Resource staff before approval can be given to use the landing. Heritage Resource staff will verify that the landing footprint has been adequately surveyed for cultural resources. If the landing has not been adequately surveyed, Heritage Resource staff must complete the survey before approval to use the landing is granted.

Environmental Consequences

Alternative B – No-Action – Direct and Indirect Effects

There would be no direct effects of the No-Action Alternative on cultural resources. None of the proposed activities would occur, only ongoing management activities other than those proposed for the Wildcat Project. Indirect effects on cultural resources include natural weathering and erosion over time of cultural resources. Failing to reduce hazardous fuels on and near cultural resources would put the resources at higher risk of adverse effects in the event of a catastrophic wildfire. These effects would include the fire itself and erosion due to lack of sufficient ground cover and other vegetation post-wildfire.

Alternative B – No-Action – Cumulative Effects

There are currently no additional projects proposed for the Wildcat project area. Due to this fact there would be no cumulative effects resulting from the No-Action Alternative.

Alternative A – Proposed Action – Direct and Indirect Effects

All known cultural sites are flagged with specific colored flagging and would be identified for avoidance during project implementation. By using a "flag-and-avoid" standard protection measure (USDA 2013) there would be no direct or indirect effects on cultural resources within the project area. The historic Clarks Trail (05-11-52-150) follows the National Forest System (NFS) road 28N99. Project design was modified so that NFS road 28N99, which was originally planned to be obliterated, would now be closed by placing boulders at both ends of the road to prevent motorized vehicle access.

Alternative A – Proposed Action – Cumulative Effects

There would be no cumulative effects resulting from the Proposed Action.

Figure 43. Historic artifact scatter from a Basque shepherd's camp found while resurveying a treatment unit.

Climate

Overview

Forests play a major role in the carbon cycle. The carbon stored in live biomass, dead plant material and soil represents the balance between CO2 absorbed from the atmosphere and its release through respiration, decomposition and burning. The increase of human emissions of carbon has further confounded the historical dynamics of the carbon cycle. These various fluxes in the carbon cycle have a short and long term effect on global and local climatic patterns (Solomon et al. 2009). In turn, these climate patterns affect forests through alteration of precipitation patterns, minimum, average and maximum temperatures and availability of carbon to forest vegetation for growth.

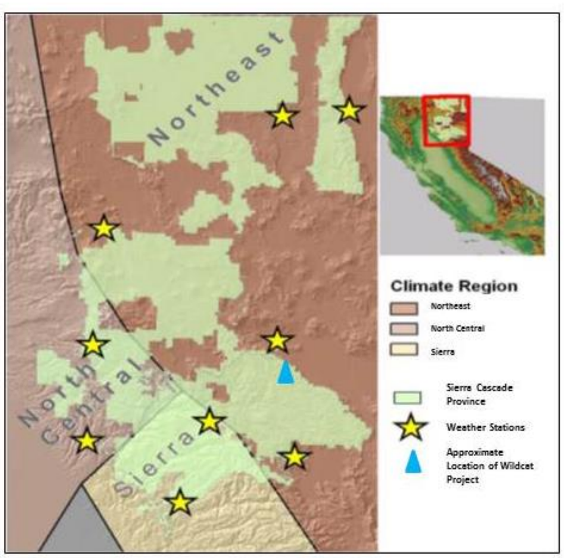
Over longer time periods, indeed as long as forests exist, they will function as both carbon sinks and sources. Complete quantifiable information about project specific effects on global climate change is not currently possible and is not essential to a reasoned choice among alternatives. However, based on climate change science, we can recognize and infer the relative effects of these treatments on the ecosystem carbon cycle, discuss likely trends that forests in the project area may face and discuss the relevant certainties as a result of the Wildcat Project.

General Trends in Climate Change

The majority of scientific research concerning climate trends indicates that climate has been changing since the 1950s and are "…unprecedented over decades to a millennia" (Pachauri et al. 2014). The International Panel on Climate Change (IPCC), the United Nations created leading international body for the assessment of climate change, attributes the main cause of this due to the increase in human activities which emit greenhouse gases such as the combustion of fossil fuels (2014). Although current General Circulation Models (GCM) used to simulate climate changes vary in their exact predictions, the general consensus is that the atmosphere and oceans have warmed, the amount of snow and ice has diminished and the average sea level has risen (Pachauri et al. 2014). Affects to the hydrologic cycle may be particularly long term and potentially irreversible with future altered and unpredictable precipitation patterns (Solomon et al. 2009). Changes to precipitation patterns are especially concerning to forested stands such as those in the Wildcat Project area as available moisture plays a fundamental role in the growth and health of forests and its resiliency to natural disturbances such as insects and wildfire.

Affected Environment

As part of the Forest Service and effort to manage and mitigate for climate change, the Forest Service Region 5 Ecology Program has summarized current and probable future climate trends for various forests, including the Plumas. The local report uses Western Regional Climate Center (WRCC) and Parameter-elevation Relationships on Independent Slopes Model (PRISM) datasets to quantify trends. The Wildcat Project is considered to be within the Northeast climate region (Figure 44). Temperature data for this climate region indicates that minimum, mean and maximum temperatures have significantly increased since 1895 (Merriam and Safford 2011). Precipitation in the same Northeast climate region has also shown a significant increase in variation as well (Merriam and Safford 2011). Merriam and Stafford (2011) noted that although total annual snowfall has not been compiled by the WRCC or PRISM datasets, the majority individual weather stations show marked decline in snowfall over the past century. The closest weather station to the Wildcat Project, Susanville, CA, shows over a 60 inch deficit between the earliest and most recent years' of total snowfall, as calculated using a regression equation (Merriam and Safford 2011).



Source: Merriam and Stafford 2011

Figure 44. Wildcat Project location in relation to Western Regional Climate Center climate regions (Merriam and Stafford 2011).

In general, regional trends suggest that the Northern Sierra Nevada may become generally warmer and wetter, with longer periods of prolonged summer drought. While warmer and wetter weather patterns may increase forest growth and carbon sequestration, warmer temperatures in combination with longer periods of prolonged summer drought will likely increase forest insect and disease outbreaks and the occurrence of high severity fire – disturbances which may result in increased carbon losses. A recent Forest Health Protection Aerial Detection Survey (USFS 2015a) has recently confirmed that due to a combination of overly dense stands and prolonged drought, tree mortality has generally increased in most areas, sometimes dramatically. Such high severity disturbances could result in type-conversion to shrublands in forested ecosystems that are not adapted to such disturbance patterns – which could drastically alter carbon cycles in the short and long term.

Fellows and Goulden (2008) found that the combination of fire suppression and past timber management practices has resulted in an increase in stem density of small trees in western mid-montane conifer forests while aboveground carbon stocks decreased due to the net loss of large trees. These dense stands are particularly vulnerable to disturbances and mortality during drought periods (Kolb et al. 1998, Smith et al. 2005 in Fellows and Goulden 2008). Fellows and Goulden (2008) suggest that large trees may be more likely to experience mortality than small trees during periods of drought. This trend was also observed by van Mantrem et al. (2009) who suggest that "regional warming and consequent increases in water deficits are likely contributors to the increase in mortality rates," and suggest that exogenous warming trends may be more of a driver of mortality, particularly in large diameter trees, than increasing stand density. Lutz et al. (2009) observed a decrease in large diameter trees, particularly in forests where fire was excluded and stand densities were high and the authors view increased water stress –either from climate change or increased stand densities- and suggest this trend may continue to increase with warming climate trends.

Environmental Consequences

Alternative B - No-action

Under the No-action Alternative, no restoration treatments would be implemented including activities designed to reduce improve forest health, increase landscape heterogeneity or educe forest fuels. As a result, these stands would remain at an elevated risk of wildfire (Table 10). As indicated in the Air Quality analysis section, a large wildfire has the potential to release high amounts of particulate emissions, including carbon. This has been observed in the recent Chips Fire (2012) and the adjacent Moonlight Fire (2007).

An increase in the proportion of high severity fire has been demonstrated for mixed-conifer forests throughout the Sierra Nevada (Miller et al. 2009). The Moonlight Fire and the Antelope Complex Fires, both of which burned in 2007 immediately adjacent and within close proximity to the project area, resulted in a large proportion of forested stands that burned with high severity resulting in nearly 100 percent basal area mortality of forest vegetation. Concerning high severity patch sizes, recent large wildfires are very different from presettlement fires with respect to the average sizes of patches of high severity fire within the fire perimeter. For those forests with fire regimes classified as fire regime I, high severity patches more than a few acres in size were unusual in fires in the Sierra Nevada before Euroamerican settlement (Show and Kotok 1924, Kilgore 1973, Stephenson et al 1991, Skinner and Chang 1996, Weatherspoon and Skinner 1996).

