United States Department of Agriculture

Somes Bar Integrated Fire Management Project

Draft Environmental Assessment

Forest Service

Pacific Southwest Region

Six Rivers National Forest

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Cover photo: Low intensity prescribed fire returns to a white oak stand near Orleans, California, during the 2014 Klamath River Prescribed Fire Training Exchange (TREX), after over a hundred years of fire exclusion. Photo courtesy of Will Harling, Mid Klamath Watershed Council.

Somes Bar Integrated Fire Management Project

Draft Environmental Assessment

Siskiyou County, California

Responsible Official: Merv George Jr., Forest Supervisor
Six Rivers National Forest
1330 Bayshore Way
Eureka, CA 95501-3834
(707) 441-3534
mgeorge@fs.fed.us

For Information Contact: Nolan C. Colegrove Sr., District Ranger
Lower Trinity, Orleans and Ukonom Ranger Districts
PO Box 410
1 Ishi Pishi Road
Orleans, CA 95556
(530) 627-3291 (Orleans)
ncolegrove@fs.fed.us

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Chapter 1. Purpose and Need

Introduction

Western Klamath Restoration Partnership (WKRP)[1] representatives prepared the *Somes Bar Integrated Fire Management Project Draft Environmental Assessment* (EA), per the National Environmental Policy Act of 1969 (NEPA), to disclose the effects of a demonstration proposal that once again welcomes fire on public lands. This project is just the first phase in realizing the goals of the *National Cohesive Wildland Fire Management Strategy*[2] (Cohesive Strategy), in accordance with traditional ecological knowledge (TEK)[3] and customs, as a framework for living with fire in the western Klamath Mountains of northern California.

The *Somes Bar Integrated Fire Management Project* (*Somes Bar Project*) exemplifies participatory planning where all contributors share responsibilities for each other's safety and well-being, and for preserving the nation's natural resources and our cultural legacy for future generations (Harling and Tripp 2014). With this vision in mind, dedicated collaborators convened workshops (Figure 1-1) and field trips, coming to agreement in principle and practice on a wide range of stewardship treatments across the landscape to begin healing the land (*Appendix A*).

Figure 1-1. WKRP workshop in Orleans shares planning efforts and gathers input from a diverse group of participants.

The proposed land management treatments were designed in alignment with the Klamath and Six Rivers national forest's land and resource management plans (SRNF and KNF LRMPs or forest plans; USDA Forest Service 1995 and 2010, respectively) and records of decision (ROD(s)), and informed by the *Karuk Tribe Eco-Cultural Resource Management Plan* (Karuk Tribe 2010), Katimiin Memorandum of

[1] ***Western Klamath Restoration Partnership (WKRP):*** WKRP formed in 2013 to build trust and a shared vision for restoring fire resilience at the landscape scale. Members include representatives from the US Forest Service, Karuk Tribe, Mid Klamath Watershed Council, Orleans-Somes Bar Fire Safe Council, Salmon River Restoration Council, The Nature Conservancy Fire Learning Network, Klamath Forest Alliance, Environmental Protection Information Center, University of California Berkeley, Bureau of Indian Affairs, National Oceanic and Atmospheric Administration, Environmental Protection Agency, and US Fish and Wildlife Service.

[2] ***National Cohesive Wildland Fire Management Strategy (Cohesive Strategy):*** The Federal Land Assistance, Management and Enhancement Act of 2009 (FLAME Act) was signed by the President in November 2009. The Act states, in part, "Not later than one year after the date of the enactment, the Secretary of the Interior and Secretary of Agriculture shall submit to Congress a report that contains a cohesive wildfire management strategy." The Act directs that a cohesive strategy be developed addressing seven specific topic areas ranging from how to allocate fire budgets at the Federal level to assessing threats to communities, and prioritizing hazardous fuels project funds. The Act is the catalyst for bringing fire leadership at all levels and agencies together and prompting a new approach to how wildland fire is managed (*www.forestsandrangelands.gov*).

[3] ***Traditional Ecological Knowledge (TEK):*** cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment (Berkes et al. 2000).

Understanding (MOU; Karuk Tribe and USDA Forest Service 2017), and the *Orleans/Somes Bar Community Wildfire Protection Plan* (CWPP; CWPP 2012).

Project Location

The *Somes Bar Project* area (Figure 1-2) encompasses 5,500 acres of National Forest System (NFS) lands administered by the Orleans/Ukonom Ranger District (RD) in Township 11 North, Range 6 East, Sections 5 and 6; Township 12 North, Range 6 East, Sections 2, 3, 4, 9, 10, 11, 14, 15, 16, 19, 20, 21, 30, 29, 31, 32 and 33; Township 14 North, Range 6 East, Sections 34 and 35; and Township 13 North, Range 6 East, Sections 3, 4, 5, 8, 9, 17, 20, 21, 22, 27, 28, 29, 32 and 33; Humboldt Meridian, California.

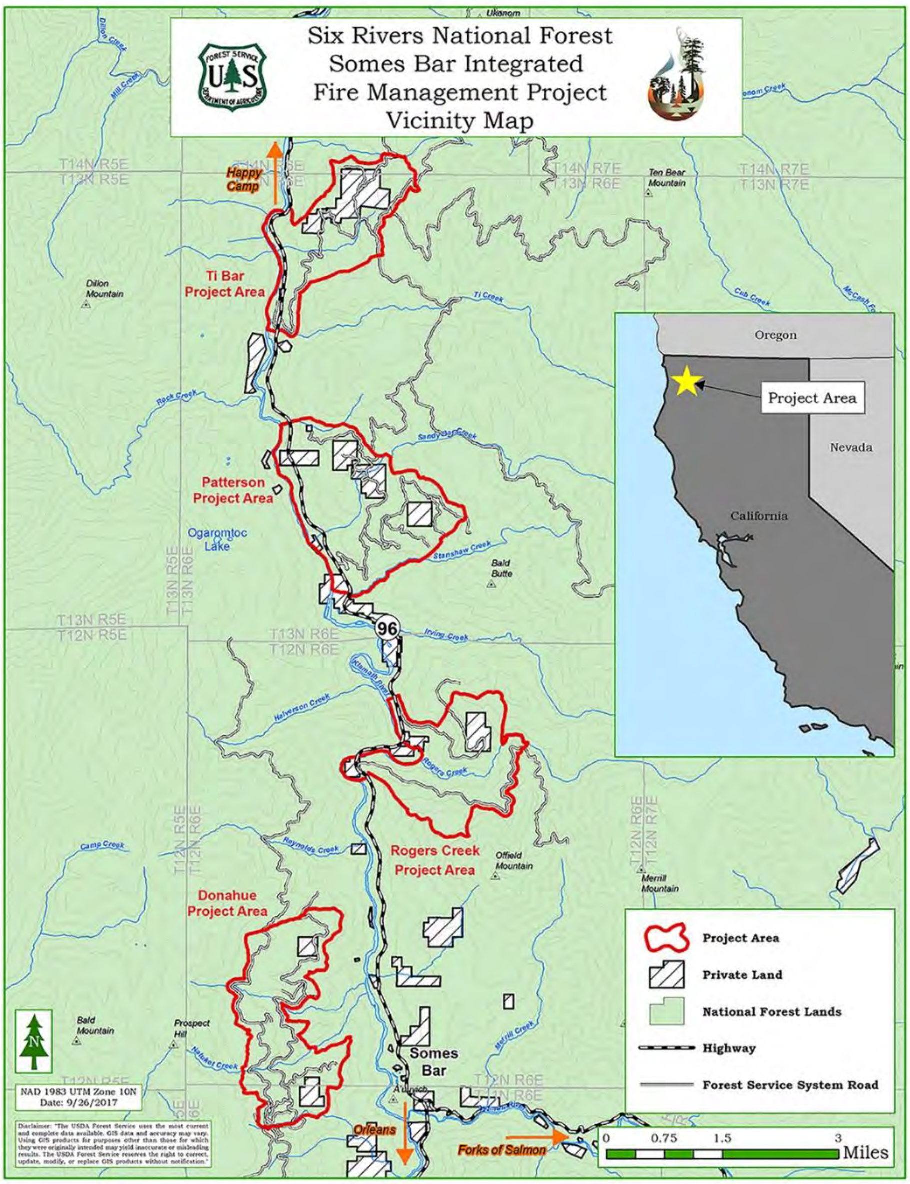

Figure 1-2. *Somes Bar Project* vicinity map.

Wildland-Urban Interface

The *Somes Bar Project* area is composed of four distinct project (or focal) areas—Donahue Flat, Patterson, Rogers Creek and Ti Bar—that surround isolated private and tribal land parcels, as depicted in Figure 1-2. The four project areas were selected for their strategic value to help protect dispersed private land inholdings and the community of Somes Bar that are within the wildland-urban interface (WUI) from wildfire, as depicted in Figure 1-3. Road access to these inholdings are narrow and windy US Forest Service (USFS or Forest Service) roads (classified as Maintenance Levels (ML) 2 to 4) that are open year-round. The closest community is Somes Bar, located in northern California's Siskiyou County.

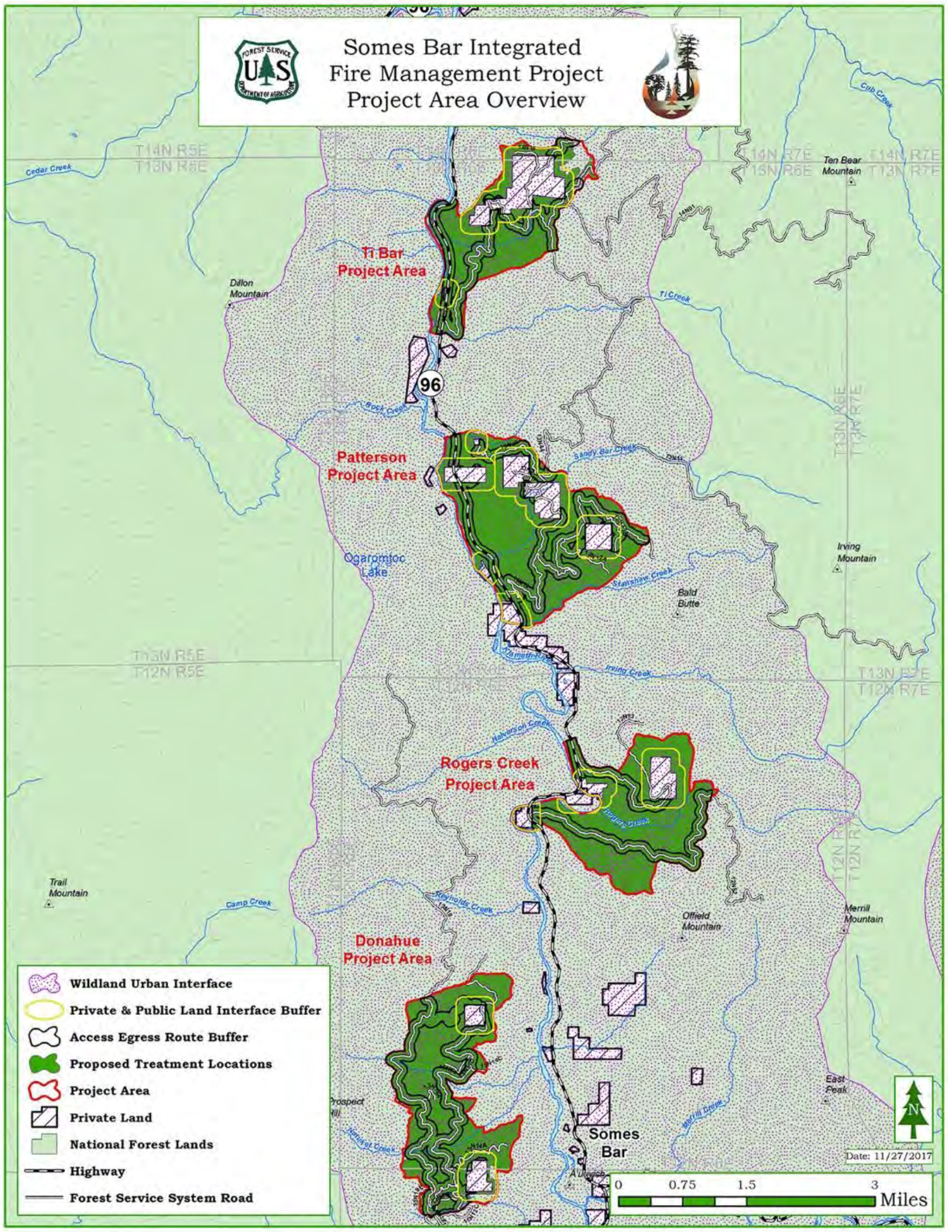

Figure 1-3. Wildland-urban interface and the project area.

Karuk Aboriginal Territory

In 1979, the federal government recognized the Karuk Tribe as a sovereign tribal nation with a government-to-government relationship with the United States (73 Fed. Reg. 18553-18557). The Karuk people reorganized from an aboriginal to a contemporary Native American form of government to facilitate more effective government-to-government interaction. The Karuk Aboriginal Territory was defined (Figure 1-4) and the Karuk Tribal Constitution developed. This recognition was without a conveyance of reservation and/or trust land, but did establish a unique jurisdiction for the Karuk people. Today, the Karuk Tribe is the second largest federally recognized tribe in California with 3,744 tribal members and 4,110 enrolled descendant tribal members.

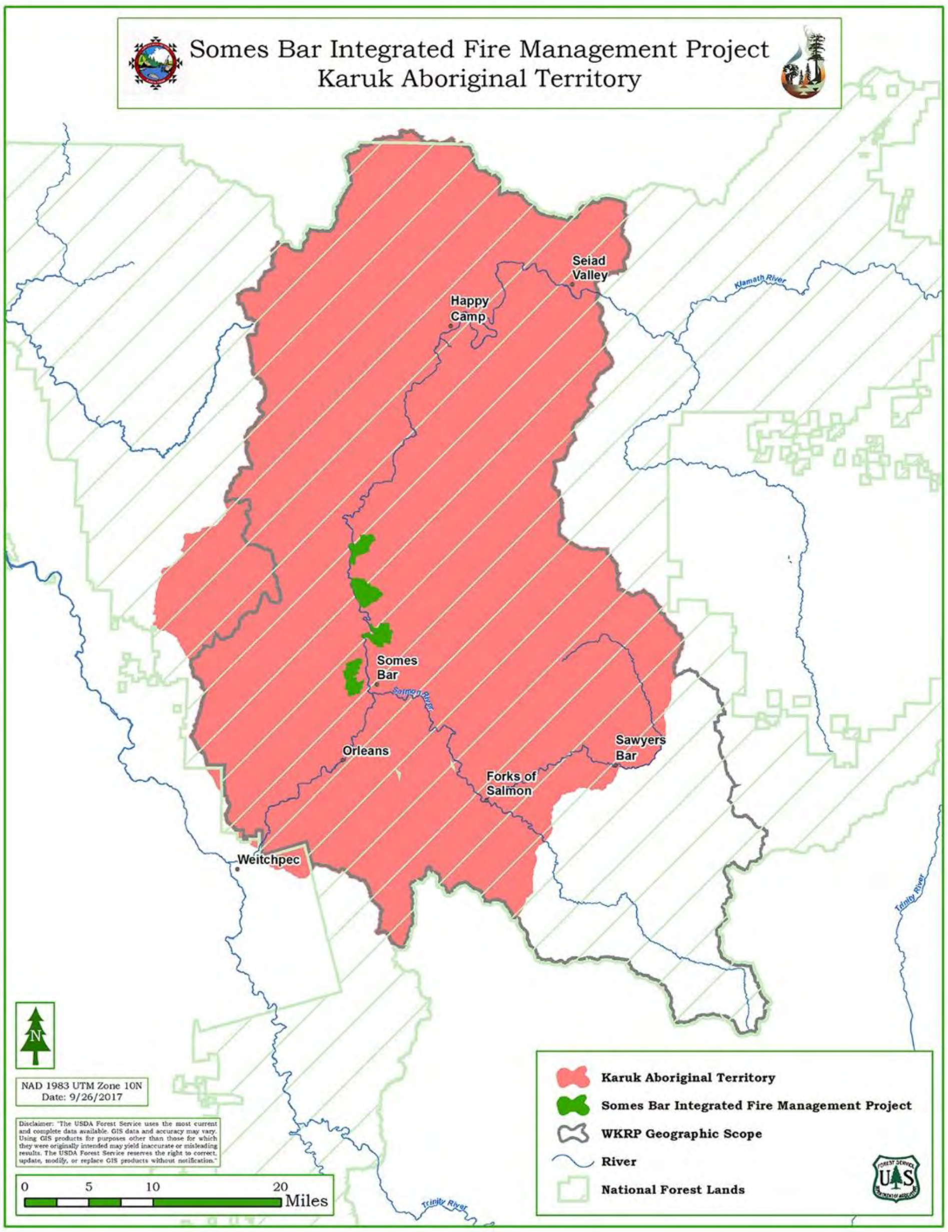

Figure 1-4. Project location relative to Karuk aboriginal territory and project area.

The 11,950-acre Katimiin Cultural Management Area (CMA) 8 lies within the Rogers Creek and Donahue focal areas (Figure 1-5). The MOU between the Karuk Tribe and the Forest Service provides a platform for both parties work together to meet mutually beneficial goals and objectives for management of this area that is of indescribable importance to the Karuk people.