Miller et al. (2009) have also shown that the average size of high severity patches in Sierra Nevada wildfires has increased by about 100% over the last 25 years.

In the Moonlight and Antelope Complex fires, over 54,000 acres or 62 percent of the total area burned under high severity. This is equivalent to over 85 square miles that burned under high severity within a three month period resulting in 75 to100 percent basal area mortality of forest vegetation. While the occurrence of fire (including low, moderate and high severity fire) on the landscape is a natural disturbance that is essential to ecosystem function, the large scale of these fires, particularly the vast proportion that burned under high severity, are well outside the historical range of variability in fire size and severity experienced for the dry Sierra Nevada forests (Miller et al. 2009, Safford 2007, Safford et al. 2007, Beaty and Taylor 2007, Beaty and Taylor 2001, McKelvey et al. 1996, Weatherspoon 1996, Weatherspoon and Skinner 1996, Skinner and Chang 1996, McKelvey and Johnston 1992, Leiberg 1902,). The conversion of forested landscapes to one dominated by brush and other non-woody vegetation also reduces the potential for carbon sequestration (Townsend et al. 1996, Taylor and Lloyd 1992).

Alternative A - Proposed Action

Given the likely trends and stated uncertainties, some general relative discussion of effects can be concluded about the Proposed Action. With regards to Air Quality, emissions for all Alternative A are displayed in Table 13 of the Air Quality analysis of the Wildcat EA. Alternative A would have a short-term direct effect through emissions associated with project activities. These emissions include smoke, dust and greenhouse gases – particularly through the use of prescribed fire treatments, but also including pile burning and vehicle and equipment emissions utilized in implementation of treatments. Additionally, as stated in the Air Quality analysis, all project burning activities are managed and coordinated with the Northern Sierra Air Quality Management District. More importantly, Alternative A also implements treatments that would reduce the potential for future uncontrolled smoke/greenhouse gas emissions from wildfires by reducing available fuels within the project area.

Several studies have examined the trade-offs of fuel treatments in terms of treatment emissions, carbon storage and creating forest structure that is resistant to high severity disturbances (Stephens et al. 2009, North and Hurteau 2009, Hurteau and North 2010). Both North and Hurteau (2009) and Stephens et al. (2009) found that while untreated forests stored more carbon, these dense, homogeneous forests were more at risk for high-severity fire. Both studies suggest that low density stands dominated by large fire-resistant pines created by fuel treatments best protect carbon stocks in forests that have an active fire disturbance regime. These studies and subsequent studies (Hurteau and North 2010) found that while fuel treatments did initially produce emissions and reductions in carbon stock, these treatments increase growth and carbon sequestration of residual trees which could recover these losses within a decade or more of growth. As indicated in the Forest Vegetation analysis, mechanically thinned units are projected to exhibit much greater diameter increases over time as compared to the No-action Alternative (Table 27). Preventing the conversion of forests to brush lands is also important in maintaining the landscape as a carbon sink (Townsend et al. 1996, Taylor and Lloyd 1992). In addition, the conversion of removed trees into long term use and durable timber products further sequestered carbon (Skog and Nicholson 1998, Markewitz 2006). Furthermore, like Stephens et al. (2009), North and Hurteau (2009), and Hurteau and North (2010), Markewitz (2006) also concluded that the net sequestration of carbon still occurred after treatment emissions were factored into the analysis. Millar et al. (2007) also indicates that treatments which physically remove densities of small trees for energy generation (biomass fuels) or long-term sequestration (sawlogs) may minimize net carbon release. Given the anticipated increase in large wildfires in California

(Miller et al. 2009, Westerling and Bryant 2008) and the estimated decrease in forest growth and yield under predicted climate change (Battles et al. 2008, Calif. Climate Action Team, 2009), the action alternatives propose beneficial treatments that would maintain forested conditions which are an essential component of the ecosystem carbon cycle. Consequently, this suggests that those alternatives that include more mechanical treatment in combination with prescribed fire rather than relying on prescribed fire only to reduce stand density may be more beneficial in managing emissions and carbon sequestration.

Battles et al. (2008) evaluated the impacts of climate change on the mixed-conifer region in California and provide insight to forest health concerns and management implications for forest managers. This study found that changes in climate could “exacerbate forest health concerns” by increasing weakened tree susceptibility to mortality as a result of fire, disease epidemics and insect outbreaks and potentially enabling forest insects and disease to expand ranges or increase potential for widespread damage. The authors suggest that forest management strategies that increase species diversity, promote heterogeneity and create lower density stands would be effective in providing “structures that are more resilient to catastrophic events like fire and epidemics” (Battles et al. 2008). McDowell et al. showed (2003) that reductions in stand density have a favorable growth effect on old-growth ponderosa pine which may reduce their susceptibility to drought induced mortality. Many of these concepts have been incorporated into the silvicultural prescriptions of Alternative A that emphasize reduction in general stand density while emphasizing structural, spatial and species heterogeneity (Table 2).

In addition recent occurrences of large scale bark beetle outbreaks have been linked to recent drought periods that have affected areas in the Southern California Mountains and in the Lake Tahoe Area (Ferrell et al. 1994, Guarin and Taylor 2005, Macomber and Woodock 1994). Such disturbances that result in abnormally large levels of mortality may often occur in complexes with forest diseases such as Heterobasidion root disease (Ferrell 1996) and these disturbances have the potential to affect fuels dynamics, potential fire behavior and resulting future forest structure and composition. Such warming trends may lead to the reproductive and overwintering success of forest pathogens and insects, thereby increasing their severity, while prolonged summer droughts, exacerbated by high stand densities, mistletoe and root disease infection, will likely lead to increased moisture stress and decreased health and vigor of forest trees making them more susceptible to mortality from such pathogens and insects (Battles et al. 2008). Indeed, all these conditions have been recently found and documented in the Wildcat Project by the Northeastern California Forest Service entomologist (USDA 2014i).

In addition reforestation treatments proposed in Alternative A would use native seed source from appropriate elevations with the anticipated effects of climate change on forests in mind. Species native to the ecological forest type would be inter-planted within eastside pine stands. The species mix to be planted would be shade-intolerant species including ponderosa and Jeffrey pine and rust-resistant sugar pine– all drought tolerant and fire adapted species. Elevation guidelines for seedling location would prevent seedlings from being planted more than 500 ft lower in elevation from the parent tree, but would allow seedlings to be planted up to 1000 ft higher in elevation from the parent tree. This would address elevational rises of forest communities/ecotones as a result of changing climate trends.

All of these previously cited studies indicate that forest vegetation treatments, such as those in the Wildcat Proposed Action, create low density stands and retain large diameter pines may be the best strategy in creating forest resilience to disturbances and to changing climate trends. These desired conditions include generally lower density open canopy stands of large residual trees which have both components of vertical and horizontal heterogeneity characterized by open gaps and clusters of variable densities which contribute to heterogeneity at multiple scales. It should be recognized that historically this forest structure is likely developed through multiple disturbances over time that varied in intensity and extent. However, the proposed treatments are the first step in the restoration process and that provide the greatest reduction of stand density, create the greatest amount of change in species composition and best enhance growth, would fully meet the project purpose and need and best promote restoration and re-alignment efforts in the face of climate change.

Legal Regulatory Compliance and Consultation

The Mt. Hough Ranger District operates under a diverse array of local, state and federal management guidance and policy as well as various executive orders.

Currently, the Mt Hough Ranger District is guided by the Plumas National Forest 1988 Land and Resource Management Plan (LRMP, USDA 1988a) as amended by the 2004 Sierra Nevada Forest Plan Amendment (SNFPA) supplemental EIS and ROD (USDA 2004 a,b).

Principle Environmental Laws

National Environmental Policy Act

The Council on Environmental Quality (CEQ) regulations for implementing the National Environmental Policy Act (NEPA) requires that federal agencies rigorously explore and objectively evaluate all reasonable alternatives and briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 Code of Federal Regulations [CFR] 1502.14).

The Wildcat EA meets the CEQ regulations requiring public scoping and a thorough analysis of issues, alternatives and effects.

National Forest Management Act

The National Forest Management Act (NFMA) reorganized, expanded and otherwise amended the Forest and Rangeland Renewable Resources Planning Act of 1974, which called for the management of renewable resources on national forest lands. The NFMA Act requires the Secretary of Agriculture to assess forest lands, develop a management plan for each unit of the National Forest System (NFS).

The Forest Service is complying with the provisions of this law by designing the project to meet the Standards and Guidelines of the Plumas National Forest Land and Resource Management Plan (USDA 1988a) and its amendments.

Endangered Species Act

The Endangered Species Act of 1973 (16 USC 1531 et seq.) requires that any action authorized by a federal agency not be likely to jeopardize the continued existence of a threatened or endangered species (TES), or result in the destruction or adverse modification of habitat of such species that is determined to be critical. Section 7 of the ESA, as amended, requires the responsible federal agency to consult with the United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service concerning TES under their jurisdiction. It is Forest Service policy to analyze impacts to TES to ensure management activities are not likely to jeopardize the continued existence of a TES, or result in the destruction or adverse modification of habitat of such species that is determined to be critical. This assessment is documented in a Biological Evaluation for Terrestrial and Aquatic Wildlife (USDA 2015) and a Biological Evaluation of Potential Effects to TES and Sensitive Plant Species (USDA 2013d) and is summarized and incorporated by reference in Chapter 3.

Wildlife and Fisheries

Consultation with USFWS is required where endangered, threatened, candidate species, or their critical habitat may be affected by a proposed federal action. Section 7 consultation with the USFWS is required for the Wildcat Project. A list of TES species was provided by the Federal Endangered and Threatened Species that may be affected by Projects on the Plumas National Forest, updated April 14, 2015, accessed via USFWS county list web page on April 14, 2015 (http://www.fws.gov/sacramento/ES_Species/Lists/es_species_lists_NF-action-page.cfm) and was used for analysis. Based on the analysis conducted in the BA/BE, it was determined that short term impacts from the proposed restoration activities may affect, and is likely to adversely affect Sierra Nevada yellow-legged frogs, their habitat, and proposed critical habitat, with multiple long term benefits to the species and its habitat. Therefore consultation (written concurrence) under Section 7 of the Endangered Species Act of 1973, as amended is required. No other TE species would be affected by the Wildcat Project.

Botany

The latest US Fish and Wildlife Service (USFWS) plant species list for Plumas County, in which the project occurs, was updated on November 6, 2013, and incorporates the database update of October 29, 2013 (USDI 2013b). This list is available in the project record and fulfills the requirements to provide a current species list pursuant to Section 7(c) of the Endangered Species Act, as amended. No federally listed plant species are known to occur within the Wildcat project area.

Consultation to Date

The Forest Service collaborated with U.S. Fish and Wildlife Service to develop the Wildcat Fuels Reduction and Vegetation Management Project. Fish and Wildlife Service provided technical assistance on this restoration project during a site visit on June 4, 2014. Forest Service requested additional technical support from Fish and Wildlife Service in April 2015 and formal consultation was requested on June 19, 2015. Fish and Wildlife Service joined the Forest Service for a second site visit on September 23, 2015. During these, and other phone and in person, meetings it was agreed that short term impacts from the proposed restoration activities may affect, and is likely to adversely affect Sierra Nevada yellow-legged frogs, their habitat, and proposed critical habitat, with multiple long term benefits to the species and its habitat. The Fish and Wildlife Service is in the process of preparing a Biological Opinion as part of our request for consultation under section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.) (Act). This decision will not be signed until we receive a Biological Opinion from Fish and Wildlife Service and conclude formal consultation.
Project specific analysis and mitigation measures determined that the proposed action may affect, and is likely to adversely affect because:

1. Project design features, such as equipment exclusion zones (TKO - tractor keep out), limited operating periods in riparian conservation areas, and prescribed burning restrictions would mediate potential effects to Sierra Nevada yellow-legged frogs.

2. Creation of a network of fuel reduction areas designed to reduce the loss of habitat caused by large stand replacing wildfire;

3. Meeting RCA Standard Operating Procedures in compliance with Riparian Conservation Objectives would safeguard against any increased sedimentation that could have short-term effects on SNYLF.

4. Implementation of a limited operating period near all historical occupied sites would further mitigate potential adverse impacts to the Sierra Nevada yellow-legged frog [no activity from October 1, or the first wetting rain (more than ¼ inch precipitation), until April 15th within a stream mile of SNYLF's detection (USDA 1988a, as amended by the SNFPA, USDA 2004a,b)].

5. Treatment of invasive plants with herbicides would be restricted within 500 feet of occupied streams. Direct spray may would be allowed between 107 feet and 500 feet from occupied sites where site specific treatment is analyzed and determined to have no or negligible risk. Select treatment methods, such as wicking herbicide directly onto plant leaves or use of low pressure hand sprayers, would be required where overspray may enter water bodies and when amphibians may be present. Select methods would be required where and when direct spray of frogs is possible. Herbicide methods, restrictions and LOPs would be incorporated into site specific invasive plant treatment cards.

The Fish and Wildlife Service is in the process of preparing a Biological Opinion as part of our request for consultation under section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*.) (Act). The Decision Notice for the EA will not be signed until we receive a Biological Opinion from Fish and Wildlife Service and conclude formal consultation.

Clean Water Act

The Forest Service is complying with the provisions of the Clean Water Act as it pertains to the Wildcat Project. Section 208 of the Clean Water Act requires States to prepare nonpoint source pollution plans that are to be certified by the State and approved by the United States Environmental Protection Agency (EPA). In response to this law, and in coordination with the State of California Water Quality Resources Control Board and EPA, the Forest Service, Region 5, began developing best management practices (BMPs) in 1975 for water quality management planning on National Forest System lands in California. This process identified the need to develop a BMP for addressing the cumulative off-site watershed effects of forest management activities on the beneficial use of water.

Section 303(d) of the Clean Water Act requires the identification of water bodies that do not meet, or are not expected to meet, water quality standards or are considered impaired. The list of affected water bodies, and associated pollutants or stressors, is provided by the State Water Resources Control Board and approved by the United States Environmental Protection Agency. No water bodies on this list are located within or immediately adjacent to the Wildcat Project area.

The Wildcat Project meets this through the incorporation of project design features (Table 2, Table 3, and Table 4), Riparian Conservation Area (RCA) designations (Table 5 and Table 6), soil standards and guidelines (PNF LRMP, pages 4-43 – 4-45); and best management practices, standard management requirements, and monitoring listed in Appendix C. Refer to the Hydrology and Soils Environmental Consequences section for a discussion of environmental consequences.

Alternative A includes treatments for improving National Forest System (NFS) roads. Treatments range from light brushing with no drainage improvements to heavy brushing and large drainage improvements. Refer to Chapter 3, Hydrology and Soils, Environmental Consequences section for a discussion of effects.

Clean Air Act

The Clean Air Act of 1970, as amended in 1977 and 1990, is the comprehensive federal law that regulates air emissions from stationary and mobile sources. Among other things, this law authorizes the Environmental Protection Agency Office of Air Quality Planning and Standards to establish National Ambient Air Quality Standards to protect public health and public welfare and to regulate emissions of hazardous air pollutants. Many aspects of the implementation, monitoring and enforcement of the Clean Air Act are delegated to the States. In this area, the Northern Sierra Air Management District regulates Forest Service burning operations and has the final say on setting burning parameters. The District is required by state law to achieve and maintain federal and state Ambient Air Quality Standards, which are air quality standards set at levels that will protect the public health.

National Historic Preservation Act

Section 101 of the National Environmental Policy Act (NEPA) requires the federal government to preserve important historic, cultural and natural aspects of our natural heritage. To accomplish this, federal agencies utilize the Section 106 process of the National Historic Preservation Act (NHPA). This process has been codified in 36 CFR 800 Subpart B. The coordination or linkage between the Section 106 process of the NHPA and the mandate to preserve our national heritage under NEPA is well understood and is formally established in 36 CFR 800.3b and 800.8. Locally, the Plumas National Forest uses a programmatic agreement (PA) between Region 5 of the US Forest Service, the California State Historic Preservation Officer and the Advisory Council on Historic Preservation to implement the Section 106 process (USDA 2001c).

Consultation with Federally recognized tribes and local Native American communities and/or interested parties was initiated in accordance with the *Programmatic Agreement Among the USDA Forest Service, Pacific Southwest Region (Region 5), California State Historic Preservation Officer, Nevada State Historic Preservation Officer, and the Advisory Council on Historic Preservation Regarding the Process for Compliance with Section 106 of the National Historic Preservation Act for Management of Historic Properties by the National Forests of the Pacific Southwest Region* (USDA 2013a), National Historic Preservation Act, and other laws and regulations. The PA requires that the Forest take into account the potential effects of projects and activities on cultural resources, prior to initiating any actions that could affect those properties (USDA 2001c).