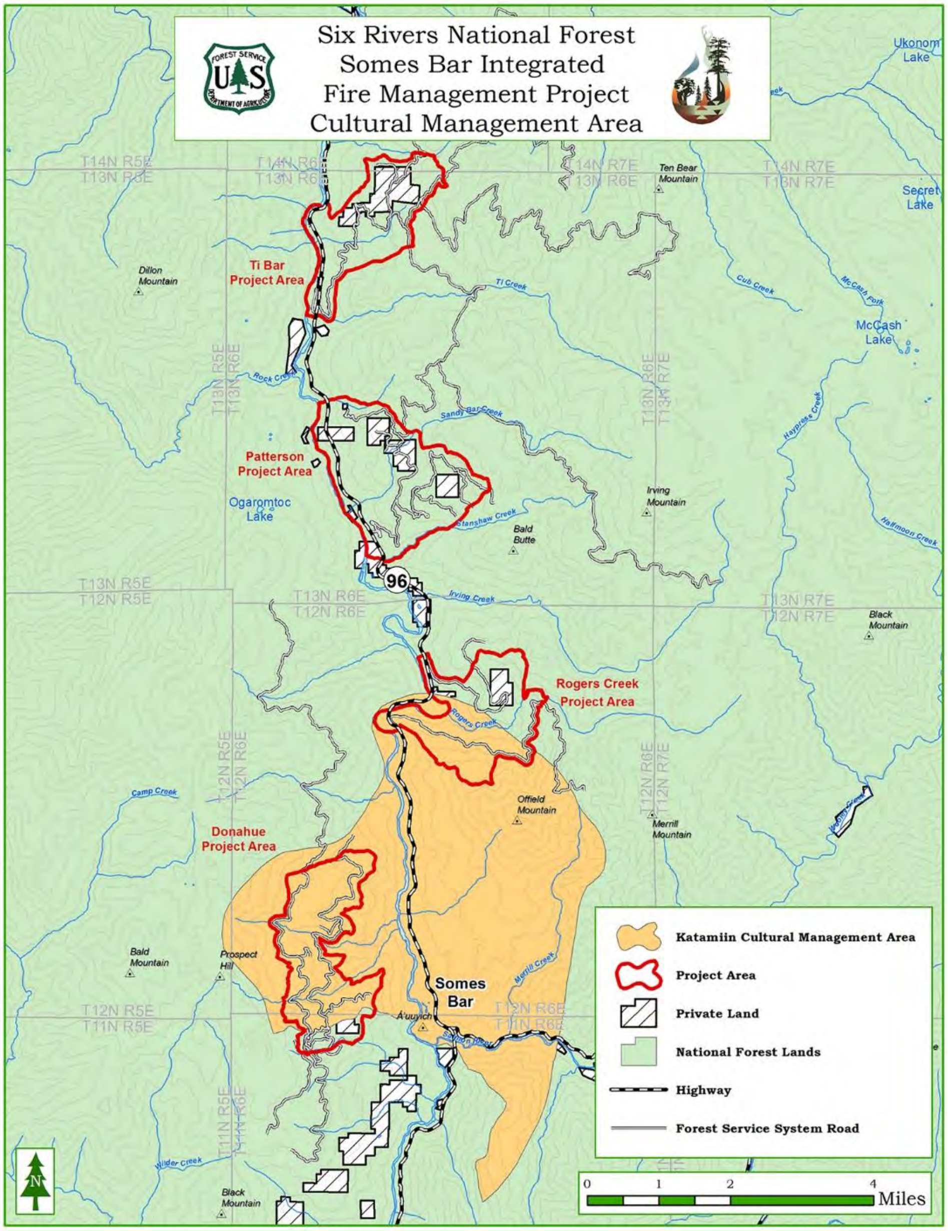

Figure 1-5. Katimiin Cultural Management Area.

On the broader scale, establishing strategic ridge-top fuelbreaks, boundary defensible space buffers, defensible space along associated egress routes and landscape fuels reduction within these focal areas would set the stage for enabling greater social license to restore the cultural burning practice of burning Offield Mountain, as part of the *Pikyavish* World Renewal Ceremony at Katimiin held each September. As an integrated focus, there are resource-rich areas utilized by the Karuk who have considerable knowledge about the productivity and management of these resources, their uses, and associated human responsibility.

Landscape Character

The project area is positioned in the western Klamath Mountains region, primarily along the Klamath River corridor. Wildfire is one of the primary natural disturbances in the landscape. All the natural vegetation types have adapted to a fire-disturbance regime, and many are dependent upon fire for their persistence. Over the past century, fire suppression along with intensive timber harvest practices (clearcutting) have altered vegetation types, favoring Douglas-fir rather than true oak species, Pacific madrone, and ponderosa and sugar pine.

The terrain can be steep and rugged, ranging from 20 to 85 percent slopes (Figure 1-6). Elevations within the project area range from about 800 to 3,000 feet. The climate is Mediterranean, characterized by hot, dry summers, followed by cold, wet winters. Most of the precipitation is rainfall, accumulating an average of 60 inches per year in the valley. The project area supports important habitats for resident and anadromous fish species, northern spotted owl, Roosevelt elk and black-tailed deer, to name a few.

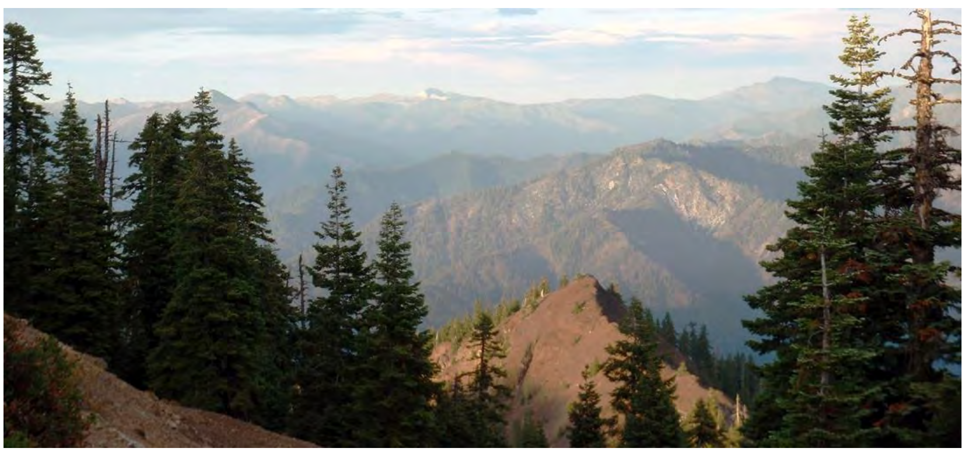

Figure 1-6. Marble rim from Orleans Mountain. Photo by Will Harling.

A Welcome Change

Despite differences in European and Native American cultures, core values, jurisdictional authorities and disjointed funding mechanisms respective of fire programs, all participants adamantly agree there are commonalities to be recognized in living with fire. The WKRP reached an agreement in principle for promoting frequent fire in that, if enough land is treated with prescribed fire more regularly at a lower intensity as the Karuk once did, there would be less flammable vegetative fuels to burn when lightning or human-caused fires do strike.

The Karuk used fire to regularly consume flammable live and dead forest litter (surface fuels), shrubs and small trees (ladder fuels), as a tool to regulate vegetative growth and composition, decrease fuels and promote cultural natural resources. The Proposed Action would establish a landscape pre-treatment hazardous fuels reduction strategy alongside well-distributed, strategically placed, ridge-top and roadside fuelbreaks that set the stage for living with fire, and allowing for safe and frequent prescribed burning operations. In this way, the *Somes Bar Project* is the first step in the long journey to manage the size and intensity of natural and human use of restorative fire across all lands, while concurrently managing wildfires threatening people, property, cultural and natural resources in a safe and effective manner.

Fire Race… The story of the Karuk or Upstream People

The time has come to listen to echoes from our land... the wisdom and teachings of Native American Indians. Their words are simple and their voices are soft. We have not heard them, because we have not taken the time to listen. Perhaps now is the time to open our ears and our hearts to the words of wisdom they have to say…

> *… A long time ago, only the three Yellow Jacket sisters had fire. Even though other animals froze, the fire was kept from them. Coyote wanted to steal fire, which had been lost in a bet. He collected various animals, and placed them at intervals from the river to the mountains. Frog was in the first place—closest to the river. There was forest fire in the mountains, and he stole it by diverting the children who were in charge of it, and then pretending to fall asleep by the fire, having placed oak bark between his toes. At the right moment, he ran away with a piece of burning charcoal. The ember was passed from one animal to the next as each got tired. Turtle was able to escape by rolling down from a mountaintop towards the river, and then gave it to Frog. Frog hid the fire in his mouth, dived in the river and swam to the other side, and spat the fire out under a Willow. Dogs howled as the fire rose up, and mankind came into existence.*

The story of Coyote stealing fire provides an example of how stories encapsulate aspects of traditional ecological knowledge (TEK) and outline the combination of responsibility, respect, and reciprocity that links the people to their environment. It demonstrates how teachings from the beginning of time help inform current practices—the keystone of the *Somes Bar Project*.

Purpose and Need for the Proposal

The purpose of the *Somes Bar Project* is to demonstrate how prescribed fire restores and maintains resilient ecosystems, communities, and economies to revitalize balanced human relationships with our dynamic landscape. The project would also reinstate the use of TEK fire integrated with emergent restorative fire practices at the landscape scale, thereby:

- Reestablishing frequent fire cycles, behavior and patterns stimulating resilient, spatially heterogeneous forest and riparian habitats and self-sustaining populations of culturally important Karuk focal species and traditions.[4]
- Promote shared values, encourage widespread personal ownership and local technical skills leading to healthy communities and economies, capable of well-coordinated land stewardship regardless of ownership or administrative boundaries.

This proposal responds to the following needs:

Restoring and Maintaining Resilient Landscapes

There is a need to treat fuels and alter forest structure to enable prescribed fire to do its ecological work frequently, at relatively self-limiting small scales, historic topographic position, and when seasonally appropriate.

Vegetation within the project area experiences wildfire behavior influenced by the Mediterranean climate and aspect-driven vegetative patterns, as well as wind currents influenced by steep, rugged topography. As an unintentional outcome of shrub and invasive weed encroachment and high stocking reforestation forestry practices between 1950 and 1994, along with considerable investment in fire suppression technologies effectively excluding this natural disturbance, flammability of overgrown forest vegetation (Figure 1-7) now makes the use of prescribed fire more complicated as a safe management tool without some fuels reduction pre-treatment.

Figure 1-7. Dense vegetation typically found in project area.

Prior to fire suppression, indigenous burning and uninhibited lightning-ignited wildfires were an inseparable part of this forest ecosystem, consuming flashy fuels on a regular cycle. These wildfire

[4] In 1911, federal policy (Weeks Act) was enacted with a strict goal to "suppress all fires". The pressure exerted on tribal and settler communities to discontinue fire use was immediate and intense.

events, coupled by frequent fire use by the Karuk, were mechanisms for environmental change and continuous renewal of healthy, heterogeneous wildlife habitats and plant communities.

Karuk culture is directly reliant and dependent on mixed fire severity regimes (Lake 2007). While fire is a central component of Karuk management and culture, increased fire severity and frequency poses particular and unique risks to specific Karuk tribal foods and cultural use species on the one hand, and to broader tribal programmatic goals and activities on the other (Lake et al. 2010). The process of mixed fire severity[5] establishes complex mosaic vegetative patterns, stand structure and species composition.

This regular consumption of surface fuels[6] (duff, litter and down logs), vertical ladder fuels[7] (saplings/understory trees and climbing invasive vines), created gaps in the forest canopy from random torching of single tree crowns and groups of trees, limited heat residence time and kept most flames close to the ground, as displayed in Figure 1-8.

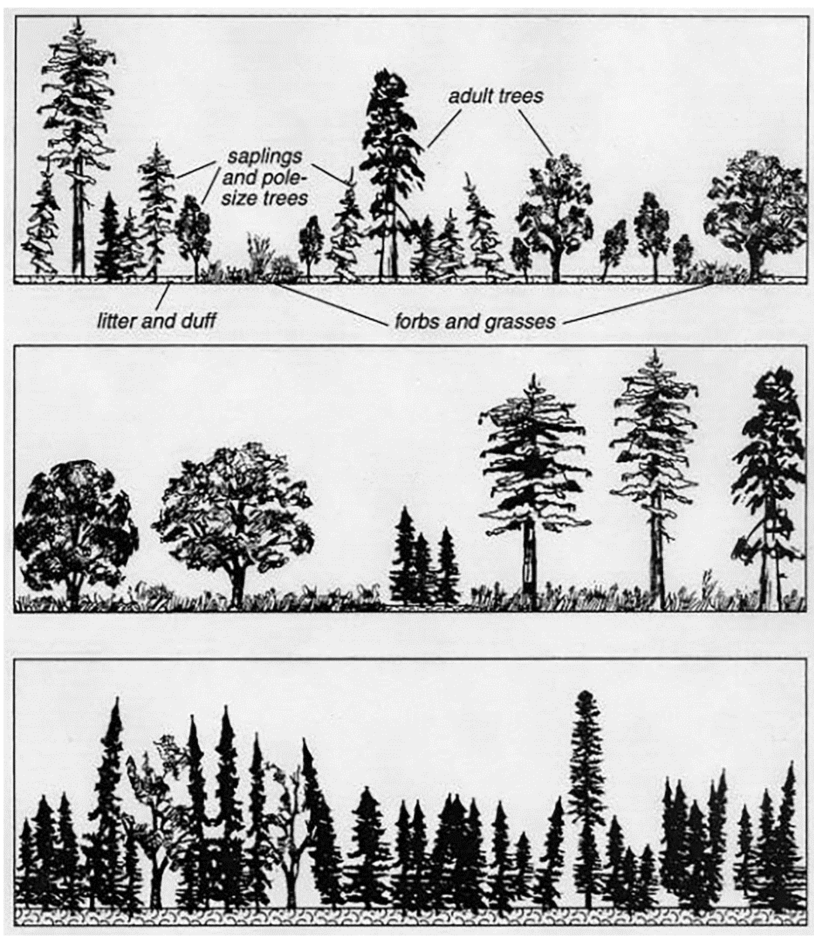

Figure 1-8. Graphic example of building fire resiliency in forests. From top to bottom: lightning fires, lightning and indigenous burning, fire suppression. (Anderson and Barbour 2003)

[5] ***Fire Severity:*** Degree to which a site has been altered or disrupted by fire; loosely, a product of fire intensity and residence time.
[6] ***Surface Fuels:*** Leaf and needle litter, dead branch material, downed logs, bark, tree cones, and low stature living plants lying horizontally, on or near the surface.
[7] ***Ladder Fuels:*** Trees growing in the forest understory that provide vertical continuity between strata, thereby allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease.

Since the early 1900s, every fire interval removed from this fire-adapted landscape has resulted in a fire deficit, compounding threats to values at risk. Today, the amount of vegetative fuels buildup across forests, shrub and grasslands are incompatible with using fire as a management tool, as burning of overgrown vegetative fuels would likely promote volatile active crown fire behavior, difficult for fire crews to contain. The need for manipulating ladder fuel patterns and lowering the amount of flammable surface fuels represents an incremental step on the journey to manage this fire deficit that otherwise would be deferred to set the stage for a more hazardous future.

Desired Condition: Heterogeneity is restored and maintained by fire to recreate patch size as if fire was never suppressed, assuming application of anthropogenic fire to establish functioning resilient heterogeneous forests at multiple scales, benefiting cultural uses, native flora, wildlife habitats and successional complexity (borrowed and adapted from Hessburg et al. 2015).

Indicators and Measures: Risk to landscapes and high-value resources and assets are diminished as measured by 1) *flame length*. Heterogeneity is enhanced as measured by 2) *percent forest canopy closure* (percent change of canopy closure in plantations) and 3) *basal area mortality.*

Resilient Communities

> *There is a need to reduce vegetative fuel hazards around private properties and critical ingress/egress routes to safeguard life, health and property, as well as improve the ability for safe and effective fire management, including planned and unplanned ignitions.*

The Karuk used fire as a way to improve access to resource areas and preserve the well-being of village communities from high-intensity flame fronts. “Utilizing former trail systems, many now converted to roads, can foster a reconnection to place for tribal communities …, and allow the incorporation of TEK into fire and fuel research and management … ” (Lake 2013)

“The relatively small percentage of fires that escape initial response are vitally important, as they account for a disproportionate percentage of the area burned, degraded air quality, damage to homes and communities, and injuries and fatalities. For example, a summary of available data shows that the top 3 percent of fires in terms of individual fire sizes account for over 90 percent of the total area burned nationwide from 2002 to 2011” (Cohesive Strategy 2014).

Departures in forest overstory, understory plant communities and subsequent fuel types have also been influenced by the introduction of exotic plants (Brooks et al. 2004), primarily in the lower portions of the focal areas. Himalayan blackberries have established and quickly colonized disturbed areas along roads and old landings. Exotic grasses, star thistle and Scotch broom function as flashy fuel hazards and can increase flammability during wildfires (CWPP 2012).

Concerns for human safety and property in the dispersed homesteads in the Rogers Creek, Patterson, Ti Bar and Donahue Flat neighborhoods from wildfire are further exacerbated by limited access and egress routes. Access may be temporarily blocked along specific routes where there is active fire, sometimes enforced by forest closure orders. As flames emit thick smoke and fire embers spread, human safety can be threatened, along with air quality and driver visibility. Even structures not immediately adjacent to wildland vegetation are at risk from wildfire, as embers can be transported by wind and ignite vulnerable homes a mile or more away from the flame front (Cohen 2000).

Desired Condition: Human health and safety, community prosperity and revitalization of our human relationships to the natural world are in harmony.

Indicators and Measures: Risk of wildfire impacts to communities is reduced and effectiveness of mitigation activities is monitored, collected and shared. This is measured by 1) *the potential rate of spread* and 2) *the change in fire type*.

Resilient Economies

> *There is a need to provide traditional and local food sources, forestry and fire management training, local living-wage jobs and commercial forest by-products to promote local economic vitality.*

The isolation of the project area, due in part to rugged terrain and narrow, windy roads, predestines the people of the area to be dependent on gathering and extracting local natural resources to supplement their diet and as capital to exchange in the market system. In the mid- to late-1900s, the logging and mining industries became important to the local economy by providing seasonal jobs for people in the area. The boom-and-bust nature of these industries contributed to unemployment and a cycle of poverty, while promoting even-age forestry management practices that inadvertently disrupted ecological cycles, compromising the services provided by industrial and traditional/cultural systems.

With the decline in big game, salmon and other foods from the land, those living in Orleans, Somes Bar and other nearby areas are compelled to purchase foods in grocery stores or rely on government commodities and subsidies. This financial deficit can make or break a family business or promote poor diet and health. Poverty can affect one’s ability to overcome or bounce back from severe weather, forest fires and other climatic change impacts, as the lack of financial resources may prevent one from receiving proper healthcare, have a monetary safety net, or prepare for future changes.

Traditional and local food source-based economies.

The lack of available traditional food sources has not only decreased the Karuk people’s nutritional intake, it has resulted in an overall absence of food devastating their aboriginal resource base, leaving Karuk people with basic issues of food security. This distinction is both based on the fact that Karuk people are denied access to many of their former (first) foods due to federal policy and environmental damage, and the fact that the nearest supermarket is a two-hour drive from most parts of Karuk ancestral territory. Studies indicate this is directly linked to the disproportionate unemployment and low socio-economic status of many Karuk people today, resulting in poverty and hunger rates that are among the highest in the state and nation (Norgaard et al. 2011).

> *Once amongst the most plentiful food systems in the world, Karuk ancestral territory now falls under the classification of a food desert.*

Access to abundant and quality hunting, fishing, and gathering areas, as well as traditional, ceremonial, or religious fire use, has significantly declined following fire exclusion. Once abundant, natural resources, including foods supporting wholesome diets, medicines promoting good health, and raw materials for making tools, clothing, cordage and structures are in a state of diminishment relative to quality and abundance (Western Regional Science-Based Risk Analysis Report 2012).

Depending on the scale and intensity of a particular fire event, a patch of habitat or conditions at a landscape scale can be altered, shifting nutrient and energy cycles and other ecological processes that favor some species or communities while adversely affecting others (Agee 1998). Changes in characteristic fire patterns can have substantial consequences for ecosystems and the species they harbor, including wildlife and plant pollinators adapted to specific open canopy vegetative types (Ice et al. 2004, Brown et al. 2000, Wilcove et al. 1998, Stein et al. 2013).

The Karuk tribal economy continues to center around formal and informal economic endeavors related to natural resources. As the abundance and range of key plant and animal species is affected by climate change, subsistence hunting, fishing and gathering activities that provide a significant percentage of food for some native families will continue to be compromised, forcing these families to spend more money on conventional groceries. This is particularly troubling given that indigenous communities are among the most economically impoverished in the United States (Leichenko 2003, Sarche and Spicer 2008).

> *Tribal communities often have tight social networks, traditions and knowledge that foster resilience in the face of climate change and mitigate the vulnerabilities that may arise as a result of financial scarcity.*

It is important to note that in a traditional cultural paradigm void of Western influence, most tribal monetary systems were tied directly to the health and abundance provided by human-natural systems. Indigenous communities typically could not generate site-specific excess needed for trade or use for specialty items, such as ceremonial regalia, without first fulfilling the human responsibility. In contrast, the contemporary regional economy and monetary system is linked to extraction, environmental degradation, and profit accumulation. As tribes move into a climate-change era, there is an opportunity (albeit challenging) to plan for tribal economic futures that restore former responsibilities and values, and prioritize social and ecological health as a key element of economic sustainability.

Forestry and fire management training.

In 2008, the US Fire Learning Network (FLN) designed a novel program to provide training and learning opportunities for wildland fire professionals. These one- to three-week events, known as Prescribed Fire Training Exchanges (or TREX), provide opportunities to implement prescribed fires (or controlled burns) and give trainees high-quality training assignments, as well as exposure to new people, places and techniques. The FLN now hosts dozens of TREX events across the country each year. The events are deliberately designed to create opportunities for trainees to work with qualified trainers. The host units, meanwhile, get qualified workers to help with large or complex burn events.

In October 2013, the WKRP hosted their first two-day TREX event in Orleans. Now, the Klamath TREX is an annual two-week training in the use of controlled burning to reduce the danger of wildfires in the western Klamath Mountains. With funding and resources from federal, tribal, state, local, and non-governmental organizations, the TREX events help bring in more participants to deliver good fire to a larger landscape. Every year, the Klamath TREX advances the training of firefighters from around the region, the nation and even the world to share best practices and knowledge about how to implement controlled burns. This training event blends traditional native burning with western science to restore fire processes around communities where it is needed most.

The Nature Conservancy (TNC), who facilitates the FLN for US Department of Agriculture (USDA) and US Department of the Interior (USDI) agencies, worked with local partners and the Forest Service's Region 5 to establish an MOU that provides the framework for cross-boundary burning and sharing of resources during TREX events. The SRNF has a current (2016) supplemental agreement that allows forest employees to participate in the Klamath TREX, and for TREX resources to be used to implement controlled burns on Forest Service lands with forest leadership. This mechanism for combining local, tribal, and federal resources would be utilized in scaling up to implement fire management actions as described in the *Somes Bar Project*.

Local living-wage jobs.

The WKRP and this project, not including the Klamath TREX or USFS employees, have already contributed over $1.4 million to the local economy. A portion of these funds has gone to local contractors and the majority has been invested in the local workforce to accomplish field surveys, environmental planning and development of a multi-party monitoring strategy. From 2016 to 2017, the number of full-time-equivalent (FTE) positions increased over 200 percent. In addition to USFS employees, WKRP now contributes almost 10 FTE jobs, all at living-wage[8] pay rates. The number of jobs is expected to increase at least as much during the implementation of the project. During the implementation of the initial treatment entry, it is estimated that WKRP, including contractors, would employ almost 20 FTE local living-wage jobs each year.

Desired Conditions: The desire is to provide for tribal and local community subsistence needs and access to high quality, abundant food and fiber resources in support of traditional economies dependent on food security. Communities are defined as food secure when all members have access to nutritionally good, safe and culturally acceptable foods through local sources at all times.

Ecological trends inform the process of intergenerational knowledge transfer and restoration of cultural use plants and substance foods, forestry-based training opportunities and local living-wage jobs to build local capacities and institutionalize a consistent bridge to a resilient landscape capable of producing food and traditional resources. The desired trajectory is to scale up to revitalize TEK through integration

[8] Based on the Massachusetts Institute of Technology living wage calculator for both Humboldt and Siskiyou Counties (*http://livingwage.mit.edu/resources/Living-Wage-User-Guide-and-Technical-Notes-2016.pdf*).

of intergenerational education programs and activities that build upon a cumulative wealth of knowledge, repeated practice and long-standing beliefs that can be passed on orally, learning from experience, and adaptive to change in perpetuity.

The training and jobs provided and project-generated revenue would be reinvested into the local economy through direct and indirect contributions to local county revenues, generated from purchases and sales of goods and services produced locally, creating diversified sources of revenue streams.

Indicators and Measures: Cultural use flora and fauna habitat restoration measured by 1) *acres enhanced*; local workforce qualification of training measured by 2) *the number of living-wage jobs providing environmental planning and hands-on field experience*; forestry related employment opportunities measured by 3) *the number of potential stable, seasonal or full time jobs*; and the potential for commercial forest products measured by 4) *the amount measured in million board feet*.

Proposed Action

The *Somes Bar Project* would establish up to 250,822 linear feet of Strategic Fire Control Features (SFCF) and implement up to 5,570 acres of landscape-scale integrated vegetative, fuels reduction and restorative prescribed burning alongside roads and interior forests, phased over 15 years. A maximum of 160 landings (30 would be newly constructed), long-term and incidental temporary hand lines, and 11 miles of temporary road access (0.6 miles of new construction) may be required to facilitate operations, as summarized in Table 1-1.

Table 1-1. Proposed action treatment summary.

Integrated Fire Management Treatments		Area and/or Length
Strategic Fire Control Features		**Feet**
Ridgetop Shaded Fuelbreak		105,524
Handline		145,298
Treatments –Total Acres		**Acres**
Manual, Prescribed Burn		2,658
Mastication, Manual, Prescribed Burn		187
Mechanical - cable system, Manual, Prescribed Burn		176
Mechanical - ground-based, Manual, Prescribed Burn		1,058
Prescribed Burn		1,491
Total		***5,570***
Landings – Mechanical and Mastication units only	**Number**	**Acres**
Existing Landing	130	63
New Landing	30	13
Total	***160***	***76***
Temporary Use Road – Access to Mechanical and Mastication units		**Miles**
Existing Mastication Access Road		2.3
Existing Temp Roads		8.1
New Temp Road		0.6
Total		***11.0***
Level 1 Roads to be Used – Provides access to Mechanical, Manual and Prescribed fire units		**Miles**
13N12A		0.9

Integrated Fire Management Treatments	Area and/or Length
13N14A	1.2
13N14C	0.2
13N14D	0.5
13N14E	0.5
13N18A	0.3
13N18E	0.5
14N15	0.5
Total	***4.7***
Legacy Road Sediment Source Restoration – Route Number	**Miles**
9400	0.09
9100	0.35
9101	0.13
9102	0.22
9103	0.19
9402	0.11
Total	***1.09***

Principle Laws and Regulations that Influence this EAs Scope

This section describes land management direction and regulations relevant to the *Somes Bar Project* area, which provided the legal framework for opportunities and constraints to achieving desired conditions. It also provides the foundation for assessing the environmental effects to the human environment analyzed in this draft EA.

The *Somes Bar Project* was developed in alignment with the Aquatic Conservation Strategy (ACS) reflected in the ROD and standards and guidelines (S&Gs) of the Northwest Forest Plan (NWFP; USDA and USDI 1994a), as incorporated into the SRNF and KNF LRMPs, as described below.

Land and Resource Management Plans

The Proposed Action is consistent with S&Gs identified in the SRNF and KNF LRMPs and RODs, as follows in Table 1-2.

Table 1-2. Management areas within the *Somes Bar Project*.

Management Areas	Management Goals	Acres
Wildland Urban Interface	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.	5,570
Cultural Management Area 8	The integrity of the area for use by the Karuk Tribe is maintained in a manner consistent with their customs and culture.	2,306

Management Areas	Management Goals	Acres
Visual Quality Objectives (VQOs)	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: 1,337
		Partial Retention: 3,781
		Modification: 617
General Forest	Lands capable, available and suitable for a host of resource conditions. Timber outputs are a high priority.	330
Late Successional Reserve	Protect and enhance conditions of late-successional and "old-growth" forest ecosystems, which serve as habitat for late-successional species.	63
Riparian Reserve	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.	3,605

Other Relevant Direction

This section describes documented assessments that are pertinent to the Proposed Action and the No Action Alternative being analyzed in this draft EA.

National Cohesive Wildland Fire Management Strategy

Wildland fire management response in the United States has evolved into an increasingly complex and multifaceted system. Climate change, fuels management, expanding WUI and associated infrastructure, budgets, along with mission differences are some of the challenges facing wildland fire managers today. The *National Cohesive Wildland Fire Management Strategy* (Cohesive Strategy 2014) seeks to ensure that the values and concerns of the public and all governments are accurately understood and reflected. This demands a more comprehensive understanding of the diverse perspectives that underlie this situation—encompassing both the social/human and science dimensions.

Managers and natural resource experts recognize that the creation of a truly national cohesive strategy will include not only the seven elements identified in the FLAME Act[2], but must also envision a broader, overarching and comprehensive consideration of all lands and fire programs. Therein lies the primary challenges facing wildfire managers, land managers, and communities in developing a strategy that meets local, regional and national needs.

A national cohesive strategy must recognize the differences and tensions that exist among the partners and stakeholders and why those differences exist (e.g., different priorities, planning processes, legal mandates, values and resources) and seek to resolve them. It must build stronger relationships based on the successes of intergovernmental agreements for mutual response; incorporate cost and data sharing; include community wildfire protection planning (i.e., CWPPs or their equivalent), regional fire risk assessments, state and forest resource assessments and strategies; and encourage increased use of partnerships, grants and other funding opportunities. Each of these tools can be used to build stronger collaborative processes and move toward shared understandings that resolve conflicts and enhance partnerships among multiple landowners across all lands and jurisdictions.

Indian Self-Determination and Education Assistance Act, and Executive Order 13175

The Indian Self-Determination and Education Assistance Act of 1975 (ISDEAA; 25 USC §450 et seq.) guides Indian self-determination and is the cornerstone of the federal relationship with sovereign tribal governments. Self-determination contracts, grants, cooperative agreements and self-governance compact agreements are authorized by the ISDEAA. These agreements between the federal government and Indian tribes and tribal organizations allow the tribes, rather than federal employees, to operate the federal programs.

Self-determination agreements generally cover individual programs or sets of interrelated programs. The self-governance agreements cover a wider range of federal programs and the tribes have more flexibility to redesign the programs and adjust funding to meet changing needs without amending the compact agreement. Major amendments include the Tribal Self-Governance Demonstration Act of 1988 (PL 100-472) that provides tribes control, decision-making authority and funding for federal programs, services, functions and activities; and the Tribal Self-Governance Act of 1994 (PL 103-413) that establishes a demonstration program and authorization for tribes to continue self-governance.

In a similar vein, Executive Order 13175 – Consultation and Coordination with Indian Tribal Governments (EO 1375; 65 Fed. Reg. 67249) provides guidance to establish consultation and collaboration with tribal officials in the development of federal policies with tribal implications. This is intended to strengthen the government-to-government relationship with Indian tribes, and to reduce the imposition of unfunded mandates upon tribes.

National Historic Preservation Act of 1966 and Section 106 Regulations

The National Historic Preservation Act of 1966 (NHPA; 16 USC §470 et seq.) is intended to preserve the cultural and historical legacy of the United States for the benefit of future generations. The NHPA requires that federal agencies consult with any Indian tribe that attaches religious and cultural significance to historic properties that may be affected by an undertaking. The law, as amended in 1992, clarifies that historic properties of religious and cultural importance to Indian tribe may be eligible for listing in the National Register. Section 106 (§106; 36 CFR 800) regulations provide that the federal agency and the State Historic Preservation Officer (SHPO) must engage Indian tribes in timely and meaningful consultation in order to resolve the adverse effects of the undertaking.

The NHPA is important to the Karuk Tribe because it provides the tribe with an opportunity through consultation to protect, or mitigate harm to, cultural resources located on federal public lands. In conjunction with the Archaeological Resources Protection Act (ARPA), Native American Graves Protection and Repatriation Act (NAGPRA), American Indian Religious Freedom Act (AIRFA), Religious Freedom Restoration Act (RFRA), Religious Land Use and Institutionalized Persons Act (RLUIPA), and Indian Sacred Sites EO 13007, the NHPA provides a method of procedural protection for the tribe's cultural resources. Through meaningful consultation, the Karuk Tribe has led the way in designing the WKRP *Somes Bar Project* in a way that goes well beyond just simple protection of historic properties, with a focus on proposing actions that will benefit cultural sites and revitalize traditional practices.

Tribal Forest Protection Act of 2004

The Tribal Forest Protection Act (TFPA; 25 USC §§3101 Note and 3115a) provides opportunities to complete collaborative stewardship work on federal lands adjacent to tribal trust lands through agreements or contracts. It provides for the protection of trust lands and tribal interests from fires, insects, disease and other threats that are in need of restoration. The Karuk Tribe believes that this can be implemented through tribal/interagency partnerships that provide for an integrated working relationship in the planning and implementation of landscape-scale restoration efforts throughout Karuk Aboriginal Territory.

Karuk Tribe Eco-Cultural Resource Management Plan

In 2010, the Karuk Tribe released a draft *Eco-Cultural Resources Management Plan* (ECRMP; Karuk 2010) to create a long-term adaptation strategy for the protection, enhancement and utilization of cultural and natural resources. The ECRMP establishes a framework for considering a wide range of human and environmental stressors to the Karuk Tribe and their cultural practices, including effects of climate change.

The ECRMP ensures that "Karuk Tribal members and Departmental personnel hold information critical to the interworking of the natural environment. Natural Resources staff is working with Federal and State agency personnel, academia, and the interested public to ensure that the integrity of natural ecosystem processes and traditional values are incorporated into current and future management strategies within our area of influence" (ECRMP p. 5).

Katimiin Memorandum of Understanding

The intent of the MOU (Karuk Tribe and USDA Forest Service 2017) is to work together to mutually coordinate planning and implementation efforts as partners, in and adjacent to the Katimiin CMA, in a manner consistent with Karuk customs, culture and federal land management direction.

Orleans/Somes Bar CWPP and Private Lands Fuels Treatment Project

In response to federal and state legislation, the Orleans/Somes Bar community began preparing a CWPP to strengthen collaboration between landowners, local, state, tribal and federal wildland fire protection agencies. The CWPP identified affected communities at risk from wildfire and strategies to promote Firewise (*www.firewise.org*), fire-adapted communities. The 2015 lightning-caused wildfires and subsequent neighborhood evacuations, further moved collaborators to recognize the urgency of taking an "all lands" approach to address threats to people, property, cultural and natural resources at-risk of high-intensity wildfire. Recent fire events show that continued fire exclusion and barriers to managing fire within its historic regime perpetuates risk to the public and fire management personnel.

In 2015, the forest fiscally supported members of the WKRP and the Mid Klamath Watershed Council (MKWC) to further complementary fuels reduction on private lands, adjacent to and within the interior of the surrounding *Somes Bar Project* area on NFS lands. These partners engaged landowners to plan and implement fuels reduction work around their homes. Several landowners voluntarily participated in the *Private Lands Fuels Treatment Project*, which was planned and analyzed under a separate federal decision. This private lands project provided much of the social license to move forward with the *Somes Bar Project*, located on public lands.

These on-going outreach efforts incorporate active community participation in project planning design and implementation to facilitate the creation of fire-adapted communities and change the public perception that all fire is bad.

Decision Framework

The Six Rivers National Forest Supervisor, as the Responsible Official, will use his discretionary authority to decide whether to implement the *Somes Bar Project* as proposed, make modifications, or not implement the project at this time.

Collaboration, Public Involvement and Tribal Consultation

A Story that needs to be Told

There is a paradigm shift happening in wildfire management in northern California today. The *Somes Bar Project* seamlessly integrates, in practice, principles underlying the Cohesive Strategy and Karuk traditions passed down and preserved over generations for millennia.

The challenge for land managers lies in the fundamental dynamic tension between the need for periodic fire to sustain healthy wildlands and cultural lifestyles, and interests in suppressing wildfires to minimize safety threats to those living in the WUI, where homes and wildlands intermingle. For the residents of Orleans and Somes Bar, surrounded by forested public lands susceptible to high-intensity wildfire behavior, the question is not *if*, but *when* the next event will occur.

US Forest Service Fire Management

In recent years, the USFS philosophy underlying managing wildfire is no longer simply about Smokey Bear's fire prevention campaign. The Cohesive Strategy reflects this shift in philosophy stating, "Addressing wildfire is not simply a fire management, fire operations, or wildland-urban interface problem—it is a larger, more complex land management and societal issue".

Gone is the agency's approach that wildland fire demands control, containment and suppression universally throughout the NFS (2012 Planning Rule (77 Fed. Reg. 21162)).

The agency's vision for the next century is to "Safely and effectively extinguish fire, when needed; use fire where allowable; manage our natural resources; and as a Nation, live with wildland fire."

Karuk Fire Management

Once, over one hundred villages were occupied by the Karuk's ancestral people as masterful stewards of the land, where natural resources were abundant and easily accessible alongside the middle course of the Klamath and Salmon rivers in northern California (Figure 1-4).

The federal government's primary trust responsibility to Indian tribes was reaffirmed in 2014 by Secretarial Order 3335: *Federal Trust Responsibility to Federally Recognized Indian Tribes and Individual Indian Beneficiaries*. The Karuk believe fire is a spirit transformed following a time of darkness and cold, one of many spirits that transformed into everything in the natural world, including humans. Fire is considered a healing agent capable of producing change to restore balance when respected, understood, and utilized in an appropriate natural/cultural context (Lake et al. 2010). As cultural resources are synonymous with natural resources, the management, protection, preservation, and accessibility to cultural resources by the Karuk are vital to perpetuate traditional practices.

The Karuk skillfully used fire as caretakers of the land, as an instrument in concert with nature to expertly cultivate cultural use plants, invigorate forage for wildlife, emit smoke to suppress infestations and promote periods of inversion cooling for anadromous fisheries reliant on cold water.

> *"We share our existence with plants, animals, fish, insects, and the land and waters. We are responsible for their well-being. Our ancestral landscapes overflow with stories and expressions from the past, which remind us of who we are and direct us to implement sound traditional management practices in a traditional and contemporary context." (Karuk DNR Strategic Plan p.4)*

Over 80 percent of the plants utilized by the Karuk people depend on restorative fire for germination, as well as the quality and quantity of the plant materials (Anderson 2006). For example, basketry materials are required to be specific sizes for various types of baskets (Lake 2007). Acorn abundance and quality are also dependent on regular burning (Anderson 2005). Specific fire intervals are needed to manage these resources, and these intervals vary between different cultural use plant species (Lewis 1993, Anderson 2006, Lake 2007). These prescribed fires may or may not have been started in conjunction with wildland fires ignited by lightning (Lake 2013).

Community Wildfire Management – Orleans/Somes Bar Fire Safe Council

Since May 2001, the Orleans/Somes Bar Fire Safe Council has been acting on the direction of the National Fire Plan (USDA Forest Service 2000a), which instructs federal land managing agencies to work closely with communities to protect people and resources in the WUI. In 2001, the Western Governors' Association published a 10-year comprehensive strategy for reducing wildland fire risks to communities and the environment, which further highlighted the role of communities in shaping fire and fuels management decisions on private and adjacent public lands (Cohesive Strategy 2001).