This project has been surveyed in accordance with the National Historic Preservation Act of 1966, as amended, and it’s implementing regulations (36 CFR 800) and the 2013 Region 5 Programmatic Agreement.

Based on project redesign on Clark’s Trail (NFS road 28N99), use of the flag-and-avoid SPM on the existing cultural resources and the lack thereof within the remaining Wildcat project treatment units there will be no impacts to cultural resources and the proposed activities would not preclude any of these unevaluated cultural resources from being listed or eligible for listing on the National Register of Historic Places (NRHP).

By using “flag-and-avoid” SPM’s as authorized by the 2013 Region 5 Programmatic Agreement (USFS 2013) there will be no direct or indirect effects on cultural resources within the project area and this project will be in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended and its implementing regulations (36 CFR 800).

Executive Orders

Consultation and coordination with Indian Tribal governments, Executive Order 13175 of November 6, 2000

The following tribes were consulted during the NEPA scoping phase of the Wildcat Project on January 25, 2014 and during the 30-day comment period on April 23, 2015:

- Concow Maidu Tribe of Mooretown Rancheria
- Estom Yumeka Maidu Tribe of Enterprise Rancheria
- Greenville Rancheria
- Mechoopda Indian Tribe of Chico Rancheria
- Susanville Indian Rancheria
- Tyme Maidu Tribe of Berry Creek Rancheria
- Maidu Summit Consortium

Indian Sacred Sites, Executive Order 13007 of May 24, 1996

Through scoping and consulting with local Native American tribes, it was determined that there were no known Indian sacred sites in the Wildcat Project.

Invasive species, Executive Order 13112 of February 3, 1999

Executive Order 13112 created the Invasive Species Council (ISC) in order to prevent the introduction of invasive species, provide for their control and minimize the economic, ecological and human health impacts that invasive species cause. Federal agencies are required to:

- Identify actions that may affect the status of invasive species
- Use relevant programs and authorities to prevent the introduction, control and monitoring of invasive species
- Provide for native species restoration as well as their habitats
- Promote public information
- Not condone or carry out actions that may spread invasive species
- Consult with the ISC and other stakeholders as appropriate

The Wildcat Project meets the Executive Order by following the noxious weed management Standards and Guidelines in Appendix A of the ROD for SNFPA (USDA 2004b). The SNFPA guidelines direct proactive management of noxious weeds that meet with the Executive Order.

District botanists carried out the intent of the Executive Order and the noxious weeds Standards and Guides by:

- Identifying and controlling invasive plant infestation areas
- Preventing the spread of noxious weeds through SOPs and site specific mitigation
- Educating the public regarding the presence and spread of noxious weeds

Floodplain management, Executive Order 11988 of May 24, 1977 and Protection of Wetlands, Executive Order 11990 of May 24, 1977

Executive Orders 11988 and 11990 require Federal agencies to avoid, to the extent possible, short- and long-term effects resulting from the occupancy and modification of flood plains and the modification or destruction of wetlands. These executive orders provide for protection and management of floodplains and wetlands. They are intended to preserve the natural and beneficial values served by floodplains and wetlands.

The Wildcat Project meets these executive orders by incorporating project riparian conservation objectives (Appendix B); adhering to the Riparian Conservation Area (RCA) designations (Appendix C), (USDA, 2004); and implementing best management practices, standard management requirements (Appendix C), and project design criteria (Table 2, Table 3, Table 4, Table 5, and Table 6.) By using BMPs, the Wildcat Project meets the executive orders according to the SNFPA ROD (USDA 2004b, Section VII).

Environmental Justice, Executive Order 12898 of February 11, 1994

Executive Order 12898 requires that Federal agencies make achieving environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health and environmental effects of their programs, policies and activities on minority and low-income populations.

Although low-income and minority populations are within the vicinity of the Wildcat project area, activities associated with the Project would not discriminate against them. Proposed activities would not adversely affect community, social, economic and health and safety factors. Public scoping was conducted in accordance with NEPA regulations to identify any potential issues or hazards associated with the Ingalls Project.

Special Area Designations

The selected alternative will need to comply with laws, regulations and policies that pertain to the following special areas:

Research Natural Areas

There are no Research Natural Areas within the Wildcat project area.

Wilderness Areas

There are no Wilderness Areas within the Wildcat project area.

Inventoried Roadless Areas

There are no Inventoried Roadless Areas within the Wildcat project area.

Wild and Scenic Rivers

There are no Wild and Scenic Rivers within the Wildcat project area.

Municipal Watersheds (FSM 2540)

There are no Municipal Watersheds within the Wildcat project area.

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:

FEDERAL, STATE, AND LOCAL AGENCIES:

Indian Valley Chamber of Commerce

Plumas-Sierra Counties Department of Agriculture

Plumas County Board of Supervisors

Lassen County Fire Safe Council

Feather River Land Trust

California Department of Forestry and Fire Protection

Sierra Institute for Community and Environment

Northern Sierra Air Quality Management District

U.S. Fish and Wildlife Service

California Department of Fish and Game

Feather River Resource Conservation District

California Department of Food and Agriculture

Plumas County Environmental Health Department

Bureau of Land Management

Central Valley Regional Water Quality Control Board

Chester/Lake Almanor Chamber of Commerce

Crescent Mills Fire Department

Quincy Department of Public Works

California Department of Water Resources

Indian Valley Community Services District

U.S. EPA

Indian Valley Fire and Rescue

Plumas County Road Department

USDA Natural Resource Conservation Service

California Fisheries and Water Unlimited

Lassen County Board of Supervisors

TRIBES:

Concow Maidu Tribe of Mooretown Rancheria

Estom Yumeka Maidu Tribe of Enterprise Rancheria

Greenville Rancheria

Mechoopda Indian Tribe of Chico Rancheria

Susanville Indian Rancheria

Tyme Maidu Tribe of Berry Creek Rancheria

Maidu Summit Consortium

OTHERS:

A complete list of interested parties who received project information for the scoping and comment periods is available in the project record at the Mt. Hough Ranger District, Quincy, California. The list is not included in this EA to reduce paper, the EA's length, and file size.

References

Almquist, T.L. and R.G. Lym. 2010. Effect of Aminopyralid on Canada Thistle (Cirsium arvense) and the Native Plant Community in a Restored Tallgrass Prairie. *Invasive Plant Science and Management*, 155-168.

Arroyo-Cabrales, J. and de Grammont, P.C. 2008. Antrozous pallidus. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. <www.iucnredlist.org>. Downloaded on 03 April 2013.

Bakke, D. 2007. Analysis of Issues Surrounding the Use of Spray Adjuvants with Herbicides. Pacific Southwest Regional Pesticide Use Specialist.

Bales, Roger C. 2011. Soil moisture response to snowmelt and rainfall in a Sierra Nevada mixed-conifer forest. *Vadose Zone*.

Battles, J. J., Robards, T., Das, A., Waring, K., Gilless, J. K., Biging, G., & Schurr, F. 2008. Climate change impacts on forest growth and tree mortality: a data-driven modeling study in the mixed-conifer forest of the Sierra Nevada, California. Climatic Change, 87(1), 193-213.

Beaty, R. M., & Taylor, A. H. 2001. Spatial and temporal variation of fire regimes in a mixed conifer forest landscape, Southern Cascades, California, USA. Journal of Biogeography, 28(8), 955-966.

Beaty, R. M., & Taylor, A. H. 2007. Fire disturbance and forest structure in old-growth mixed conifer forests in the northern Sierra Nevada, California. Journal of Vegetation Science, 18(6), 879-890.

Beck, K.G. 2013. Canada Thistle - Fact Sheet No. 3.108. Fort Collins, CO: Colorado State University Extension.

Blakesley, J.A., M.E. Seamans, M.M. Conner, A.B. Franklin, G.C. White, R J. Gutiérrez, J. E. Hines, J.D. Nichols, T.E. Munton, D.W.H. Shaw, J.J. Keane, G.N. Steger, and T.L. McDonald. 2010. Population Dynamics of Spotted Owls in the Sierra Nevada, California. Wildlife Monographs 174:1-36.

Bland, J.D. 2006. Features of the Forest Canopy at Sierra Sooty Grouse Courtship Sites, Summer 2006. Calif. Dept. Fish & Game Contract No. S0680003.