> *"We believe the reintroduction of fire at the landscape level is necessary to protect, promote, and preserve the cultural and natural resources and ecological processes within the planning area. The mission of the OSB FSC is to help plan, implement and monitor the reinstatement of historic fire regimes primarily through strategic fuels reduction in a manner that protects life, property, improves forest health, and enhances the resources valued by its stakeholders. This mission will be accomplished in collaboration with the Karuk Tribe, USFS, and other agencies and community organizations."*

Western Klamath Restoration Partnership

Through outreach and involvement of local, state, tribal and federal entities, the Western Klamath Fire Learning Network (WKFLN) was formed to address the need for increased education and communication around fire and fire management. Momentum grew to surrounding communities after the first meeting in May 2013, and stakeholder groups from the Salmon River attended the July 2013 meeting. Based on their participation and interest, the partnership settled on a planning scope that included the entire Salmon River watershed. The name of the group changed to the Western Klamath Restoration Partnership (WKRP) to reflect this increase in geographic scope.

> *"Establish and maintain resilient ecosystems, communities, and economies guided by cultural and contemporary knowledge through a truly collaborative process that effectuates the revitalization of continual human relationships with our dynamic landscape." –WKRP Vision*

Scoping

The interdisciplinary team (IDT) used comments received during the scoping period to refine the proposed action and as the basis to explore alternatives (refer to *Chapter 2* of this draft EA, for discussion of alternatives considered in detail and those eliminated from detailed study and *Appendix B* for response to comments).

Relevant Issues

Relevant issues represent minor and/or non-variable consequences, which would be avoided, partially or fully mitigated by design criteria and operating procedures disclosed in *Chapter 2* (Alternative 2) and throughout *Chapter 3* of this draft EA.

Threats to Native and Traditional Ecological Knowledge Plants

Prescribed burning in the spring and ground disturbance from log skidding, sorting and loading may damage native plant species, while increasing solar radiation favoring the spread of invasive weeds.

Human Disturbance

Operational noise, presence of field crews, and smoke generated from prescribed burning may periodically disturb neighbors.

Habitat Disturbance

The removal of select crown fuels (codominant conifer trees), along with ladder fuels and surface fuels reduction treatments, including prescribed burning, may act to simplify forest stand structure in the short term, impacting habitat quality and TEK focal species.

Soil Erosion

Tree harvest and associated logging operations (e.g., skidding, temporary road and landing construction), coupled with phased initial and maintenance prescribed burning may increase sedimentation downstream.

Non-Significant Issues

Non-significant 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 §1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review… (§1506.3)."

Chapter 2. The Alternatives

Introduction

The National Environmental Policy Act (NEPA) is our country's basic charter for environmental responsibility. The NEPA applies when a federal agency has discretion to choose amongst one or more alternative means of accomplishing a particular goal (CEQ 40 CFR 1508.23). In compliance with NEPA implementing regulations, the following chapter discloses:

- o Early community planning, underlying key collaborative principles and rationale influencing the scope, temporal and spatial extent of the project area, and proposed treatment methods.
- o Description of the Alternatives Considered in Detail (Alternative 1 (No Action) and Alternative 2 (Proposed Action)), including the methodology applied to develop Alternative 2 and detailed information on treatment locations, design and disclosure of associated mitigation measures.
- o Comparison of Alternatives Considered in Detail, at the end of this chapter, includes a tabular comparative display of the alternatives' potential effects, further described in narrative later in *Chapter 3. Environmental Consequences*.

Early Community Planning

Out of necessity, communities across the country have jump-started local planning efforts to protect themselves from intense wildfires. History has shown that real change occurs when grassroots movements connect to larger national shifts in policy and opinion. In 2013, the Western Klamath Restoration Partnership (WKRP) convened workshops and utilized an Open Standards process (Figure 2-1) for conservation planning for the entire Middle Klamath sub-basin. For California, scientist Malcolm North recently predicted the rise of mega-fires across the state, as fuel loading and climate change combine to overwhelm the most technologically advanced firefighting force in history.

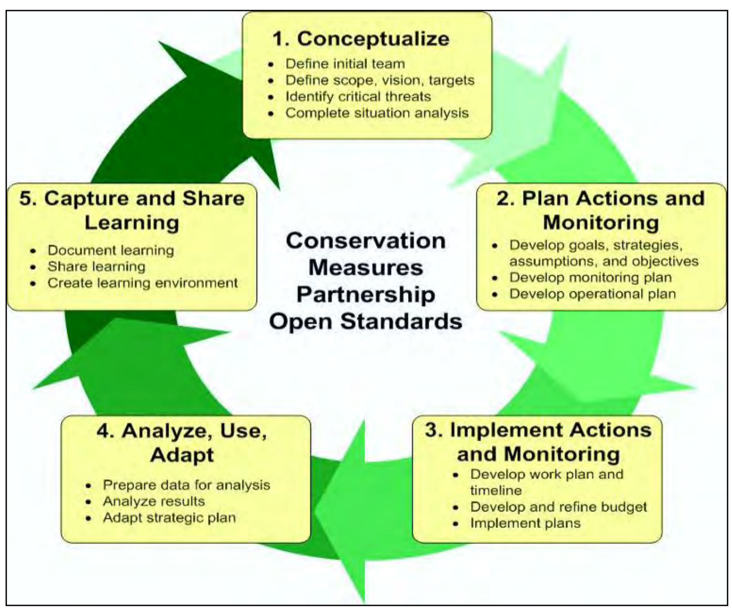

Figure 2-1. WKRP utilized a collaborative process to develop overlay assessments to better prioritize manual, mechanical and prescribed burning treatment methods and locations.

Given current climate predictions, the Klamath region is predicted to have four times more fires by 2085. Fire historian Stephen Pyne identifies the lack of prescribed fire as another major factor in the current fire situation. "If contemporary fire agencies had the chance to replay the light burning controversy, they would almost certainly choose fire lighting over firefighting as a basis for wildland stewardship." This understanding is shared by a majority of residents in the planning area, and the need to increase the use of prescribed fire as a tool to protect communities was expressed throughout the WKRP workshops. To expand the use of controlled burning to the scale needed will require incorporating science, policy, public understanding and sentiment, economics, and mechanisms for risk management that are just now being developed. There is urgency to create this new vision, for the specter of climate change has made historic fire regimes a moving target, given the amount of current departure from the fire resilient forests of a century ago.

Shared values emerged through identification of six Conservation Targets or Values. *Targets* and *values* are interchangeable terms in the Open Standards process. Though they are called targets in some places throughout the process and values in others, the intent is to not only consider our actions, but also aim to achieve improvement of target viability. The Conservation Values/Targets are:

- Fire-adapted communities
- Restored fire regimes
- Healthy river systems
- Resilient biodiverse forests, plants and animals
- Sustainable local economies, and
- Cultural and community vitality.

Identifying Critical Threats to Conservation Values

In identifying *critical threats*, the WKRP started with a threat mapping exercise. This process was used as an aid to consider real world threats to the viability to the values and targets. Some key threats emerged from this exercise, including:

- Lack of stable jobs
- Erosion of community and cultural values, including Karuk traditional practices
- Lack of beneficial fire
- Altered forest structure and composition (overly dense forests)[9]
- High fuel loading
- Lack of defensible space
- Habitat degradation (terrestrial and aquatic), and
- Impaired fishery.

[9] The group discussed that we may need to move the *fire-adapted communities* target to very good to enable us to move *restored fire regimes* to good. The status of fire regimes as currently being in fair condition is in question as the argument could be made that it is actually poor due to nearly 50 percent of the planning area not seeing fire in the last 100 years.

Defining Goals and Objectives

The overarching goal of the WKRP is to improve the viability of all conservation targets. The group reflected on the status of the target, discussed real world issues affecting the status and the ability to change them, and came up with a goal to improve target viability. Though the metric of measurement is subjective, it provides a framework for partners to periodically reevaluate targets in light of lessons learned. These targets are long term and will likely still be applicable generations from now. Table 2-1 below provides a guide of how perceived current target viability moves to potential future target viability through efforts of the WKRP and the broader community.

Table 2-1. Perceived current and future target viability.

Target/Value	Current Status	Potential Future Status
Sustainable Local Economy	Poor	Fair
Cultural and Community Vitality	Poor / Fair	Good
Fire-Adapted Communities	Fair	Good
Restored Fire Regimes	Fair	Good
Resilient, Biodiverse Forests, Plants and Animals	Fair	Good
Healthy River Systems	Fair	Fair

Three big points that emerged throughout the workshops were:

1. The need to develop multi-organizational capacities;
2. The need for on-the-ground demonstration projects to prove we can go from agreement in principle to agreement in practice; and
3. The need to plan big, but start small, learn from the outcomes of our work, and have the ability to refine our prescriptions/descriptions as we progress.

Another recurring theme was the intent to implement all three primary components of the *National Cohesive Wildland Fire Management Strategy* (Cohesive Strategy 2014):

1. Restoring and Maintaining Resilient Landscapes
2. Creating Fire-Adapted Communities, and
3. Responding to Wildfires.

Refining Strategies

In order to change the viability of targets/values, strategies were discussed and decided upon and logical points of insertion in our results chains were identified. These strategies were meant to reverse threats to our values into positive results, which would affect other threats to ultimately increase the likelihood of achieving our targets. This forced the partnership to identify the root causes of the problems and what could be done to strategically address them. The nine strategies that were ultimately settled on are as follows:

1. Develop and implement landscape level strategic fuels reduction treatments;
2. Increase use of fire to restore and maintain pre-European conditions in a contemporary context;

3. Increase local restoration capacity;
4. Create sustainable diverse revenue streams to address all threats and values;
5. Accelerate development of fire-adapted communities;
6. Integrate food security into forest management actions;
7. Advocate for and support implementing existing fisheries restoration plans;
8. Develop integrated, inter-generational education programs and activities that complement our identified strategies; and
9. Develop inclusive partnerships for implementing zones of agreement.

The following overlay assessment description represents the basic zone of agreement for all treatment types. It served as a guide to planning and prioritizing projects on the landscape scale for multiple social, ecological, and economic factors:

1. Creating defensible space around structures and critical infrastructure through manual and prescribed burning fuels reduction treatments. Mechanical treatments were considered for the 500-foot buffer. The structures layer was updated in 2014 for the entire planning area by the Karuk Department of Emergency Services:
    a. 100-foot buffer: 1 point
    b. No buffer: 2 points
2. Safe and reliable access and egress routes will be maintained by manual, mechanical and prescribed burning treatments (if implemented, will also provide cost effective linear features to stop wildfires and start prescribed fires):
    a. Critical access/egress routes (300-foot buffer): 2 points
    b. Complete road system layer, public and private (300-foot buffer): 1 point
3. Public/private boundary layers (Green Line – buffer applied from edge of private property onto public lands). Revisiting residential properties to create fuelbreaks (Figure 2-2) along the public-private boundary allows both federal and private landowners to have more certainty that fires, especially prescribed fires, do not inadvertently spread across property lines:
    a. 200-foot buffer: 2 points
    b. ¼-mile buffer: 1 point

Figure 2-2. A shaded fuelbreak created in a tanoak forest benefits the landowner who lives just upslope, elk that frequent the stand to feed and bed down, and tribal members who gather tanoak acorns for subsistence and ceremonial use.

4. Fuelbreaks along existing firelines, ridges, and trails help tie in road and streams to establish fire sheds—areas where fires (both controlled and wildfires) can be contained or stopped. Control features outside the wildland-urban interface (WUI) should also be addressed to slow the spread of larger "mega-fires" through the backcountry. These actions could be as simple as conducting controlled burns in the fall along significant ridges to break up fuels at the landscape level.
    a. Existing firelines (300-foot buffer): 2 points
    b. Current and historic trails: 1 point
    c. Upper third slopes: 1 point
5. Maintaining existing fuels treatments on public and private lands to increase fuelbreak effectiveness.
    a. 0 to 3 years since treatment: 1 points
    b. 3 to 10 years since treatment: 2 points
    c. 11-plus years since treatment: 1 point
6. Targeted fuel treatments for cultural and ecological resource benefits to protect tribal practices dependent on the use of fire as a land management tool, and to preserve plant and animal species that depend on habitats maintained by frequent fires:
    a. Wildlife Layers
    b. Elk winter range restoration potential layer
        i. Low (0.8): 1 point

ii. High (0.9 or 1.0): 2 points

iii. Spotted owl nest sites buffer (1/2-mile diameter): 1 point

c. Vegetation Layers (Landfire Biophysical Settings (BpS))

i. Klamath Mixed Evergreen BpS (tanoak distribution): 1 point

ii. Klamath Siskiyou Lower Montane Serpentine Woodland: 1 point

iii. Black Oak BpS Layer: 1 point

iv. White Oak BpS Layer: 1 point

v. Baker Cypress Stands: 2 points

vi. Meadow Restoration: 1 point

vii. Willow/Riparian Stands: 1 point

viii. Beargrass Areas: 1 point

ix. Hazel Areas: 1 point

x. Iris Areas: 1 point

xi. Huckleberry Stands: 1 point

d. Native American Cultural Use Areas: 1 point

Separate overlay assessments were done to better prioritize manual, mechanical and prescribed burn treatments, based on specific timing, location, access, and other specific needs/factors relating to each treatment type. The following changes and assumptions were made to the general overlay assessment and point scheme described above:

Manual Fuels Treatment

- Only prioritized fuels treatments from 2002 and earlier, assuming they would need further thinning to allow for positive re-introduction of prescribed fire: 1 point.
- Did not consider insolation or south and southwest facing slopes (included too many inaccessible areas and brought focus away from communities).
- Did not include managed stands or mid-mature dense stands (these areas need mechanical thinning).
- Excluded from prioritization all areas with slopes over 80 percent.

Mechanical Fuels Treatment

- No points for 100-foot structure buffer. Kept two points for 500-foot buffer. Assumed no mechanical treatments that close to homes.
- Only used quarter-mile community (neighborhoods) buffer, but gave it 2 points to reduce focus directly on the property lines.
- Did not include previous manual fuels treatment layers.

- o Reduced the weight on the firelines buffer from two to one point. Most mapped firelines are not accessible for mechanical harvest.
- o Did not include historic trails.
- o Did not include insolation.
- o Added a point to mid-mature dense stands layer: 2 points.
- o Added layer for plantations over 40 years old: 2 points.
- o Did not include crown fire potential.
- o Excluded serpentine (buck brush) veg type from Landfire BpS veg layer. These areas are proposed mid-winter prescribed burns.
- o Excluded from prioritization: inner gorges, slopes over 40 percent except within 1,500 feet of existing roads (allowing for potential skyline treatments), northern spotted owl (NSO) activity center (AC) buffers, and existing landslides.

Prescribed Burning Treatments

- o Critical access egress routes: 1 point (rather than 2).
- o Recent wildfires (within past 10 years): 2 points (rather than 1).
- o A new layer showing plantations over 20 years old was added: 1 point.
- o A new layer showing areas with predicted flame lengths over eight feet was added: 1 point.
- o Crown fire potential layer was removed.

Manual fuels treatments (public and private) are one of the strongest areas of agreement in principle identified. Prescribed burning was also strongly supported. Additionally, while these treatments will save firefighting expenditures in the future, they do not generate funding by themselves and will require a significant investment to implement at the scale described.

Mechanical treatments were strongly supported by some participants, but strongly discouraged by others unless there was a clear path for collaboration as defined through the Open Standards process to allow for meaningful stakeholder involvement. Mechanical treatments have affected the viability of traditional food and fiber resources in some areas; however, manual treatments may not be able to restore the potential natural vegetation on a site that has undergone a type-level conversion due to lack of fire. In some cases, girdling of trees followed by prescribed fire was proposed by participants to restore potential natural vegetation in areas where mechanical treatments are not an option. The overlay assessment informed the identification of high-priority areas based on the shared values and zones of agreement, as depicted in Figure 2-3.

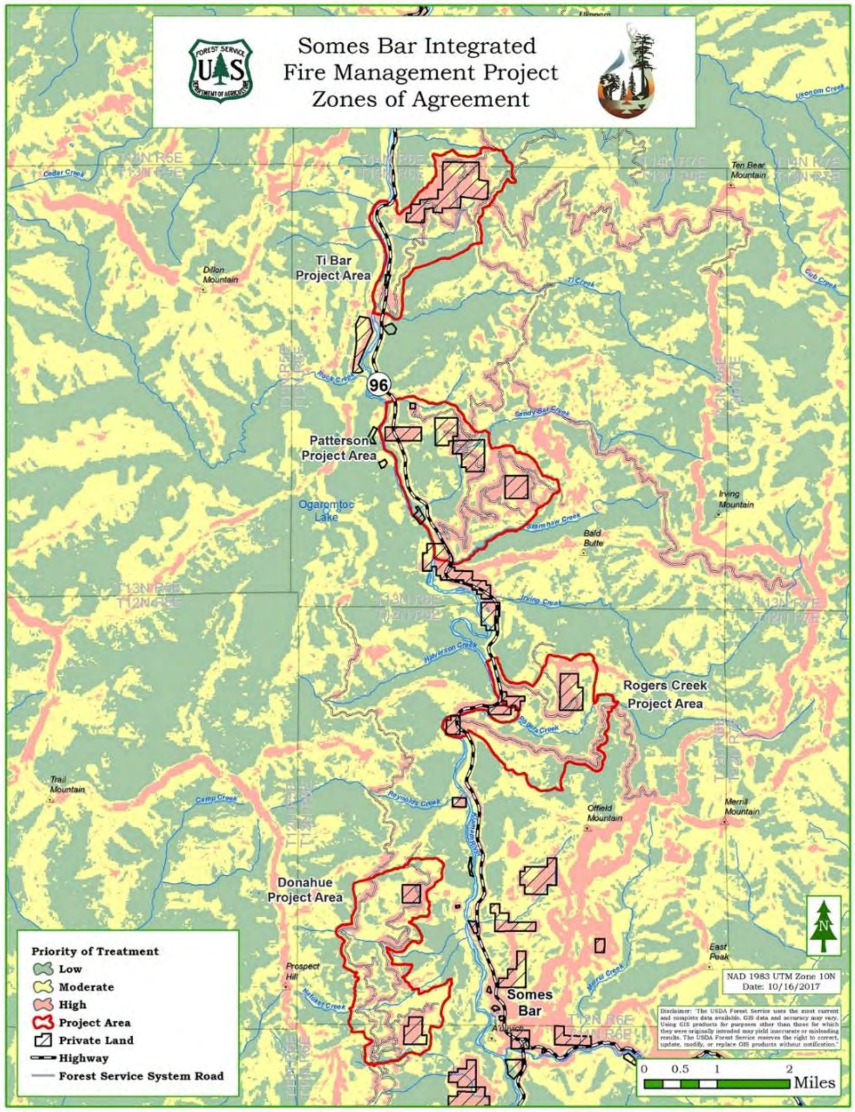

Figure 2-3. The WKRP plan for restoring fire-adapted landscapes identified strategic features (roads, mechanical and manual treatments around private property and burn treatments between roads and mountain ridgetops) to protect neighborhoods.

Fire Hazard Assessment

Fire hazard assessment is more complicated than can be described by Fire Regime Condition Class (FRCC) alone. Fire starts, mid-mature dense stands, and slope-aspect insolation maps are also included to determine fire hazard assessment within the planning area. The FRCC helps planners determine how much landscape vegetation has changed from the way it was historically to the way it is today. Figure 2-4 represents where the contemporary fire return intervals (FRI) have been altered when compared to historic fire return intervals. Lands with high fire return departure are shown as red; moderate, yellow; and green, low departure. For fuel hazard, low, medium and high rankings were valued as one, two, or three points respectively. Assessing FRCC was used to help guide management objectives and set priorities for treatments.

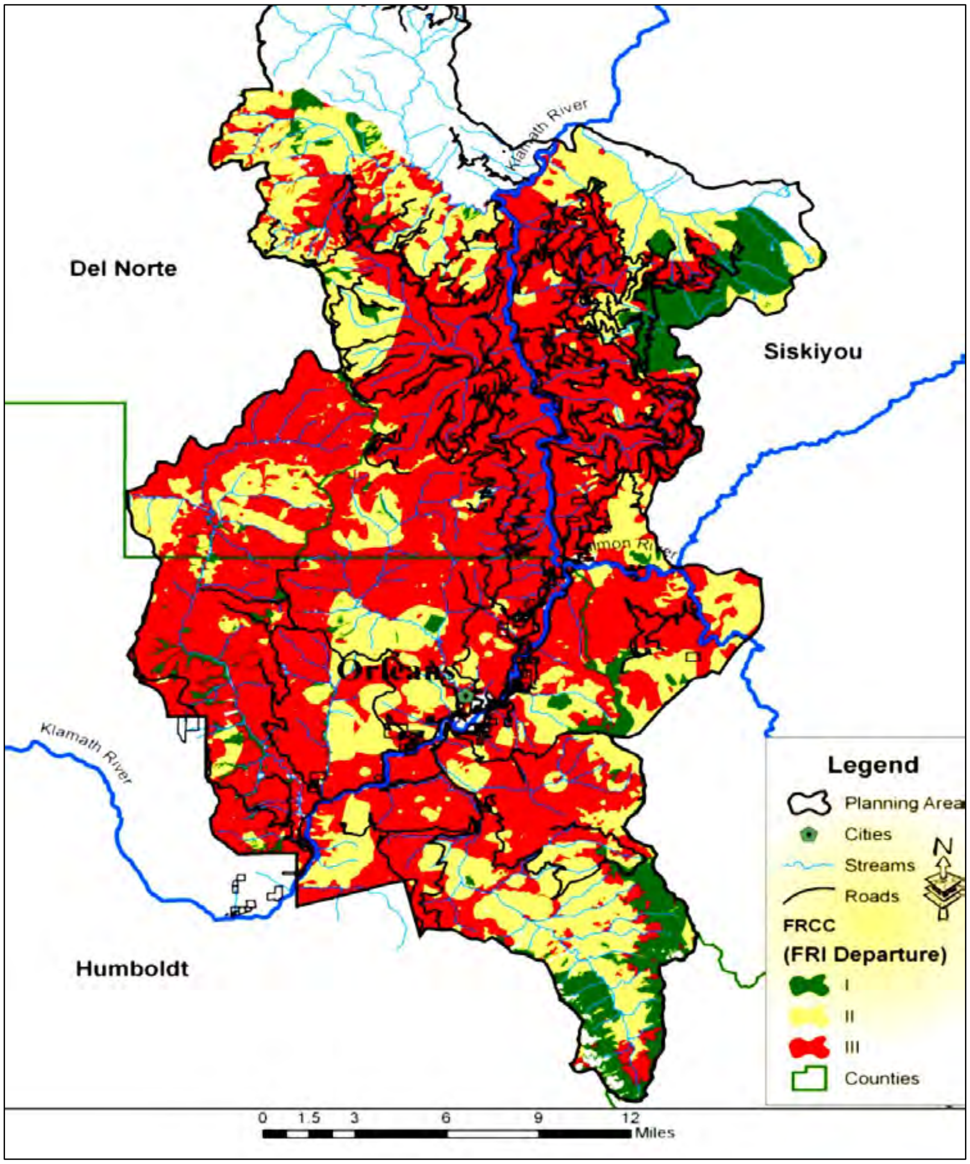

Figure 2-4. Fire regime condition class based on departure from fire return interval.

The overlay below (Figure 2-5) displays fire starts from 1922 to 2005, both as points and as a density gradient, to show areas within the planning area that historically burned. This overlay, coupled with other fire hazard assessments of the location of mid-mature dense stands (concentrated fuels), slope-aspect insolation, areas of community importance, emergency access routes, risk of wildland fire, and firefighting capability linked to each community asset were considered when determining recommended rankings for treatment priority.

Concerning firefighting capability, ranking and value have an inverse relationship. For example, the Karuk Medical Clinic and Department of Natural Resources have a fuel hazard ranking of low (1 point), a risk of wildland fire occurrence of medium (2 points), and a firefighting capability ranking of high (1 point). This point scale has possible total values ranging from three to nine, which correlate to overall risk.

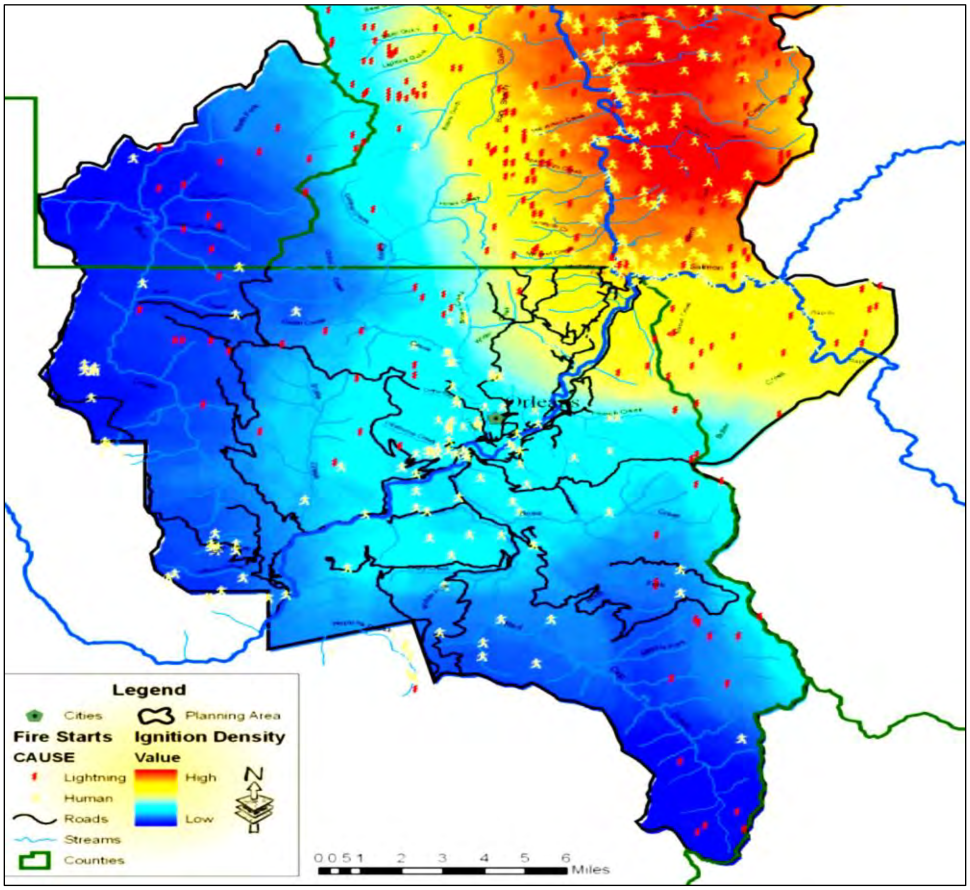

Figure 2-5. Fire starts by cause and ignition density.

Risk of wildland fire occurrence was determined by using a combination of the asset's position on the slope (low, mid, upper) and how frequently the area experienced fire in the past. The risk of wildland fire occurrence considered recorded historic fires in near the project area between 1975 and 2015, as displayed in Table 2-2. During the early community planning effort, overall risk rankings were defined as low (3 to 4 points), medium (5 to 7 points), and high (8 to 9 points).

Table 2-2. Recent wildfire starts compared to total acreage burned in the project area vicinity.

Fire Years	# of Fires	Total Acreage Burned
2005-2015	693	355,459
1995-2005	800	91,151
1985-1995	826	18,450
1975-1985	691	2,178

Since 1978, recorded wildfires have burned more than 430,000 acres in this same geographic area (see Figure 2-6 and Table 2-3). In 2017, the Ukonom and Haypress fires burned approximately 25,000 acres immediately adjacent to the focal areas. The only wildland fire recorded within the project area was the Marble Fire, in August 2017, which burned 318 acres in the Patterson focal area.

Table 2-3. Recorded wildfires, greater than 200 acres in the project area vicinity.

Year	Fire Name	Acres
1987	King Titus	68,071
1987	Yellow	51,060
1994	Jack	28,206
1998	UNK	8,797
2006	Hancock	21,866
2006	Somes	15,506
2007	King Creek	10,477
2008	Haypress	13,665
2008	Jake	38,417
2008	Merrill	8,339
2008	Mill	65,882
2008	Panther	44,497
2008	Three	4,923
2013	Butler	22,445
2017	Haypress	21,086
2017	Ukonom	4,237

Figure 2-6 illustrates the absence of fire processes over the last 95 years, the influence of seasonal easterly prevailing winds driving rapid moving flame fronts, and large areas affected. The Ukonom Ranger District (RD) tends to experience a noticeably higher rate of lightning occurrence compared to other areas of the forest over the same period, particularly in the higher elevation terrain in the Marble Mountain Wilderness east of the project area. This frequency for lightning is almost twice as much as the rest of the forest combined. Fire suppression within the WUI has increased forest density and hazardous surface and aerial fuels, increasing the risk for large-scale, high-intensity wildfires, including active crown fires.

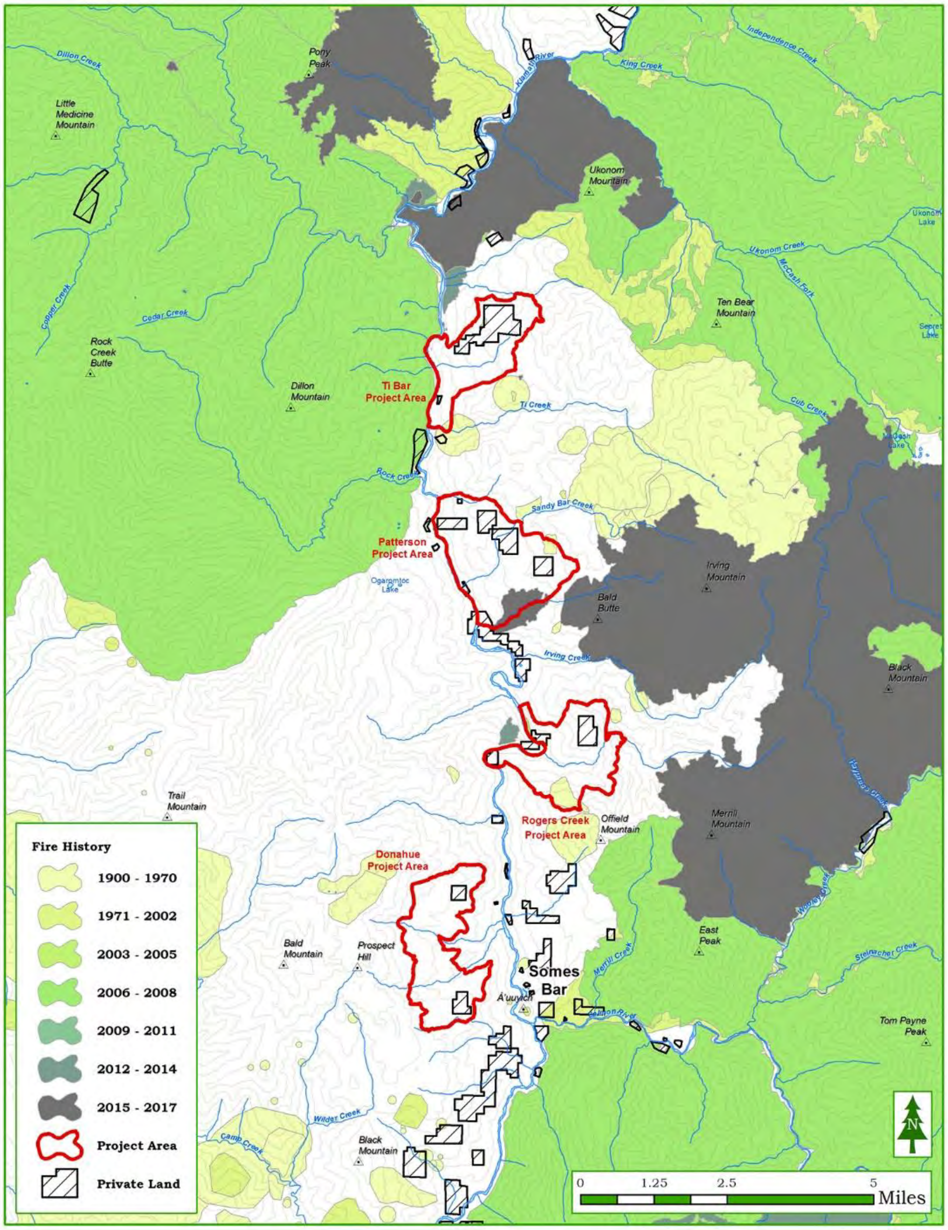

Figure 2-6. Fire history from 1900 to 2017 within and surrounding the focal areas.

Alternatives Considered in Detail

Two alternatives were considered in detail and are discussed by resource values in *Chapter 3.* The No Action Alternative (Alternative 1) provides a comparative baseline of what could happen if the Proposed Action (Alternative 2) is not implemented.

Alternative 1 – No Action

The No Action Alternative provides a baseline for comparing the Proposed Action. Under this alternative, proposed treatments would not occur. Recent fire events show that continued fire exclusion and barriers to managing fire within its historic regime perpetuates risk to the public and fire management personnel. As reflected by the 2014 letter of intent from USDA Chief Tidwell, "We do not accept unnecessary risk or transfer it to our partners or future generations." Every fire interval removed from a fire-dependent ecosystem compounds risk and defers it to a more hazardous future. Enabling fire to be managed at an acceptable level of risk now will mitigate unacceptable consequences and reduce risk to future generations. In the past two decades, a rapid escalation of extreme wildfire behavior, accompanied by significant increases in risk to responders and citizens, home and property losses, costs, and threats to communities and landscapes have been observed (Cohesive Strategy 2014).

Fire Suppression

Within the project area, the appropriate response for a wildland fire on National Forest System (NFS) lands would continue to be direct and indirect suppression tactics as described in the Klamath (KNF) and Six Rivers national forests' (SRNF) land and resource management plans (LRMPs or forest plans). The US Forest Service (USFS or Forest Service) policy for fire suppression is to conduct fire suppression in a timely, effective, and efficient manner with a high regard for public and firefighter safety, followed by protection of natural resources. It is the objective of the Forest Service to respond to each wildland fire ignition in a timely manner with appropriate forces. Firefighting resources would continue to focus strategies and tactics to aggressively suppress wildfires near at-risk, isolated parcels of private property in the WUI as the highest priority, necessary due to the current and continued accumulation of flammable forest vegetation likely to contribute to high-intensity fire behavior that could threaten communities, infrastructure and private property amenities.

The probability of a fire burning over a landscape is based on factors such as the chance of ignition, potential rate of spread, historical and predicted weather conditions, topography, and length of the fire season (Miller 2000). Consequences regarding these factors are analyzed and based on fire computer modeling, and are discussed for the No Action Alternative, as well as the Proposed Action, in *Chapter 3* of this draft EA.

Fire Prevention

Wildland fire prevention activities would continue to occur under the No Action Alternative. Wildland fire prevention is the informing, educating, and regulating of human behavior or activities that influence the various types of potential ignition sources within flammable vegetation. Analysis of human-caused fires indicates that these fires are most likely to occur near inhabited areas or heavily used areas, such as campgrounds or along forest roads or trails (USDA Forest Service 1995). Efforts to educate the public on safe fire use would continue through personal contacts, interpretive programs, interagency fire prevention cooperatives, the use of posters and signs, radio and press releases.

Continuation of public neighborhood fire prevention meetings, discussions of defensible space, fire apparatus access, education about home construction materials (flammability) and design, etc., would continue to take place periodically. In 2012, the Orleans Somes Bar Fire Safe Council (FSC), with assistance from the Orleans Volunteer Fire Department (VFD), USFS, Karuk Tribe, California Department of Forestry and Fire Protection (CAL FIRE), Salmon River FSC, Humboldt County FSC,

FSC of Siskiyou County, Siskiyou County, private landowners, and the community at large completed their community wildfire protection plan (CWPP) for northwestern California, in Humboldt and Siskiyou counties, and a small portion of Del Norte County. The purpose of the CWPP is to provide the communities, agencies and the Karuk Tribe with information that can be used to help protect Orleans and Somes Bar from severe wildland fires, while helping to guide the planning and implementation of community fire safety projects.

Prescribed Fire Training Exchange

Approximately six (6) full-time-equivalent (FTE) jobs are created through the Klamath Prescribed Fire Training Exchange (TREX). These exchanges were designed by the US Fire Learning Network (FLN) to provide opportunities to implement prescribed fires (or controlled burns) and give trainees high-quality training assignments, as well as exposure to new people, places and techniques. Each year, there are approximately 50 TREX training opportunities with about 100 participants each.

Prescribed burning reduces fuel loading and wildfire risks to protect communities, homes and lives. With proper planning and under the right conditions, prescribed burns are an effective tool. Burning also increases the food and fiber resources for subsistence gatherers, contributing to the local economy. This effort requires close coordination with multiple organizations and residents to be successful, including the Forest Service, Karuk Tribe, Mid Klamath Watershed Council (MKWC), Cultural Fire Management Council, FLN, The Nature Conservancy, Salmon River Restoration Council, Northern California Prescribed Fire Council, California FSC, CAL FIRE, Firestorm, Orleans VFD, and other partners. The TREX organizers work with regulatory agencies and partners to coordinate these burns, which will be implemented following strict protocols to ensure safe fuels reduction, capacity building for fire managers, and future opportunities for managing wildfires more frequently for resource objectives without increased threats to communities.

Alternative 2 – Proposed Action

Function: Bringing Back Fire

Since it has taken nearly 100 years of growth to produce present-day, "non-natural" vegetative structural conditions, it is predicted that it will likely take several decades of resource management to return the cultural environment and balance of ecological cycles.

As designed for this Proposed Action in the short-term, the desired future condition would be to sustain a flame length less than four (4) feet under 90th-percentile weather conditions[10]. The selection of a desired less than 4-foot-flame length is to facilitate restoration of historic fire regimes. Experts also recognize a 100-percent attainment of the desired future condition within the project area is not probable.