Bloom, P.H., G.R. Stewart and B.J. Walton. 1986. The status of the northern goshawk in California, 1981-1983. State of California, The Resources Agency, Department of Fish and Game, Wildlife Management Branch, Administrative Report 85-1. 26pp.

Bossard, C.C., J.M. Randall, and M.C. Hoshovsky. 2000. Invasive Plants of California's Wildlands. Berkeley, CA: University of California Press.

Boyt, 2011. The Department of Water Resources, Northern Region Office; 2009 Antelope Lake Surveys, Jessica Boyt.

Bradford, D.F. 1984. Temperature modulation in a high-elevation amphibian, Rana muscosa. Copeia 1984(4): 966-976.

Buchalski, M.R., J.B. Fontaine, P.A. Heady, J.P. Hayes and W.F. Frick. 2013. Bat response to differing fire severity in mixed-conifer forests, California. PLoS ONE 8(3): e57884. Doi:10.1371/journal.pone.0057884

Burnett, R.D. and A.M. Fogg. 2011. PRBO Northern Sierra 2010 Aspen and Meadow Monitoring Reports. PRBO Conservation Science Contribution Number 1813. 48pp.

Burnett, R.D. and L.J. Roberts. 2015. A quantitative evaluation of the conservation umbrella of spotted owl management areas in the Sierra Nevada. PLoS ONE 10(4):e0123778. Doi: 10.1371/journal.pone.0123778

Campos, B.R. and R.D. Burnett. 2014. Avian Reponse to Mechanical Aspen Restoration in Sierra Nevada Coniferous Forest. Restoration Ecology, The Journal of the Society for Ecological Restoration. Doi: 10.11111/rec.12114.

Climate Action Team (2009) Climate action team biennial report to the governor and legislature. Sacramento, California

CA Soil Survey Committee. 1989. Computation of EHR.

Cafferata et al. 2007. "Water Resource Issues and Solutions for Forest Roads in California." *Hydrological Science and Technology*, 2007: 5-22.

Cal-IPC 2006. California Invasive Plant Inventory (Publication 2006-02). California Invasive Plant Council.

Carlton, D. 2004. Fuels Management Analyst Plus Software, Version 3.8.19. Fire Program Solutions, LLC, Estacada, Oregon.

Cawley, K. "Black Mountain/Granite Mudflow." Forest Service Memo to Milford District Ranger, Milford, 1990.

CDFA 2009. Pest Ratings of Noxious Weed Species and Noxious Weed Seed. Sacramento, CA: State of California, Department of Food and Agriculture.

CEQ 1971. "Council on Environmental Quality Guidelines, 40 CFR 1508.7." 1971.

Cluck, Danny. 2014. Insect and Disease Evaluation of the Wildcat Project (FHP Report NE14-02).

Collins. B.M., and S.L. Stephens. 2010. Stand-replacing patches within a 'mixed severity' fire regime: quantitative characterization using recent fires in a long-established natural fire area. Landscape Ecology 25(6):927-939.

Collins, B. M., and S. L. Stephens. 2012. Fire and fuels reduction. Managing Sierra Nevada Forests. US Department of Agriculture, Forest Service. Pacific Southwest Research Station, Albany, CA (2012): 1-12.

Congress 1966. *National Historic Preservation Act (NHPA), as amended through 2006*. United States Government, Washington D.C. http://www.achp.gov/nhpa.html

Damm 2013. Royal Elk Park Management 2013 Year End Use Report, Adam Damm.

D'Antonio, C. M. 2000. Fire, plant invasions, and global changes. Pages 65-93 in H. A. Mooney and R. J. Hobbs, editors. Invasive species in a changing world. Island Press, Covelo, California, USA.

Davies, K.W., A.M. Nafus, and D.D. Johnson. 2011. Interim Medusahead Management Guide for the Intermountain West. Burns, OR: USDA - Agricultural Research Service.

DeStefano, S., S.K. Daw, S.T. Desimone and E.C. Meslow. 1994. Density and productivity of northern goshawks: Implications for monitoring and management. Studies in Avian Biology 16:88-91.

Donald, W.W. and A.G. Ogg. 1991. Biology and Control of Jointed Goatgrass (Aegilops cylindrica), a Review. *Weed Technology*, 3-17.

Dunk, J.R., J.J. Keane, A.E. Bowles, T. Narahashi, D.L. Hansen, S. Vigallon, and J.J.V.G. Hawley. 2011. Experimental Effects of Recreation on Northern Goshawks. Final Report.

DWR 2014. Department of Water Resources. *California Data Exchange Center.* April 22, 2014. http://cdec.water.ca.gov/cgi-progs/staMeta?station_id=ANT (accessed 2004-2013).

Erickson et al. 1985. "Decomposition of logging residues in Douglas-fir, western hemlock, Pacific silver fir, and pnderosa pine ecosystems." *Canadian Journal of Forest Research*, 1985: 914-921.

Fellers, G. M. and K.L. Freel. 1995. A Standardized Protocol for Surveying Aquatic Amphibians. Technical Report NPS/WRUC/NRTR-95-01. National Biological Service Cooperative Park Studies Unit, University of California Division of Environmental Studies, Davis, California. 117 pp.

Fellows, A. W., & Goulden, M. L. 2008. Has fire suppression increased the amount of carbon stored in western US forests?. Geophysical Research Letters, 35(12).

Ferrell, G. T., Otrosina, W. J., & Demars Jr, C. J. 1994. Predicting susceptibility of white fir during a drought-associated outbreak of the fir engraver, Scolytus ventralis, in California. Canadian Journal of Forest Research, 24(2), 302-305.

Ferrell, G. T. 1996. The influence of insect pests and pathogens on Sierra forests.

Fites-Kaufman, J.A., Rundel, P., Stephenson, N. & Weixelman, D.A. 2007. Montane and subalpine vegetation of the Sierra Nevada and Cascade ranges. In: Terrestrial Vegetation of California, 3rd edn (eds Barbour, M.G., Keeler-Wolf, T. & Schoenherr, A.A.), University of California Press, Berkeley, CA, pp. 456–501.

Franklin, A. B., R. J. Gutiérrez, J. D. Nichols, M. E. Seamans, G. C. White, G. S. Zimmerman, J. E. Hines, T. E. Munton, W. S. LaHaye, J. A. Blakesley, G. N. Steger, B. R. Noon, D. W. H. Shaw, J. J. Keane, T. L. McDonald, and S. Britting. 2004. Population Dynamics of the California Spotted Owl (Strix occidentalis occidentalis): A Meta-Analysis. Ornithological Monographs 54:56.

Franklin, J.F., and Fites-Kaufmann, J., 1996. Assessment of late-successional forests of the Sierra Nevada. In: Sierra Nevada Ecosystem Project, Final Report to Congress, Vol. II. University of California, Water and Wildlands Resources Center, Davis, CA, pp. 627–657

Gallagher, C. V. (2010). Spotted Owl Home Range and Foraging Patterns Following Fuels-Reduction Treatments in the Northern Sierra Nevada, California (Doctoral dissertation, University of California, Davis).

Garcia and Associates (GANDA). 2009. 2009 Annual Noxious Weed Control Monitoring Report Addressing License Condition No. 27. Rock Creek–Cresta Hydroelectric Project FERC No. 1962. Prepared for PG&E. Dated October 2009.

Garcia and Associates (GANDA). 2010. 2010 Annual Noxious Weed Control Monitoring Report Addressing License Condition No. 27. Rock Creek–Cresta Hydroelectric Project FERC No. 1962. Prepared for PG&E. Dated October 2010.

Grigal, D.,. "Effects of extensive forest management on soil productivity." *Forest Ecology and Management* (F), 2000: 167-185.

Guarín, A., & Taylor, A. H. (2005). Drought triggered tree mortality in mixed conifer forests in Yosemite National Park, California, USA. Forest Ecology and Management, 218(1), 229-244.

Gutiérrez, R.J. 2012. Personal communication. Department of Fisheries, Wildlife and Conservation Biology, Universtity of Minnisota.

Hayes, J.P. and S.C. Loeb. 2007. The influences of Forest Management on Bats in North America *in* Bats in Forests Conservation and Management. Johns Hopkins University Press, Baltimore, Maryland. 335 pp. Helms, John A, and Mark A Rutter. "Tree Physiology as a basis for better Silviculture." *California Agriculture*, 1979: 12-13.

North, M., Hurteau, M., & Innes, J. 2009. Fire suppression and fuels treatment effects on mixed-conifer carbon stocks and emissions. Ecological applications, 19(6), 1385-1396.

Hurteau, M. D., & North, M. 2010. Carbon recovery rates following different wildfire risk mitigation treatments. Forest Ecology and Management, 260(5), 930-937.

Pachauri, R. K., Allen, M. R., Barros, V. R., Broome, J., Cramer, W., Christ, R., ... & van Vuuren, D. (2014). Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

Jennings, M.R. and M.P. Hayes. 1994. Amphibian and reptile species of special concern in California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, CA. Contract #8023 Final Report. 255pp.

Keane, J., Conner, M., Gallagher, C.V., Gerrard, R.A., Jehle, G., Shaklee, P. 2011. Spotted Owl Module Plumas Lassen Study 2011 Annual Report. USDA, Forest Service Pacific Southwest Research Station.

Keane, J. 2012. Understanding Management Effects: Examples and Opportunities. Online webinar presented April 2012. https://uc-d.adobeconnect.com/_a841422360/p7dw0wf0zp1/?launcher=false&fcsContent=true&pbMode=normal

Keinath, D.A. 2004. Fringed myotis (Myotis thysanodes): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/fringedmyotis.pdf.

Kennedy, P.L. 1997. The northern goshawk (Accipiter gentilis atricapillus): is there evidence of a population decline? Journal of Raptor Research 31: 95-106.

Kilgore, B. M. 1973. The ecological role of fire in Sierran conifer forests: its application to national park management. Quaternary Research, 3(3), 496-513.

Kolb, T.E., Holmberg, K.M., Wagner, M.R., and Stone, J.E. 1998. Regulation of ponderosa pine foliar physiology and insect resistance mechanisms by basal area treatments. Tree Physiol. 18: 375–381.

Knapp, R. A. 1996. Non-native trout in natural lakes of the Sierra Nevada: an analysis of their distribution and impacts on native aquatic biota. Pages 363-407 in Sierra Nevada Ecosystem Project: final report to Congress. Volume III, Chapter 8. Centers for Water and Wildland Resources, University of California, Davis.

Kolka, R K, and M F Smidt. "Effects of forest road amelioration techniques on soil bulk density, surface runoff, sediment transport, soil moisture, and seedling growth." *Forest Ecology and Mgmt 202*, 2004: 313-323.

Kyser, G. B., J.M. DiTomaso, M.P. Doran, S.B. Orloff, R.G. Wilson, D.L. Lancaster, D.F. Lile, and M.L. Porath. 2007. Control of Medusahead (Taeniatherum caput-medusae) and Other Annual Grasses with Imazapic. *Weed Technology*, 21:66-75.

Lee, D.C. and L.L. Irwin. 2005. Assessing risks to spotted owls from forest thinning in fire-adapted forests of the western United States. Forest Ecology and Management 211: 191-209.

Lutz, J. A., van Wagtendonk, J. W., Thode, A. E., Miller, J. D., & Franklin, J. F. 2009. Climate, lightning ignitions, and fire severity in Yosemite National Park, California, USA. International Journal of Wildland Fire, 18(7), 765-774.

Litschert, S E, and L H MacDonald. "Frequency and characteristics of sediment delivery pathways from forest harvest units to streams." *Forest Ecology and Management 259*, 2009: 143-150.

MacDonald, Lee H, and Drew B.R. Coe. *Road Sediment Production and Deliver: Processes and Management.* Boulder: Colorado State University, 2007.

S.A. Macomber, C.E. Woodcock. 1994. Mapping and monitoring conifer mortality using remote sensing in the Lake Tahoe Basin. Rem. Sens. Environ., 50, pp. 255–266

Markewitz, D. 2006. Fossil fuel carbon emissions from silviculture: impacts on net carbon sequestration in forests. Forest Ecology and Management, 236(2), 153-161.

Martin, D. L. 1992. Sierra Nevada anuran survey: An investigation of amphibian population abundance in the National Forests of the Sierra Nevada of California. Summer 1992 survey. Prepared for the U.S. Forest Service. 76 pp.

Matthews, K.R., and C. Miaud. 2007. A skeletochronological study of the age structure, growth, and longevity of the mountain yellow-legged frog, Rana muscosa, in the Sierra Nevada, California. Copeia 2007: 986–993.

Matthews, K.R., and H.K. Preisler. 2010. Site fidelity of the declining amphibian Rana sierrae (Sierra Nevada yellow-legged frog). Can. J. Fish. Aquat. Sci. 67:243–255.

Mayer, K.E., and W.F. Laudenslayer, eds. 1988. A Guide to Wildlife Habitats of California. California Department of Forestry and Fire Protection, Sacramento, CA. 166pp. http://www.dfg.ca.gov/biogeodata/cwhr/wildlife_habitats.asp

N.G. McDowell, J.R. Brooks, S.A. Fitzgerald, B.J. Bond. 2003. Carbon isotope discrimination and growth response of old Pinus ponderosa trees to stand density reductions. Plant Cell Environ., 26, pp. 631–644

McGurk, B. J., and D. R. Fong. 1995. Equivalent roaded area as a measure of cumulative effect of logging. *Environmental Management*: 19: 609-621.

McKelvey, K. S., & Johnston, J. D. 1992. Historical perspectives on forests of the Sierra Nevada and the Transverse Ranges of southern California: forest conditions at the turn of the century. J. Verner, KS McKelvey, BR Noon, RJ Gutiérrez, GI Gould, Jr., and

TW Beck, technical coordinators. The California Spotted Owl: A Technical Assessment of its Current Status. USDA Forest Service, Pacific Southwest Research Station. General Technical Report PSW-GTR-133, 225-246.

McKelvey, K.S., Skinner, C.N., Chang, C., Et-man, D., Husari, S.J., Parsons, D.J., van Wagtendonk, J. W., and C.P. Weatherspoon. 1996. An Overview of Fire in the Sierra Nevada. In: Sierra Nevada Ecosystem Project: Final Report to Congress, Vol. II, Assessments and scientific basis for management options. University of California, Davis, Centers for Water and Wildland Resources. pp. 1033-1040Menning, K.M. et al. Modeling aquatic and riparian systems, assessing cumulative watershed effects, and limiting watershed disturbance. Pages 33-51 in Sierra Nevada Ecosystem Project: final report to Congress, addendum. Centers for Water and Wildland Resources. Davis: University of California, 1996.

Merriam, Kyle and Safford, Hugh. 2011. A summary of current trends and probable future trends in climate and climate-driven processes in the Sierra Cascade Province, including the Plumas, Modoc, and Lassen National Forests.

Miller, J. D., Knapp, E. E., Key, C. H., Skinner, C. N., Isbell, C. J., Creasy, R. M., & Sherlock, J. W. 2009. Calibration and validation of the relative differenced Normalized Burn Ratio (RdNBR) to three measures of fire severity in the Sierra Nevada and Klamath Mountains, California, USA. Remote Sensing of Environment, 113(3), 645-656.

MGW Biological and Klamath Wildlife Resources. 2006. Habitat use, home range, and movements of Mountain Yellow-legged Frogs (Rana muscosa) in Bean Creek on the Plumas National Forest, Final Report.

MGW Biological. 2013a. Final Report “Wildcat” California Spotted Owl Survey, Plumas National Forest, Mt. Hough Ranger District 2012-2013.

MGW Biological. 2013b. Wildcat Northern Goshawk Survey, Plumas National Forest, Mt. Hough Ranger District 2012-2013 Final Report.

Monaco, T.A., T.M. Osmond, and S.A. Dewey. 2005. Medusahead Control with Fall- and Spring-Applied Herbicides in the Northern Utah Foothills. *Weed Technology*, 653-658.

Moody, T.J., Fites-Kaufman, J. Stephens, S.L. 2006. Fire History and Climate Influences from Forests in the Northern Sierra Nevada, USA. Fire Ecology 2(1):115-141.

Mullally, D. P., and J. D. Cunningham. 1956. Ecological relations of Rana muscosa at high elevations in the Sierra Nevada. Herpetologica, 12:189-198.

Neary et al. "Fire effects on belowground sustainability: a review and synthesis." *Forest Ecology and Management*, 1999: 51-71.

North, M.; Stine, P.; O’Hara, K; Zielinski, W.; Stephens, S. 2009. An ecosystem management strategy for Sierra mixed-conifer forests. Gen. Tech. Rep. PSW-GTR-220. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 49 p.

North, M., ed. 2012. Managing Sierra Nevada forests. Gen. Tech. Rep. PSW-GTR-237. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 184 p.