[10] ***"90th percentile" Weather Conditions:*** The combination of temperature, humidity, wind, and fuel moisture that is warmer, drier, and windier than 90 percent of all summer days. Under 90th percentile weather conditions, 10 percent of the summer days are assumed hotter, drier and windier. For example, the fire season is described as the 153-day period between May 1 and September 30. Ten percent (or 15 days) would be hotter, drier, and windier than the conditions described as 90th percentile.

Environmental and legal constraints, such as weather, on-the-ground fuelbed conditions, and application of required mitigations to ensure compliance with air quality, down wood, roadless and riparian standards, etc., would restrict treatment intensity and duration in some areas.

Alternative 2 represents an effective approach to revitalizing the ecosystem and preparing communities to live cooperatively with wildfire within the Project Area and would provide for public and firefighter safety.

> *The long-term objective is to set the stage for the near future so wildfire can become a restorative management tool to promote diversity of native plants, stimulate sprouting of deciduous oaks and shrubs and so trees can survive long enough to develop thick, scorch and insect-resistant bark and healthy crowns.*

The following overarching tactics would be implemented:

Ridge-Top Containment (strategic fuelbreak)

- Stop or contain planned prescribed fire during burning operations. During burning, these defensible control lines act to hold or confine fire within the burn plan area.
- Provide defensible control lines from which firefighters can safely intervene when responding to unplanned fire ignitions outside the project area.

Interface Boundary Confinement (defensible space buffers)

- Stop or confine planned prescribed burning during operations by providing a defensible space between private property and prescribed burning on NFS lands. During burning, these defensible control lines act to hold or confine fire within the burn plan area.
- Increase the probability of unplanned fire ignited on private land from entering NFS lands and unplanned fire ignited on NFS lands from entering onto private land.

Interior Confinement Lines (control line, fireline or handlines)

- Stop or confine planned prescribed fire during multiple phased burning operations.

Control

- Pre-treatment of hazardous fuels across the landscape would establish a mosaic pattern, setting the stage for low and moderate intensity prescribed burning and wildfire that can be safely contained and controlled without substantial augmentation of suppression reinforcements.
- Prescribed burning treatments would occur *once* associated perimeter containment and interior control line fuelbreaks are in place.

Integration of Karuk traditional management philosophy and practices (TEK)

Although Alternative 2 is designed to benefit diverse community interests and reinstate fire processes to restore natural and cultural resources holistically, WKRP recognized the aboriginal values were forefront. The Karuk philosophy of renewal reaffirms the responsibility of humans as stewards, as well as a critical ecosystem component. The tribe believes in renewal of the human-environment relationship that is compatible with ecological processes, promotes a sustainable economy, and increases ecosystem resilience.

This paradigm shift was the driving consideration influencing project design, which did not involve single species management; rather, whole landscape improvement—for the collective benefit of people, animals and plants. Since involving all aspects of TEK (traditional ecological knowledge) in this initial project would be too complex, a few focal species were selected to begin to formulate a story of human re-emergence in accepting the people's collective responsibility in a contemporary future.

Focal Species

The focal species selected represent different components of the landscape and are those that are either:

- Directly regulated by laws, such as the Endangered Species Act (ESA),
- Associated with water-quality regulations, or
- Founded in TEK as being foundational in human-fire relationships.

The focal species provided an umbrella framework for the landscape-level analysis. Some of these components are regalia species in tribal ceremonies. Regalia species are crucial to tribal people through ancestral tradition. If those components are put together, management for the focal species promises to provide a realistic and holistic approach to whole landscape management. The following five focal species were selected according to these guidelines for the *Somes Bar Project* and the planning efforts of the greater WKRP collaborative:

1. **Northern spotted owl (NSO):** This regulated species tends to use old growth forest habitats. While the interpretation could be made that the NSO is a messenger of a sick forest habitat dynamic, that function is traditionally associated with another species—the Pacific fisher—which is not only legally regulated, but is a regalia species. In Karuk culture, the Pacific fisher represents NSO habitats in the environment. Though owls are known as messengers of sickness and death, it is the great horned and screech owls that are told to carry these specific messages. These two species are known to have specific names in the Karuk language. The NSO is not known to have a specific name, but has been found in practice to be one of the first species to decline when the habitat dynamics deteriorate owing to fire exclusion and other contemporary management practices.
2. **Pacific fisher:** This species, which as a regalia species directly ties to TEK principles, is a potential surrogate for NSO using the forest and oak woodlands. The fisher, in fact, covers a wider array of habitat dynamics, which in turn is more representative of fire process and function. The fisher is not just associated with conifer forests, but also with upland oak stands, which are traditionally more open and contain bunch grasses. The fisher plays a very central role in

ceremony and culture—the Pacific fisher is carried through the Karuk World Renewal ceremonies holding the arrows used to pierce the earth and wake up the world.

3. **Roosevelt elk:** This species tends to use open areas, higher elevation grasslands, or passageways provided by native serpentine soils, representing a bridge between the human-fire relationships (men carry fire in elk horns) and howling dogs (wolf returning to adjacent landscapes). In looking to an imminent return of the wolf, elk habitat dynamics are critical in protecting their reproductive rights from the wolf, as well as enhancing our ability to see things through the eyes of the wolf in teaching the importance of family, togetherness, or collaboration.

   To build upon the open end of the fisher-habitat dynamic, Roosevelt elk was also identified as a focal species. Though neither the fisher nor the elk were mentioned explicitly in the summarized story, they have a unique place in ceremonial practice, use and management that helps to start building a story leading us into a contemporary future, while maintaining the traditional foundations of Karuk living culture. With elk specifically, there is the traditional male responsibility of taking care of the animals. In fulfilling this male role in fire management, fire is carried in an elk horn. In integrating the habitat needs of large ungulates and other species needing more open space, we start to enhance the entire spectrum of habitat needs. With fisher covering the dense habitats transitioning to the more open habitats, and the elk transitioning from the wide-open habitats back to the denser habitats, there is plenty of overlap in habitat use. This can help to frame site-specific variation when it comes to formulating a proposed action or need for adaptation, moving towards recovering the habitat dynamics and ecosystem processes required by the spotted owl.

4. **Pacific giant salamander:** This species tends to be concentrated in the low gradient riparian areas. Riparian areas require special focus in the current regulatory environment. This is not unfounded in traditional Karuk practice. The Pacific giant salamander is the traditional focal species treated with the utmost respect—it has its own prayer in Karuk World Renewal ceremonies, and is considered the sacred water purifier. Though water-quality parameters can be measured as an indicator of water quality, Karuk culture requires that no harm come upon this species, and in turn, riparian habitats receive special focus, and water from the source to the ocean and back again is protected as the primary directive.

5. **Willow:** This species tends to be concentrated around the riverine areas. The story of Coyote stealing fire illustrates the crucial place of Willow within human culture. One can correlate the human use and responsibility to the plants and animals to a cyclic interaction among all living things. This interaction operates among TEK, practice, and belief pathways. The willow grows around and at the edge of the river, often close to the sites of traditional villages. Willow is used to make fire, and is a crucial basket-weaving resource. It is particularly important in terms of female responsibility. Willow also harbors the river mussel, whose shell is used by women to carry fire when upholding the traditional female fire use responsibility to the plants.

Traditional Cultural Properties

Traditional cultural properties (TCPs) and their consideration within historic preservation law has allowed for a deeper understanding of what needs to be identified and protected through active cultural management. Traditional cultural properties are places that tie the practices of a living community with ancestral use; vegetation features, landscape features, the setting, and the feeling of a place may all be concrete contributory elements in the designation of a TCP.

Cultural vegetation characteristics (CVC) make up a special category of tribal archaeological data. They are main constituents of resource areas that provide evidence of human management. They are defined as vegetation assemblages indicative of historic human use, management, or occupation. They are indicators that provide historically relevant information, which may justify their designation as a site, property, or as a feature in determining the eligibility of a larger district.

Examples of vegetation that show evidence of management include huckleberry, sugar pine, California black oak and tanoak. Tanoak groves require fire and removal of younger trees to ensure the heath, vitality and productivity of the main trees. A high-quality grove will have mature, well-spaced trees. Huckleberries need to be managed in order to produce useful berries for people and animals. Both of these become unproductive if left to grow unchecked. Sugar pines are often found in strategic places on ridges, and would have been managed to serve as ignition sources. Accordingly, they are commonly found in conjunction with other plants that thrive in areas well managed by fire, such as tanoak, hazel, manzanita, or beargrass.

Treatment Objectives and Considerations

- Focus mechanical and/or manual thinning around hardwood trees that are deficit on the landscape and legacy trees of cultural value to retain, enhance, and increase CVCs and resources within existing natural stands that have been subject to encroachment by Douglas-fir. These include black oak, white oak, madrone, chinquapin, and tanoak species, sugar pine, ponderosa pine, and other species with unique structural characteristics. These treatments would also be used to:
    - Reduce probability of future loss of these trees due to increased encroachment by Douglas-fir and due to high severity fire;
    - Revitalize the Karuk culture by allowing for the reintroduction of fire, while maintaining maximum amount of existing cultural vegetation characteristics and resources that are still present at these sites after more than a century of fire suppression and lack of cultural management; and
    - Increase overall diversity and heterogeneity of these stands to increase habitat value and use by wildlife and other species.
    - Work towards restoration of the former progeny site within Katimiin Cultural Management Area (A-spur treatments in Donahue) by using mechanical, mastication and/or manual treatments to work towards restoring more natural conditions.

- Mechanical and/or manual treatment up to 300 feet from roadside to provide safe access/egress and ease of prescribed fire implementation.
- Mechanical/manual treatment within 500 feet of private property to protect property and ensure limited mortality from prescribed fire adjacent to private land.
- Mastication and/or manual treatment within plantations that cannot be treated mechanically due to lack of maturity and/or other concerns to provide safe access/egress and ease of prescribed fire implementation.
- Mechanical thinning within plantations, adjacent to access/egress roads and of large enough size to compensate for the cost of treatment, to increase and enhance foraging habitat and provide access/egress.
- Minimize the need for new infrastructure (temporary roads and landings) when planning mechanical treatments.
- Take incremental steps to prepare the landscape for future treatments aimed to revitalize ceremonial practice of cultural burning Offield Mountain. This includes treating plantations on the north face of Offield Mountain to allow for prescribed fire treatments in this area.

Description of Treatment Methods

A guiding premise for sustaining ecosystems and protecting biodiversity put forth by Kaufmann and others (1994) is to manage ecosystems to conserve the structure, composition, and function of all elements, including their frequency, distribution, natural loss and revival. Fire effects are woven through all aspects of this premise. The dynamic nature of ecosystems and the scale of landscape patterns and processes are fundamental characteristics that the interdisciplinary team (IDT) considered in integrating TEK and agency knowledge of fire into land management.

Alternative 2 would apply phased, strategically placed manual, mechanical, and prescribed burning treatments across the landscape and around private inholdings to establish defensible space, critical fuelbreaks and safe access routes to aid fire control and frequent burning to promote TCPs. Refer to Table 2-5, Table 2-6, and Table 2-7 for more details on phasing of treatments and unit-specific treatments.

Once initial phased entries 1 through 3 are complete, as summarized below in the *Treatment Prescription Descriptions* section and described in *Appendix C*, repeated, carefully planned prescribed burning would continue up to 15 years. As designed, prescribed fire would be ignited from the established fuelbreaks, whereby flames creep downslope becoming the primary method to achieve ecological balance of key cultural and ecological elements, and WUI property and life protection.

The following treatment methods would be implemented to alter forest fuels structure and fuel loading:

Manual Treatments

Manual treatments are proposed as an initial entry and as a second entry following mechanical entries, to select for more fire tolerant species, lower fuels concentrations, and potential for torching to control fire behavior during burning operations.

Handheld equipment (e.g., chainsaws, loppers) is utilized to thin (cut), limb, or girdle small-diameter ladder fuels and to break up the continuity of high concentrations of shrub species. Some conifers cannot be removed without seriously damaging oak trees (Harrington and Devine 2006). Girdling removes a strip of bark from around the entire circumference of either a branch or trunk of a woody plant.

Slash generated from manual treatments would be handpiled and burned (or scattered where concentrations are low) to prepare for understory or jackpot burning. Handpile dimensions are up to 5x5x5 feet in size, piled on slopes up to 65 percent, and away from the drip line of predominant trees. Piles would be covered and ignited during favorable weather conditions.

Manual treatments as an initial entry would occur in areas where there is no opportunity for forest by-products, such as firewood and commercially valuable sawlogs. This may be due to the topography (not conducive to heavy equipment access or safe operations), protection of natural resources vulnerable to ground disturbance, or in larger more mature stands where only smaller diameter fuel reduction is necessary to prepare the ground for follow up prescribed burning.

Manual treatments would be implemented within select riparian areas. Most of the perennial and intermittent streams in the project area provide a natural obstacle to the rate of spread and consumption from understory/jackpot burning and may not require much treatment as the first entry. Where thinning of small-diameter ladder fuels is needed to ensure positive prescribed burning effects adjacent to streamcourses, thinning would be limited to vegetation less than 6-inch dbh (diameter at breast height). Placement of piles would be minimized near stream channels, as well as adjacent large downed woody debris, key habitat components for Pacific giant salamanders.

Mechanical Treatments

Ground-, cable- and road-based heavy equipment (e.g., yarders, tractors) are utilized to improve growing conditions for trees of interest and reduce ladder fuels. In plantations, the residual average canopy closure would be 45 to 50 percent. For example, non-plantations, where larger black and white oak or sugar pine are being encroached by other less fire-tolerant conifer species, efforts would be aimed at culturing around these more fire-tolerant species to promote their health and vigor and to help ensure these species continue to thrive in the project area. This would also aid in efforts to provide meaningful forest industry jobs. Activity fuels may also be handpiled and burned.

Ridgetop-Shaded Fuelbreaks

Ridgetop-shaded fuelbreaks are strategic ridges identified as important control features for prescribed burning and would assist with wildland fire response tactics. They are similar to the access/egress shaded fuelbreaks, but narrower in scope. Manual treatments may include handpile burning or lopping and scattering of fuels up to 100 feet off ridge features, supported by two-foot-wide handline construction.

Prescribed Burning

To achieve the desired results of low- to moderate-burning intensity, manual and mechanical treatments would be completed to allow for prescribed fire conditions that minimize high-severity fire effects. Some of the project area is not accessible due to very steep terrain or is already in the condition (more open stands, no ladder fuels) that would achieve the desired effects from burning without any pre-treatments.

Prescribed burning (Figure 2-7) would target the reduction of small-diameter ladder fuels and break up the continuity of excessive surface fuel build up. Important cultural and ecological plant and tree species would be protected from adverse fire effects, either by installing temporary firelines or altering ignitions patterns as identified in a burn plan. Riparian areas would not be directly ignited, but fire would not be prevented from entering into them. If its determined that the initial fuel loading is too heavy in the riparian area to allow prescribed fire to enter, then handlines or "wet lines" would be temporarily employed to reduce the potential for adverse impacts to stream temperature and water quality. Follow up understory burn treatments would occur approximately every two (2) to seven (7) years according to site-specific objectives.

Figure 2-7. Prescribed burn in progress.

Treatment Prescription Descriptions

The WKRP IDT designed a series of phased entry, integrated fuels reduction and ecological restoration land management treatments for 15 years, to the degree suppression would no longer be the primary choice for fire managers in the near future. These treatments are intended to be a turning point at which a full range of response options for using prescribed fire and unplanned wildfire ignitions as a restoration tool could be employed to heal the natural world in balance with people, benefiting amenities, TEK and natural resources.

During treatment (prescription) development, the IDT rigorously explored rate of change and scale of adaptive treatment methods, including entry cycles, seasonal timing, and spatial scale and position, recognizing implications for affecting TEK, water resources, plants, animals, aquatic species and people.

The implementation strategy entails pre-treating select areas where crown and/or ladder fuels would hamper safe application of prescribed fire. Where mechanical pre-treatments are necessary, manual treatments of understory ladder reduction would occur, followed by prescribed burning. Where crown and ladder fuels are not excessive and/or no access exists, initial entry would commence with prescribed burning.

The IDT developed treatments in context of crown class, fuel type and canopy closure. This approach was taken to allow for micro-scale specific "best fit" adaptive treatment variations during fieldwork, responsive to the collaborative's recommendation that treatments not be arbitrarily constraining. Crown class is defined relative to the tree's structural vertical position in the forest and horizontal live crown ratio. Fuel type is defined as an identifiable association of fuel elements of distinctive species, form, size, arrangement, or other characteristics that will cause a predictable rate of spread or resistance to control under specified weather conditions. Table 2-4 provides crown class and fuel-type classifications and definitions.

Table 2-4. Crown class and fuel-type classes.

Crown Class	Fuel Type	Definition
Predominant (Protected during all entries)	Crown	Larger, older trees that pre-date the current age of the stand and have large limbs, live-crown ratios generally greater than 50 percent.
Dominant (Protected during all entries)	Crown	Trees with crowns extending above the general level of the crown cover and receiving full light from above and partly from the sides; larger than the average trees in the stand and with crowns well developed but possibly crowded on the sides. Live crown ratios generally greater than 40 percent.
Codominant	Crown	Trees with crowns forming the general level of the crown cover and receiving full light from above but comparatively little from the sides; usually with medium-sized crowns more or less crowded on the sides. Live crown ratios generally greater than 30 percent.
Intermediate	Ladder	Trees shorter than those in the two preceding classes, but with crowns either below or extending into the crown cover framed by the codominant and dominant trees, receiving a little direct light from above but none from the sides; usually with small crowns considerably crowded on the sides. Live crown ratios generally less than 30 percent.
Suppressed	Ladder	Trees with crowns entirely below the general level of the crown cover receiving no direct light either from above or from the sides. Live crown ratios are generally less than 20 percent.

Common Design Criteria for Plantations – Mechanical Treatments

- All predominant and dominant tree species would be retained. These trees are considered fire resilient due to their thick bark and generally lack of low-lying tree branches.
- A minimum 40 percent canopy closure would be retained, on average, throughout the treatment unit.

Prescription 1a: Plantations (Douglas-fir) and 1b (Pine)

The prescription for 1a and 1b are similar, with one exception. Treatments in plantations with a substantial pine tree component (1b) would be thinned to 80 to 100 residual basal area in square feet per acre dependent on the size and age of the stand (North 2012, Fettig et al. 2007, Fettig et al. 2010) to minimize the potential for increasing unwanted bark beetle populations. Douglas-fir dominated plantations would be thinned to 100 to 120 residual basal area in square feet per acre, depending on the size and age of stand.

Ladder and canopy fuels would be thinned to increase spacing between conifers (Douglas-fir) and pines (sugar, ponderosa and Jeffrey pines), followed by surface fuels treatments to increase ground-to-crown height distances. Figure 2-8 illustrates a typical plantation in the project area in need of mechanical treatment prior to initiating prescribed burning.