Pacific Gas and Electric Company (PG&E).2012. Rock Creek–Cresta Hydroelectric Project FERC Project No. 1962Annual Report on Noxious Weed Control and Monitoring – License Condition 27. Dated October 2012.

Philpott, W. 1997. Summaries of the life histories of California bat species. Unpublished document. USDA Forest Service, Sierra National Forest, Pineridge Ranger Station.

Pierson, E.D. and W.E. Rainey. 1998. Distribution, status and management of Townsend's big-eared bat (Corynorhinus townsendii) in California. California Department of Fish and Fame, Wildlife Management Division. BMCP Technical Report Number 96-7.

Pierson, E.D.; M.C. Wackenhut, J.S. Altenbach, P. Bradley, P. Call, D.L. Genter, C.E. Harris, B.L. Keller, B. Lengus, L. Lewis, B. Luce, K.W. Navo, J.M. Perkins, S. Smith, L. Welch. 1999. Species conservation assessment and strategy for Townsend's big-eared bat (Corynorhinus townsendii townsendii and Corynorhinus townsendii pallescens). Boise, ID: Idaho Conservation Effort, Idaho Department of Fish and Game.

Poff, R. "Effects of Silvicultural Practices and Wildfire on Productivity of Forest Soils." *Status of the Sierra Nevada*, 1996: Vol. II (16): 477-493.

Pope, K. L. and K. R. Matthews. 2001. Movement ecology and seasonal distribution of mountain yellow-legged frogs, Rana muscosa, in a high-elevation Sierra Nevada basin. Copeia, 2001:787-793.

Powers et al. "Long Term Soil Productivity." *Forest Ecology and Management*, 2005: 31-50.

Reinhardt, E. and N.L. Crookston. 2003. The Fire and Fuels Extension to the Forest Vegetation Simulator. Gen. Tech. Rep. RMRS-GTR-116. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 209 p.

Rotta, G.W. 1999. Biological assessment and evaluation of Herger-Feinstein Quincy Library Group Forest Recovery Act. 219 pp.

Safford H.D. 2007. Man and fire in Southern California: Doing the math. Fremontia 35(4): 25– 29.

Safford , Hugh D., Miller, Jay D., Schmidt, David, Roath, Brent, and Parsons, Annette. 2007. BAER soil burn severity maps do not measure fire effects on vegetation: a reply to Odion and Hanson. Ecosystems.

Scholl, Andrew E., and Alan H. Taylor. 2010. Fire regimes, forest change, and self-organization in an old-growth mixed-conifer forest, Yosemite National Park, USA. Ecological Applications 20.2: 362-380.

Show, S. B., & Kotok, E. I. 1924. The role of fire in the California pine forests.

Skinner, C.N. and C. Chang. 1996. Fire regimes, past and present. pp. 1041-1070 In: Sierra Nevada Ecosystem Project, Final Report to Congress, vol. II. Assessments and

Scientific Basis for Management Options. University of California, Centers for Water and Wildland Resources, Davis.

Skog, K. E., & Nicholson, G. A. 1998. Carbon cycling through wood products: the role of wood and paper products in carbon sequestration. Forest Products Journal, 48(7), 75-83.

Smallwood, K.S. 1998. On the evidence needed for listing the northern goshawks (Accipiter gentilis) under the Endangered Species Act: a reply to Kennedy. J. Raptor Research 32: 323-329.

Smith, T. F., Rizzo, D. M., & North, M. (2005). Patterns of mortality in an old-growth mixed-conifer forest of the southern Sierra Nevada, California. Forest Science, 51(3), 266-275.

Stephens, J. C., Bielicki, J., & Rand, G. M. (2009). Learning about carbon capture and storage: Changing stakeholder perceptions with expert information. Energy Procedia, 1(1), 4655-4663.

Stephens, S. L., Bigelow, S. W., Burnett, R. D., Collins, B. M., Gallagher, C. V., Keane, J. & Van Vuren, D. H. 2014. California spotted owl, songbird, and small mammal responses to landscape fuel treatments. BioScience, biu137.

Stephenson, N.L., Parsons, D.J., Swetnam, T.W., 1991. Restoring fire to the sequoia-mixed conifer forest: Should intense fire play a role? Tall Timbers Fire Ecology Conference 17, 321–337

Solomon, S., Plattner, G. K., Knutti, R., & Friedlingstein, P. (2009). Irreversible climate change due to carbon dioxide emissions. Proceedings of the national academy of sciences, 106(6), 1704-1709.

Squires, J.R. and R.T. Reynolds. 1997. Northern Goshawk (Accipiter gentilis). In: The Birds of North America, No. 298. A. Poole and F. Gill, eds. The Academy of Natural sciences, Philadelphia, PA, and The American Ornithologist's Union, Washington, D.C.

SWRCB 1998. "State Water Resource Control Board, Basin Plan - Updated 2011." 1998.

Syracuse Environmental Research Associates (SERA). 1997. Use and assessment of marker dyes used with herbicides. Fayetteville, NC. Syracuse Environmental Research Associates, Inc.

Syracuse Environmental Research Associates (SERA). 2006. Borax: Human Health and Ecological Risk Assessment - FINAL REPORT. Fayetteville: Syracuse Environmental Research Associates, Inc.

Syracuse Environmental Research Associates (SERA). 2007. Aminopyralid: Human Health and Ecological Risk Assessment - FINAL REPORT. Fayetteville: Syracuse Environmental Research Associates, Inc.

Syracuse Environmental Research Associates (SERA). 2011. Imazapyr: Human Health and Ecological Risk Assessment - FINAL REPORT. Fayetteville: Syracuse Environmental Research Associates, Inc.

Syracuse Environmental Research Associates (SERA). 2004. Imazapyr: Human Health and Ecological Risk Assessment - FINAL REPORT. Fayetteville: Syracuse Environmental Research Associates, Inc.

Taylor, J. A., & Lloyd, J. 1992. Sources and sinks of atmospheric CO2. Australian Journal of Botany, 40(5), 407-418.

Tempel, D. J., and R. J. Gutiérrez. 2013. Relation between occupancy and abundance for a territorial species, the California spotted owl. Conservation Biology 27:1087–1095.

Townsend, A. R., B. H. Braswell, E. A. Holland, J. E. Penner. 1996. Spatial and temporal patterns in potential terrestrial carbon storage resulting from deposition of fossil fuel derived nitrogen, Ecol. Appl., 63, 806–814.

Turner, M.G., W.H. Romme, R.H. Gardner and W.W. Hargrove. 1997. Effects of fire size and pattern of early succession in Yellowstone National Park. Ecological Monographs 67(4):411-433.

USDA 1988a. Plumas National Forest Land and Resource Management Plan. USDA Forest Service Plumas National Forest, Quincy, CA.

USDA 1988b. Plumas National Forest Environmental Impact Statement for the Land and Resource Management Plan. USDA Forest Service, Pacific Southwest Region, Vallejo, CA.

USDA 1988c. Soil Resource Inventory. Quincy: USDA Forest Service

USDA 1988d. Cumulative Off-site Effects Analysis, Interim Directive No. 1. Soil and Water Conservation Handbook. FSH.2509.22, Chapter 20. San Francisco: USDA Forest Service.

USDA 1993. California Spotted Owl Sierran Province Interim Guidelines Environmental Assessment (CASPO IG EA).

USDA 1999. Lassen, Plumas, Tahoe National Forests. Herger-Feinstein Quincy Library Group Forest Recovery Act FEIS and ROD. EIS, Quincy: USDA, 1999.

USDA 2000. Water Quality Management for Forest System Lands in California: Best Management Practices. Technical, Vallejo: USDA Forest Service.

USDA 2000a. Survey Methodology for Northern Goshawks in the Pacific Southwest Region. USDA Forest Service. August 9th, 2000.

USDA 2000b. Log Cubic Volume and Weight (tons). Sequoia National Forest: Kathleen S. Roche, Certified Silviculturist.

USDA 2001a. Sierra Nevada Forest Plan Amendment (SNFPA) Record of Decision (ROD). USDA Forest Service, Pacific Southwest Region. Vallejo, CA. January 2001.

USDA 2001b. Sierra Nevada Forest Plan Amendment (SNFPA) Final Environmental Impact Statement (FEIS). USDA Forest Service, Pacific Southwest Region. Vallejo, CA. January 2001. http://www.fs.fed.us/r5/snfpa/library/archives/feis/index.htm

USDA 2004a. Final Supplemental Environmental Impact Statement Sierra Nevada Forest Plan Amendment. USDA Forest Service Pacific Southwest Region. Vallejo, CA.