Figure 2-8. Mechanical treatment unit in a 50-year-old plantation, featuring multi-stemmed tanoaks inter-mixed with Douglas-fir.

First Entry (1a and 1b). Mechanical fuels treatment (ground based and cable yarding).

At the treatment unit scale, areas of high- and low-stand density (retention patches and openings) would be interspersed throughout the unit. The remaining portion of the stand would be thinned retaining an average 45 to 50 percent canopy cover. Species variability would be enhanced by thinning around true oaks, sugar, ponderosa or Jeffrey pines, madrone, and Pacific yew wherever possible. Figure 2-9 illustrates encroachment of black oaks in a plantation. Thinning around suppressed oak trees is a priority. Use the upper end of canopy cover range along roadways, around invasive weeds and adjacent to retention patches. Use the lower end of canopy cover range along ridges and adjacent to gaps.

Figure 2-9. Mature black oaks being outcompeted by younger Douglas-fir. The Douglas-firs are in the stem exclusion stage, putting all their resources into growing taller in the competition for light and shading out the oaks.

Retention patches. The use of ground-based machinery (tractors and masticators) is prohibited within retention patches. Retention patches would retain forest canopy from 5 to 10 percent of each unit, clumped in 0.25- to 1.0-acre patches, strategically placed where there is evidence of culturally important gathering areas or TEK species habitats that would benefit from more forest cover or shade (i.e., gathering or elk calving areas).

Where woodrat nests are found, choose 0.25 acres adjacent to retention patch to cut all tanoak sprouts less than 4-inch dbh to encourage re-sprouting and create future woodrat habitat where appropriate.

Openings. Openings in the forest canopy would be created to increase heterogeneity and promote cultural vegetation. Traditional ecological knowledge data and on-site observations are used to locate openings in areas where TEK species or cultural vegetation would benefit from increased or filtered light. Locate in areas where conditions in the stand may already be less dense (e.g., encroached meadows).

Improve quality foraging habitat for local elk populations and warmer sites by creating 0.5- to 1-acre openings. Where non-elk habitat and cooler sites are present, gaps would range from 0.25 to 0.5 acres.

Second Entry (4c). Manual hand cutting, handpiling, grapple or excavator piling, and pile burning.

Small diameter trees and shrubs, 4- to 6-inch dbh and less, would be manually cut from beneath overstory trees, and/or aggregations of small-diameter Douglas-fir plantation trees would be thinned. Figure 2-10 illustrates a typical young plantation in the project area. Retain approximately 30 percent of the vegetation to be cut in the latter portion (150 to 300 feet) of the access/egress road treatment and inner riparian reserves. Enhance species variability by thinning around true oaks, sugar, ponderosa or Jeffrey pines, madrone, Chinquapin, and Pacific yew wherever possible. Reduce concentration of tanoak sprouts by thinning 25 to 50 percent of live sprouts over 4-inch dbh.

The cut trees and shrubs, and existing slash, would be manually piled, jackpot or lopped and scattered, depending on fuel-loading conditions. Low-impact machine piling may be employed to reduce costs and increase production. Create piles approximately 5x5x5 feet in size and place away from the dripline of predominant trees and sensitive plant buffer areas. Burn piles under appropriate conditions as described in the burn plan.

Third Entry (5b). Prescribed fire.

Handlines would be constructed by manual methods prior to ignition. A prescribed burn under an existing canopy of trees would be designed to reduce concentrations of excess live and dead vegetation. This type of burning would be initiated when fuel moistures are low enough to carry fire and still within prescription parameters. Burning would only be initiated on “burn days” or with an approved variance.

Figure 2-10. Manual treatment unit in a 32-year-old plantation, Douglas-firs mixed with multi-stemmed tanoaks.

Prescription 2 – Non-Plantation

Commercial thinning would occur to increase the health and vigor of shade-intolerant tree species by providing needed light and growing space around these trees, and to reduce crown and ladder fuels by increasing spacing between trees and tree crowns. This would be followed by thinning ladder fuels to increase ground-to-crown height distances and surface fuel reduction treatments to promote desired prescribed fire effects. The creation of gaps and openings described below are designed to improve overall stand heterogeneity.

Thinning would focus where shade-tolerate species have tree crowns that are impinging on culturally important shade-intolerant species (trees of interest), removing the smallest trees necessary to release trees of interest. In areas not containing trees of interest, removal of a portion of the suppressed and intermediate-crown class conifer trees would occur to reduce ladder fuel concentrations, while maintaining the multi-aged structure of the stand. Figure 2-11 is an example of a non-plantation in the project area.

First Entry (2). Mechanical fuels treatment.

Retain trees of interest, such as black and white oak, sugar pine, madrone, ponderosa and Jeffrey pine, chinquapin and tanoak, greater than 8-inch dbh. Mark for cutting all Douglas-fir trees within the dripline of the tree of interest. Continue to mark additional Douglas-fir for removal until shade on the crown area of the tree of interest has been reduced by 50 percent.

Figure 2-11. Mechanical treatment unit in a non-plantation, high stem density forest resulting from fire suppression. These trees, which have grown up in the fire suppression era, are too big to treat effectively with a manual treatment.

Retention patch clumps of 5 to 10 percent of the unit in 0.25- to 1.0-acre sections would be strategically placed where there is evidence of culturally important gathering areas or TEK species habitats that would benefit from less solar radiation (i.e., gathering or elk calving areas). Where woodrat nests are found, choose 0.25 acres adjacent to retention patch to cut all tanoak sprouts less than 4-inch dbh to encourage re-sprouting and create future woodrat habitat where appropriate.

Openings in the forest canopy would be applied to ground-based logging systems ranging from 10 to 20 percent of the unit area, positioned away from system roads where invasive plants are present. Openings would be located in a manner that would provide benefits to TEK species such as beargrass, iris, manzanita, and true oaks or where other TEK focal species would benefit from filtered light.

Locate in areas where conditions in the stand may already be less dense (e.g., existing interior landings, skid roads, or encroached meadows). Improve quality foraging habitat for local elk populations and warmer sites by allowing for 0.5- to 1.0-acre openings. Where non-elk habitat and cooler sites are present, gaps would range from 0.25 to 0.5 acres.

Use the upper end of canopy cover range along roadways, around invasive weeds and adjacent to retention patches. Use the lower end of canopy cover range along ridges and adjacent to gaps or openings.

Second Entry (4c). Manual hand cutting, handpiling, grapple or excavator piling, and pile burning.
Small diameter trees and shrubs, 4- to 6-inch dbh and less, would be manually cut from beneath overstory trees, and/or aggregations of small-diameter Douglas-fir plantation trees would be thinned. Retain approximately 30 percent of the vegetation to be cut in the latter portion (150 to 300 feet) of the access/egress road treatment and inner riparian reserves. Enhance species variability by thinning around true oaks, sugar, ponderosa or Jeffrey pines, madrone, chinquapin, and Pacific yew wherever possible. Reduce concentration of tanoak sprouts by thinning 25 to 50 percent of live sprouts over 4-inch dbh.

The cut trees and shrubs, and existing slash, would be manually piled, jackpot or lopped and scattered depending on fuel loading conditions. Low-impact machine piling may be employed to reduce costs and increase production. Create piles approximately 5x5x5 feet in size and place away from the dripline of predominant trees and sensitive plant buffer areas. Burn piles under appropriate conditions as described in the burn plan.

Third Entry (5b). Prescribed fire.

Defer prescribed burning in non-plantations for two (2) years post mechanical treatments to allow previously encroached trees to respond to improved stand conditions. Handlines would be constructed by manual methods prior to ignition. A prescribed burn under an existing canopy of trees would be designed to reduce concentrations of excess live and dead vegetation. This type of burning would be initiated when fuel moistures are low enough to carry fire and still within prescription parameters. Burning would only be initiated on “burn days” or with an approved variance.

Prescription 3 – Plantation Ladder Fuel Mastication

The objective is to break up some of the continuous fuelbed in young Douglas-fir plantations in preparation for prescribed burning. Figure 2-12 is a good example of a where masticators would be operated to reduce ladder fuel concentrations. Utilizing former skid and logging roads, masticators work on reducing fuel loading on and adjacent to these linear features. In essence, they create a path through dense plantations from which crews can conduct additional manual fuel reduction treatments and planned burning operations.

Figure 2-12. Young plantation (very high stem density of tanoak, madrone and Douglas-fir) where masticators are employed to reduce fuel loading in preparation for prescribed burning.

First Entry (3). Mastication.

Masticate small-diameter vegetation, generally less than 4- to 6-inch dbh, across 60 percent of the treatment area to minimize the amount of slash material on the ground. Some of these areas would have a follow up manual treatment.

Second Entry (4c). Manual hand cutting, handpiling, grapple or excavator piling, and pile burning.

Choose retention patches in clumps of 5 to 10 percent of the unit in 0.25- to 1.0-acre sections where the masticator did not enter. Retention patches would be strategically placed where there is evidence of culturally important gathering areas or TEK species habitats that would benefit from less solar radiation (i.e., gathering or elk calving areas). Where woodrat nests are found, choose 0.25 acres adjacent to the retention patch to cut all tanoak sprouts less than 4 inches dbh to encourage resprouting and create future woodrat habitat where appropriate.

The cut trees and shrubs, and existing slash, would be manually piled, jackpot or lopped and scattered depending on fuel loading conditions. Low-impact machine piling may be employed to reduce costs and increase production. Create piles approximately 5x5x5 feet in size and place away from the dripline of predominant trees. Burn piles under appropriate conditions as described in the burn plan.

Third Entry (5d). Prescribed fire.

Handlines would be constructed by manual methods prior to ignition. A prescribed burn in a treated stand would be designed to reduce concentrations of excess live and dead vegetation. Defer prescribed burning in mastication units for two (2) to five (5) years to allow for adequate decomposition of masticated material to promote desired prescribed fire effects. This type of burning would be initiated when fuel moistures are low enough to carry fire and still within prescription parameters. Burning would only be initiated on “burn days” or with an approved variance.

Prescriptions 4a – Plantation Ladder Fuel Manual Thinning

Reduce ladder fuels by breaking up the continuity of both vertical and horizontal fuels using manual methods in preparation for prescribed fire.

First Entry (4a). Plantation ladder fuel manual thinning.

Small-diameter trees and shrubs, generally up to 6-inch dbh, would be manually cut from beneath overstory trees, and/or aggregations of small-diameter Douglas-fir plantation trees would be thinned or limbed. Spacing for leave trees should be approximately 16 feet apart. Retain approximately 30 percent of the vegetation to be cut in the latter portion (150 to 300 feet) of the access/egress road treatment and inner riparian reserves. Enhance species variability by thinning around true oaks, sugar, ponderosa or Jeffrey pines, madrone, chinquapin, and Pacific yew when present. Reduce concentration of tanoak sprouts by thinning 25 to 50 percent of live sprouts under 4-inch dbh. Create or enhance openings approximately 0.25 to 0.33 acres in size where feasible.

The cut trees, shrubs, and existing slash would be manually piled, jackpot, or lopped and scattered depending on fuel-loading conditions. Low-impact machine piling may be employed to reduce costs and increase production. Create piles approximately 5x5x5 feet in size and place away from the dripline of predominant trees. Burn piles under appropriate conditions as described in the burn plan.

Second Entry (5c). Prescribed fire in manual units.

Handlines would be constructed by manual methods prior to ignition. A prescribed burn in a treated stand would be designed to reduce concentrations of excess live and dead vegetation, while maintaining gaps created during the first entry. This type of burning would be initiated when fuel moistures are low enough to carry fire and still within prescription parameters. Burning would only be initiated on “burn days” or with an approved variance.

Prescriptions 4b – Non-Plantation Ladder-Fuel Manual Thinning

Reduce ladder fuels by breaking up the continuity of both vertical and horizontal fuels using manual methods in preparation for prescribed fire. Figure 2-13 is an example of a non-plantation manual thinning treatment unit.

Figure 2-13. Manual treatment unit in a non-plantation, high stem density forest resulting from fire suppression. These trees, which have grown up in the fire suppression era, are small enough to be treated effectively by hand.

First Entry (4b). Non-plantation ladder-fuel manual thinning.

Small diameter conifer trees and shrubs, between 4- and 6-inch dbh, would be manually cut from beneath overstory trees, and/or aggregations of small-diameter Douglas-fir trees would be thinned. Spacing for leave trees should range from 20 to 24 feet apart to promote stand heterogeneity. Retain approximately 30 percent of the vegetation to be cut in the latter portion (150 to 300 feet) of the access/egress road treatment and inner riparian reserves. Enhance species variability by thinning around true oaks, sugar, ponderosa or Jeffrey pines, madrone, and Pacific yew wherever possible. Reduce concentration of tanoak sprouts by thinning 25 to 50 percent of live sprouts over 4-inch dbh. Where feasible, reduce contiguous patches of evergreen huckleberry, in a mosaic pattern, up to 50 percent of what is present in the unit, especially when adjacent to the largest trees.

Create or enhance openings approximately 0.25 to 0.33 acres in size where feasible. Consider girdling to enhance openings where feasible. The cut trees, shrubs, and existing slash would be manually piled, jackpot, or lopped and scattered depending on fuel loading conditions. Create piles approximately 5x5x5 feet in size and place away from the dripline of predominant trees. Burn piles under appropriate conditions as described in the burn plan.

Second Entry (5c). Prescribed fire in manual units.

Handlines would be constructed by manual methods prior to ignition. A prescribed burn in a treated stand would be designed to reduce concentrations of excess live and dead vegetation, while maintaining gaps created during the first entry. This type of burning would be initiated when fuel moistures are low enough to carry fire and still within prescription parameters. Burning would only be initiated on “burn days” or with an approved variance.

Prescriptions 5a – Prescribed Fire in Plantations and Non-Plantations

Treatment units are located in the interior of the project areas, away from access/egress roads and private lands.

First Entry (5a). Prescribed fire in plantations and non-plantations.

It is acknowledged that not every acre of these units would be treated; however, prescribed fire would be used to break up the continuity of fuel loading and maintain existing openings where appropriate. Mixed severity is anticipated and control features and firing tactics would keep higher severity fire effects to less than 10 percent of the units treated, with fire as a first entry. Treatments in these areas would be conducted only after the fuelbreaks and other treatment unit work has been completed. Handlines would be constructed by manual methods prior to ignition. This type of burning would be initiated when fuel moistures are low enough to carry fire and still within prescription parameters. Figure 2-14 is an example of a stand where prescribed fire is the first entry.

Figure 2-14. Prescribed fire treatment unit, low amounts of ladder fuels and ample surface fuels create a condition where prescribed fire is an effective treatment.

Maintenance Burning

It is expected that following the final treatment entries, all units would require varying degrees of maintenance using prescribed burning to achieve project treatment objectives. The frequency of maintenance burning is generally expected to be from two (2) to seven (7) years after the third entry, once mechanical, manual and prescribed treatments have been completed.

The maintenance burn cycle would be based on the amount of short-term fuel loading buildup from field surveys relative to desired fuel conditions. Burning would be initiated when fuel moistures are low enough to carry fire and still within prescription parameters for low to moderate intensity. Burning would only be initiated on "burn days" or with an approved variance.

Implementation Strategy

Table 2-5 summarizes the phasing and order of treatments intended to prepare the landscape for prescribed burning, achieving the desired fire effects intended to meet the purpose and need for the project. The sequencing is designed to ensure safe and efficient application, while minimizing undesirable effects to natural and TEK resources.

Table 2-5. Phasing of treatments.

Proposed Treatments	Prescription ID	Acres
First Entry		
Plantations – Mechanical thinning and removal of fuels, handpile and handpile burn.	1a and 1b	660
Non-Plantations – Cultural tree species restoration and ladder-fuel mechanical thinning.	2	573
Plantations – Ladder-fuel mastication.	3	187
Plantation – Ladder-fuel manual thinning.	4a	502
Non-Plantation – Ladder-fuel manual thinning.	4b	2,156
Plantation and Non-Plantation – Ladder-fuel prescribed fire.	5a	1,491
Total		***5,570***
Second Entry		
Manual Thinning Ladder Fuel Post Mechanical and Post Mastication Entries.	4c	***1,420***
Third Entry (provided associated handlines and control features are in place)		
Prescribed Fire – Understory and jackpot burn in all mechanical units, where needed.	5a	1,233
Prescribed Fire – Understory and jackpot burn in all manual units, where needed.	5b	2,658
Prescribed Fire – Understory and jackpot burn in all mastication units, where needed.	5c	187
Total		***4,078***
Maintenance Entry		
Prescribed fire in mechanical and manual treated units.		***5,570***

Proposed Action – Unit-Specific Treatment Descriptions

The unit-specific information of first entry treatments is presented in Table 2-6 and Table 2-7. Upon completion of the first entry prescription (Table 2-6), a second entry (4c) of manual hand cutting, piling and burning, followed by a third entry (5b) of prescribed burning would be implemented (see Figure 2-15, Figure 2-17, Figure 2-19 and Figure 2-22). All units would then receive maintenance burning every three (3) to seven (7) years.

Table 2-6. First entry mechanical unit treatments.