USDA 2004b. Record of Decision Sierra Nevada Forest Plan Amendment. USDA Forest Service Pacific Southwest Region, Vallejo, CA.

USDA 2004c. Record of Decision Sierra Nevada Forest Plan Amendment Errata. USDA Forest Service Pacific Southwest Region, Vallejo, CA.

USDA 2004d. National Strategy and Implementation Plan for Invasive Species. Washington, DC: USDA Forest Service.

USDA 2005a. Fringed myotis. In: Species Accounts – Animals. Available at: http://www.fs.fed.us/r5/scfpr/projects/lmp/docs/species-animals.pdf.

USDA 2006. Letter to Forest Supervisors from Regional Forester (B. Pendleton) Regarding Sensitive Species List Revision. Vallejo, CA: USDA Forest Service.

USDA 2006a. Subsoiling Review. Letter from Plumas and Tahoe National Forest Supervisors, Quincy: USDA Forest Service.

USDA 2007. HFQLG Implementation Team Soil Monitoring Report. Internal Agency Report, Quincy: USDA.

USDA 2007a. Record of Decision, Sierra Nevada Forests Management Indicator Species Amendment. U.S. Forest Service, Pacific Southwest Region. December, 2007. 18pp.

USDA 2009. Forest Service Manual 2550 Soil and Water Resources. Washington D.C.: USDA Forest Service.

USDA 2010a. PNF Public Motorized Travel Management. EIS, Vallejo: USDA Forest Service.

USDA 2010b. Plumas National Forest Public Motorized Travel Management, 2010 Record of Decision.

USDA 2010c. Forest Service Manual 2500, Chapter 2550--Soil Management. Manual, Washington, DC.: USDA.

USDA 2011a. BMP Water Quality Management Handbook Amendment - 2509.22_10. FSH Amendment, Vallejo: USDA Forest Service.

USDA 2011b. Forest Service Manual 2900 - Invasive Species Management. Washington, DC: USDA Forest Service.

USDA 2011c. Sierra Nevada Yellow-legged frog monitoring HFQLG pilot project area Plumas and Tahoe National Forests. Unpublished Report.

USDA 2012a. Field Guide for Managing Canada Thistle in the Southwest. Albuquerque, NM: USDA Forest Service.

USDA 2012b. National BMP for Water Quality Management on NF System. Handbook, Washington, DC: USDA .

USDA 2012c. PNF Annual Report for the BMP Evaluation Program 2010-2012. Quincy: US Forest Service.

USDA 2012d. Wildcat and Belden Amphibian Surveys on the Plumas National Forest in 2012. Unpublished report prepared by Eric Mathews, Biological Technician Crew Leader.

USDA 2012e. National Best Management Practices for Water Quality Management on National Forest System Lands. Vol I. Technical, USDA Forest Service.

USDA 2013a. Update to the Regional Forester's Sensitive Species List. Vallejo, CA: USDA Forest Service.

USDA 2013b. A Cultural Resource Inventory of the Wildcat Fuels Reduction Resurvey Project Area, ARR#02-12-2013. (Douglas J. Baughman). Quincy, CA: USDA Forest Service.

USDA 2014. Forest Service Manual 2500, Chapter 2560–Groundwater Resource Management. Manual, Washington, DC: Draft in Federal Register, 2014.

USDA 2014a. Wildcat Fuels Reduction and Vegetation Management Project Forest Vegetation Report. USDA Forest Service, Plumas National Forest, Quincy, California. Huynh, Maurice. 2014.

USDA 2014b. Biological Assessment/Biological Evaluation for Terrestrial and Aquatic Wildlife Species for the Wildcat Project (Colin Dillingham). Quincy, CA: USDA Forest Service.

USDA 2014c. Management Indicator Species Report for the Wildcat Fuels Reduction and Vegetation Management Project (Colin Dillingham). Quincy, CA: USDA Forest Service.

USDA 2014d. Migratory Bird Species Report for the Wildcat Project (Colin Dillingham). Quincy, CA: USDA Forest Service.

USDA 2014e. Botanical Report on Special Interest Species for the Wildcat Fuels Reduction and Vegetation Management Project (Japhia Huhndorf). Quincy, CA: USDA Forest Service.

USDA 2014f. Invasive Plant Species Risk Assessment for the Wildcat Fuels Reduction and Vegetation Management Project (Japhia Huhndorf). Quincy, CA: USDA Forest Service.

USDA 2014g. Recreation, Lands, and Scenic Resources Report for the Wildcat Fuels Reduction and Vegetation Management Project (Erika Brenzovich). Quincy, CA: USDA Forest Service.

USDA 2014h. A Cultural Resource Inventory of the Wildcat Hazardous Fuels Reduction 2014 Resurvey Project Area ARR # 02-15-2014 / R2014051102015 An Addendum to A Cultural Resource Inventory of the Wildcat Fuels Reduction Resurvey Project Area (ARR# 02-12-2013 / R2013051102012). USDA Forest Service, Plumas National Forest. Quincy, California. Baughman, Douglas J. 2014

USDA 2014i. Insect and Disease Evaluation for the Wildcat Fuels Reduction and Vegetation Management Project. Daniel R. Chuck, Forest Entomologist, Northeastern California Shared Services Area.

USDA 2014j. USDA Forest Service, Pacific Southwest Region, Biological assessment for actions that affect the Sierra Nevada Yellow-legged frog, northern distinct population segment of the mountain yellow-legged frog, and Yosemite toad on National Forest Lands in the Sierra Nevada.

USDA 2015. Plumas National Forest National Visitor Use Monitoring Data Collected Fiscal Year 2010.

USDI 2013a. U.S. Department of the Interior, Fish and Wildlife Service Federal Endangered and Threatened Species that occur in or may be affected by projects in Plumas County. U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office.

USDI 2014. U.S. Department of the Interior, Fish and Wildlife Service Endangered and Threatened Wildlife and Plants; Final Rule to List the Sierra Nevada Yellow-Legged Frog (Rana sierrae). Federal Register. Vol. 79 FR 24255: 24310. https://www.federalregister.gov/articles/2014/04/29/2014-09488/endangered-and-threatened-wildlife-and-plants-endangered-species-status-for-sierra-nevada

Van Mantgem, P.J., Stephenson, N.L., Bryne, J.C., Daniels, L.D., Franklin, J.F., Fule, P.Z., Harmon, M.E., Larson, A.J., Smith, J.M., Taylor, A.H., Veblen, T.T. 2009. Widespread increase of tree mortality rates in the western United States. Science, Vol 323, 23 January 2009 pp. 521-524

Verner, J., K. S. McKelvey, B. R. Noon, R. J. Gutiérrez, G. I. Gould, and T. W. Beck. 1992. The California spotted owl: a technical assessment of its current status. Pacific Southwest Research Station, Forest Service, US Department of Agriculture, Albany, CA.

Vredenburg, V.T., R. Bingham, and R.A. Knapp. 2007. Concordant molecular and phenotypic data delineate new taxonomy and conservation priorities for the endangered mountain yellow-legged frog. Journal of Zoology. 271: 361–374.

Weatherspoon, C. P. 1996. Fire-silviculture relationships in Sierra forests.

Weatherspoon, C. P., & Skinner, C. N. 1996. Landscape-level strategies for forest fuel management. In Sierra Nevada ecosystem project: final report to congress (Vol. 2, pp. 1471-1492). University of California, Davis, Centers for Water and Wildland Resources.

Westerling, A. L., & Bryant, B. P. 2008. Climate change and wildfire in California. Climatic Change, 87(1), 231-249.

Weber, K. 2009. Antrozous pallidus. Available at: http://animaldiversity.ummz.umich.edu/site/accounts/information/Antrozous_pallidus.html. (last accessed 02 April 2013).

Weller, T.J. and C.J. Zabel. 2001. Characteristics of fringed myotis day roosts in northern California. Journal of Wildlife Management 65:489-497.

Zielinski, W.J. and T.E. Kucera. 1995. American marten, fisher, lynx, and wolverine: survey methods for their detection. USDA Forest Service, Pacific Southwest Research Station, General Technical Report PSW-GTR-157.

Zeiner, D.C., W.F. Laudenslayer, Jr., and K.E. Mayer, Compiling Editers. 1988. California's Wildlife, Volume I: Amphibian and Reptiles. State of California, The Resources Agency, Department of Fish and Game, Sacramento, CA. 272 pp.