Unit ID	Treatment Category	Harvest Method	Prescription	Acres	Volume Estimate (MBF)	TEK Resource	Pre-Treatment Canopy Cover Range (%)	Post-Treatment Canopy Cover Range (%)
2101	Mechanical	Ground-based	1b	10	80	Cultural Vegetation	94-99	40-60
2105	Mechanical	Ground-based	1a	7	35	Cultural Vegetation,	85-99	40-60
2110	Mechanical	Ground-based	1a	6	30	Pacific fisher, Cultural Vegetation	75-99	40-50
2111	Mechanical	Ground-based	1b	8	45	Cultural Vegetation	94-99	40-50
2112	Mechanical	Ground-based	1b	16	100	Pacific fisher, Cultural Vegetation, Pacific giant salamander	86-99	40-50
2113	Mechanical	Ground-based	2	13	50	Elk, Trees of Interest, Cultural Vegetation, Pacific giant salamander	80-99	40-50
2114	Mechanical	Ground-based	2	16	75	Elk, Trees of Interest, Cultural Vegetation, Pacific giant salamander	78-99	40-50
2116	Mechanical	Ground-based	2	20	120	Elk, NSO, Trees of Interest, Cultural Vegetation, Pacific giant salamander	79-99	40-60
2117	Mechanical	Ground-based	1b	12	80	Elk, Cultural Vegetation, Pacific giant salamander	60-99	40-60
2119	Mechanical	Ground-based	2	3	0	Elk, Trees of Interest, Cultural Vegetation	73-99	40-60
2120	Mechanical	Cable-based	2	6	0	Elk, Trees of Interest, Cultural Vegetation	69-99	40-60
2124	Mechanical	Cable-based	2	4	20	Elk, Trees of Interest, Cultural Vegetation	81-99	40-50
2127	Mechanical	Ground-based	2	35	250	Elk, Pacific fisher, Trees of Interest, Cultural Vegetation	71-99	40-60
2128	Mechanical	Ground-based	1a	3	0	Elk, Cultural Vegetation	79-98	40-50
2131	Mechanical	Ground-based	1a	8	80	Cultural Vegetation	87-99	40-60
2132	Mechanical	Ground-based	2	11	15	Elk, NSO, Trees of Interest, Cultural Vegetation, Pacific giant salamander	82-99	40-60
2142	Mechanical	Ground-based	2	9	0	Elk, Pacific fisher, Willow, Cultural Vegetation,	0-72	40-50
2145	Mechanical	Ground-based	2	20	0	Elk, NSO, Trees of Interest, Cultural Vegetation	65-99	40-50
2148	Mechanical	Ground-based	2	5	18	Trees of Interest, Cultural Vegetation	89-99	40-50
2151	Mechanical	Ground-based	1a	1	0	Elk, Cultural Vegetation	55-86	40-50
2157	Mechanical	Cable-based	2	0	0	Cultural Vegetation	91-92	40-50
2158	Mechanical	Cable-based	2	3	0	Elk, Cultural Vegetation	90-98	40-60
2200	Mechanical	Ground-based	1a	6	40	Elk, Cultural Vegetation	83-99	40-50
2203	Mechanical	Ground-based	1b	13	45	Elk, Pacific fisher, Cultural Vegetation	46-99	40-50
2217	Mechanical	Ground-based	1a	24	180	Elk, Pacific fisher, Cultural Vegetation	80-99	40-50
2218	Mechanical	Ground-based	2	10	25	Elk, Trees of Interest, Cultural Vegetation	76-99	40-60
2221	Mechanical	Ground-based	1a	10	60	Elk, Cultural Vegetation	71-99	40-60
2224	Mechanical	Ground-based	2	3	5	Elk, Cultural Vegetation	82-99	40-60

Unit ID	Treatment Category	Harvest Method	Prescription	Acres	Volume Estimate (MBF)	TEK Resource	Pre-Treatment Canopy Cover Range (%)	Post-Treatment Canopy Cover Range (%)
2225	Mechanical	Ground-based	2	7	40	Trees of Interest, Cultural Vegetation	87-99	40-60
2226	Mechanical	Ground-based	1a	4	12	Cultural Vegetation	97-99	40-60
2227	Mechanical	Ground-based	1b	33	180	Elk, Cultural Vegetation	82-99	40-60
2228	Mechanical	Cable-based	2	8	0	Elk, Cultural Vegetation	78-99	40-60
2230	Mechanical	Ground-based	1a	16	100	Elk, Cultural Vegetation	89-99	40-60
2231	Mechanical	Cable-based	2	1	0	Cultural Vegetation	91-99	40-60
2235	Mechanical	Ground-based	1b	10	40	Cultural Vegetation	84-99	40-60
2237	Mechanical	Ground-based	1a	17	110	Cultural Vegetation, Pacific giant salamander	78-99	40-50
2242	Mechanical	Ground-based	1a	26	100	Cultural Vegetation, Pacific giant salamander	81-99	40-50
2248	Mechanical	Ground-based	2	29	0	Pacific fisher, Trees of Interest, Cultural Vegetation, Pacific giant salamander	78-99	40-50
2249	Mechanical	Ground-based	2	78	350	Elk, NSO, Trees of Interest, Cultural Vegetation, Pacific giant salamander	84-99	40-60
2260	Mechanical	Ground-based	2	6	0	Elk, Trees of Interest, Cultural Vegetation	59-98	40-50
2264	Mechanical	Ground-based	1b	26	30	Cultural Vegetation, Pacific giant salamander	73-99	40-50
2265	Mechanical	Ground-based	1b	40	180	Elk, Cultural Vegetation	85-99	40-50
2266	Mechanical	Ground-based	2	7	70	Elk, Trees of Interest, Cultural Vegetation	81-99	40-50
2272	Mechanical	Ground-based	2	3	10	Elk, Trees of Interest, Cultural Vegetation	59-97	40-50
2273	Mechanical	Ground-based	2	3	10	Elk, Pacific fisher, Trees of Interest, Cultural Vegetation	66-99	40-50
2320	Mechanical	Cable-based	1a	4	100	Cultural Vegetation	29-97	40-60
2321	Mechanical	Cable-based	2	9	0	Cultural Vegetation	81-99	40-60
2328	Mechanical	Ground-based	1a	12	0	Cultural Vegetation	65-99	40-60
2336	Mechanical	Cable-based	2	17	70	Elk, NSO, Trees of Interest, Cultural Vegetation	76-99	40-60
2400	Mechanical	Ground-based	2	34	700	Elk, NSO, Pacific fisher, Trees of Interest, Cultural Vegetation	83-99	40-60
2401	Mechanical	Cable-based	2	2	0	Trees of Interest, Cultural Vegetation	48-97	40-60
2402	Mechanical	Ground-based	1a	7	18	Elk, Cultural Vegetation, Pacific giant salamander	66-99	40-50
2404	Mechanical	Ground-based	1a	4	0	Cultural Vegetation	69-99	40-50
2405	Mechanical	Ground-based	1a	4	20	Elk, Cultural Vegetation	81-99	40-50
2407	Mechanical	Ground-based	1b	26	190	Cultural Vegetation, Pacific giant salamander	81-99	40-50
2409	Mechanical	Ground-based	1a	9	0	Cultural Vegetation	80-99	40-50
2411	Mechanical	Ground-based	1b	23	180	Cultural Vegetation	88-99	40-60
2412	Mechanical	Ground-based	1b	19	100	Cultural Vegetation, Pacific giant salamander	92-100	40-60
2414	Mechanical	Cable-based	1a	7	0	Cultural Vegetation, Pacific giant salamander	55-99	40-50

Unit ID	Treatment Category	Harvest Method	Prescription	Acres	Volume Estimate (MBF)	TEK Resource	Pre-Treatment Canopy Cover Range (%)	Post-Treatment Canopy Cover Range (%)
2419	Mechanical	Ground-based	1a	8	70	Elk, Cultural Vegetation	95-99	40-60
2421	Mechanical	Ground-based	1b	19	120	Elk, Cultural Vegetation, Pacific giant salamander	86-99	40-60
2422	Mechanical	Ground-based	2	5	60	Elk, Trees of Interest, Cultural Vegetation	77-99	40-50
2423	Mechanical	Cable-based	2	6	0	Cultural Vegetation, Pacific giant salamander	83-99	40-50
2425	Mechanical	Cable-based	1a	17	0	Cultural Vegetation, Pacific giant salamander	87-99	40-60
2426	Mechanical	Cable-based	2	6	0	Cultural Vegetation, Pacific giant salamander	88-99	40-60
2431	Mechanical	Cable-based	2	16	0	Elk, Trees of Interest, Cultural Vegetation, Pacific giant salamander	30-99	40-60
2433	Mechanical	Ground-based	1a	8	40	Elk, Cultural Vegetation	95-99	40-50
2434	Mechanical	Cable-based	2	5	0	Cultural Vegetation, Pacific giant salamander	84-99	40-60
2452	Mechanical	Ground-based	2	6	60	Elk, Trees of Interest, Cultural Vegetation	83-99	40-60
2453	Mechanical	Ground-based	2	7	60	Elk, Pacific fisher, Trees of Interest, Cultural Vegetation	91-99	40-60
2454	Mechanical	Ground-based	2	31	450	Elk, NSO, Pacific fisher, Trees of Interest, Cultural Vegetation	83-99	40-60
2456	Mechanical	Ground-based	1b	9	70	Elk, Cultural Vegetation	85-99	40-60
2460	Mechanical	Cable-based	1b	20	0	Cultural Vegetation, Pacific giant salamander	74-99	40-50
2461	Mechanical	Ground-based	1a	44	240	Elk, Cultural Vegetation	90-99	40-50
2462	Mechanical	Cable-based	2	25	0	NSO, Trees of Interest, Cultural Vegetation, Pacific giant salamander	82-99	40-60
2463	Mechanical	Ground-based	1b	11	80	Elk, Cultural Vegetation	79-99	40-60
2465	Mechanical	Cable-based	1a	10	0	Cultural Vegetation	83-99	40-50
2466	Mechanical	Ground-based	1a	7	35	Cultural Vegetation	92-99	40-50
2467	Mechanical	Ground-based	1a	11	0	Cultural Vegetation	83-99	40-60
2470	Mechanical	Ground-based	1b	10	70	Cultural Vegetation	75-99	40-50
2474	Mechanical	Ground-based	2	29	0	Elk, NSO, Pacific fisher, Trees of Interest, Cultural Vegetation, Pacific giant salamander	40-99	40-60
2475	Mechanical	Ground-based	1a	17	0	Cultural Vegetation	73-99	40-50
2480	Mechanical	Ground-based	1a	17	45	Elk, Cultural Vegetation	86-99	40-60
2481	Mechanical	Ground-based	1a	26	80	Elk, Cultural Vegetation	78-99	40-50
2492	Mechanical	Ground-based	1a	4	27	Cultural Vegetation	86-99	40-50
2493	Mechanical	Ground-based	2	29	260	Elk, NSO, Trees of Interest, Cultural Vegetation	87-99	40-60
2494	Mechanical	Cable-based	2	6	80	Elk, Trees of Interest, Cultural Vegetation	83-99	40-60
2500	Mechanical	Ground-based	2	35	300	Elk, Trees of Interest, Cultural Vegetation	82-99	40-50
2505	Mechanical	Ground-based	1a	8	20	Cultural Vegetation	65-98	40-50
2508	Mechanical	Cable-based	2	2	0	Trees of Interest, Cultural Vegetation	82-99	40-60

Table 2-7. First entry manual, mastication and prescribed burning unit treatments.

Unit ID	Treatment Category	Prescriptions	Acres	Pre-Treatment Canopy Cover (%)	TEK Resource	Post-Treatment Canopy Cover (%)
2100	Manual & Prescribed Fire	4b, 5c	84	87-99	Cultural Vegetation, NSO, Pacific giant salamander	85
2102	Manual & Prescribed Fire	4a, 5c	7	71-99	Cultural Vegetation	84
2103	Manual & Prescribed Fire	4b, 5c	5	83-99	Elk, Cultural Vegetation	84
2107	Manual & Prescribed Fire	4a, 5c	5	62-99	Cultural Vegetation, Pacific giant salamander	81
2108	Manual & Prescribed Fire	4a, 5c	5	22-97	Cultural Vegetation	49
2115	Manual & Prescribed Fire	4a, 5c	44	86-99	Elk, Pacific fisher, Cultural Vegetation, Pacific giant salamander	86
2118	Manual & Prescribed Fire	4b, 5c	14	78-99	Elk, Cultural Vegetation, Pacific giant salamander	83
2121	Manual & Prescribed Fire	4b, 5c	15	71-99	Elk, NSO, Cultural Vegetation, Pacific giant salamander	80
2122	Manual & Prescribed Fire	4b, 5c	8	89-99	NSO, Cultural Vegetation	84
2123	Manual & Prescribed Fire	4b, 5c	12	76-99	Cultural Vegetation	81
2125	Manual & Prescribed Fire	4b, 5c	4	69-98	Elk, Cultural Vegetation	79
2126	Manual & Prescribed Fire	4b, 5c	22	65-99	Elk, Cultural Vegetation, Pacific giant salamander	80
2129	Manual & Prescribed Fire	4a, 5c	6	26-76	Cultural Vegetation	41
2133	Manual & Prescribed Fire	4b, 5c	3	60-99	Cultural Vegetation	79
2134	Manual & Prescribed Fire	4b, 5c	12	0-43	Willow, Cultural Vegetation, Pacific giant salamander	75
2135	Manual & Prescribed Fire	4b, 5c	12	74-99	Elk, Cultural Vegetation, Pacific giant salamander	82
2136	Manual & Prescribed Fire	4b, 5c	81	57-99	Elk, NSO, Cultural Vegetation, Pacific giant salamander	78
2137	Manual & Prescribed Fire	4b, 5c	28	41-99	Elk, Cultural Vegetation, Pacific giant salamander	71
2138	Manual & Prescribed Fire	4b, 5c	6	2-97	Elk, Cultural Vegetation, Pacific giant salamander	60
2139	Manual & Prescribed Fire	4b, 5c	26	0-99	Cultural Vegetation, Pacific giant salamander	60
2140	Manual & Prescribed Fire	4b, 5c	21	0-97	Cultural Vegetation, Pacific giant salamander	60
2141	Manual & Prescribed Fire	4b, 5c	20	2-97	Elk, Pacific fisher, Cultural Vegetation, Pacific giant salamander	60
2143	Manual & Prescribed Fire	4b, 5c	8	61-99	Elk, Cultural Vegetation, Pacific giant salamander	78
2146	Manual & Prescribed Fire	4b, 5c	40	68-99	Cultural Vegetation, Pacific giant salamander	79
2147	Manual & Prescribed Fire	4b, 5c	17	67-99	Cultural Vegetation	78
2149	Manual & Prescribed Fire	4b, 5c	8	83-99	Trees of Interest, NSO, Cultural Vegetation, Pacific giant salamander	83
2150	Manual & Prescribed Fire	4a, 5c	3	91-99	Elk, Cultural Vegetation	86
2152	Manual & Prescribed Fire	4b, 5c	11	88-99	Elk, Cultural Vegetation, Pacific giant salamander	85

Unit ID	Treatment Category	Prescriptions	Acres	Pre-Treatment Canopy Cover (%)	TEK Resource	Post-Treatment Canopy Cover (%)
2153	Manual & Prescribed Fire	4b, 5c	14	78-99	Cultural Vegetation, NSO, Pacific giant salamander	83
2154	Manual & Prescribed Fire	4b, 5c	9	52-99	Cultural Vegetation, NSO	74
2155	Manual & Prescribed Fire	4b, 5c	8	83-99	Cultural Vegetation	84
2156	Manual & Prescribed Fire	4b, 5c	8	82-99	Cultural Vegetation	84
2159	Manual & Prescribed Fire	4b, 5c	8	55-99	Elk, Cultural Vegetation, Pacific giant salamander	80
2160	Manual & Prescribed Fire	4b, 5c	10	78-99	Elk, Cultural Vegetation	83
2161	Manual & Prescribed Fire	4b, 5c	9	66-98	Elk, Cultural Vegetation, Pacific giant salamander	77
2162	Manual & Prescribed Fire	4b, 5c	9	77-99	Elk, NSO, Trees of Interest, Cultural Vegetation, Pacific giant salamander	81
2163	Manual & Prescribed Fire	4b, 5c	22	30-99	Elk, Trees of Interest, Cultural Vegetation, Pacific giant salamander	69
2164	Manual & Prescribed Fire	4b, 5c	5	95-99	Trees of Interest, Cultural Vegetation, Pacific giant salamander	88
2165	Manual & Prescribed Fire	4b, 5c	19	0-26	Elk, Pacific fisher, Willow, Cultural Vegetation, Pacific giant salamander	25
2166	Manual & Prescribed Fire	4b, 5c	36	71-99	Cultural Vegetation	81
2167	Manual & Prescribed Fire	4b, 5c	1	96-99	Cultural Vegetation	87
2168	Manual & Prescribed Fire	4b, 5c	8	75-99	Cultural Vegetation	82
2169	Manual & Prescribed Fire	4b, 5c	4	88-99	Elk, Cultural Vegetation	85
2202	Manual & Prescribed Fire	4b, 5c	12	50-99	Elk, Trees of Interest, Cultural Vegetation	74
2206	Manual & Prescribed Fire	4b, 5c	18	58-99	Elk, NSO, Pacific fisher, Cultural Vegetation, Pacific giant salamander	77
2207	Manual & Prescribed Fire	4a, 5c	12	66-97	Cultural Vegetation	74
2210	Manual & Prescribed Fire	4a, 5c	14	89-99	Elk, Cultural Vegetation, Pacific giant salamander	86
2211	Manual & Prescribed Fire	4b, 5c	11	69-99	Elk, Pacific fisher, Cultural Vegetation	79
2213	Manual & Prescribed Fire	4b, 5c	10	82-99	Cultural Vegetation	85
2216	Manual & Prescribed Fire	4b, 5c	4	93-99	Cultural Vegetation, Pacific giant salamander	87
2219	Manual & Prescribed Fire	4b, 5c	4	91-99	Cultural Vegetation, Pacific giant salamander	87
2220	Manual & Prescribed Fire	4a, 5c	20	40-99	Elk, Cultural Vegetation	63
2222	Manual & Prescribed Fire	4b, 5c	10	90-100	Cultural Vegetation, Pacific giant salamander	87
2223	Manual & Prescribed Fire	4b, 5c	7	91-99	Cultural Vegetation	87
2233	Manual & Prescribed Fire	4a, 5c	8	21-85	Elk, Cultural Vegetation, Pacific giant salamander	43
2236	Manual & Prescribed Fire	4a, 5c	6	89-99	Cultural Vegetation, Pacific giant salamander	86
2239	Manual & Prescribed Fire	4b, 5c	3	83-99	Cultural Vegetation	83
2241	Manual & Prescribed Fire	4b, 5c	2	94-99	Cultural Vegetation, Pacific giant salamander	87

Unit ID	Treatment Category	Prescriptions	Acres	Pre-Treatment Canopy Cover (%)	TEK Resource	Post-Treatment Canopy Cover (%)
2243	Manual & Prescribed Fire	4b, 5c	28	89-99	Pacific fisher, Cultural Vegetation Pacific giant salamander	87
2244	Manual & Prescribed Fire	4a, 5c	6	94-99	Cultural Vegetation	88
2245	Manual & Prescribed Fire	4b, 5c	6	90-99	Cultural Vegetation, Pacific giant salamander	86
2246	Manual & Prescribed Fire	4b, 5c	11	80-99	Cultural Vegetation, Pacific giant salamander	86
2247	Manual & Prescribed Fire	4b, 5c	14	89-99	Cultural Vegetation, NSO, Pacific giant salamander	87
2250	Manual & Prescribed Fire	4b, 5c	18	80-99	Cultural Vegetation, NSO, Pacific giant salamander	84
2251	Manual & Prescribed Fire	4b, 5c	7	95-99	Cultural Vegetation, NSO, Pacific giant salamander	88
2252	Manual & Prescribed Fire	4b, 5c	25	81-99	Elk, NSO, Cultural Vegetation, Pacific giant salamander	85
2253	Manual & Prescribed Fire	4b, 5c	59	84-99	Elk, NSO, Cultural Vegetation, Pacific giant salamander	85
2254	Manual & Prescribed Fire	4b, 5c	12	47-99	Elk, Cultural Vegetation Pacific giant salamander,	76
2255	Manual & Prescribed Fire	4b, 5c	24	37-99	Elk, NSO, Cultural Vegetation, Pacific giant salamander	72
2256	Manual & Prescribed Fire	4b, 5c	28	59-99	Elk, NSO, Cultural Vegetation Pacific giant salamander,	79
2257	Manual & Prescribed Fire	4b, 5c	10	34-99	Cultural Vegetation	71
2258	Manual & Prescribed Fire	4b, 5c	9	3-99	Cultural Vegetation, Pacific giant salamander	49
2259	Manual & Prescribed Fire	4b, 5c	104	12-99	Pacific fisher, Cultural Vegetation, Pacific giant salamander	60
2261	Manual & Prescribed Fire	4a, 5c	6	58-97	Elk, Cultural Vegetation	70
2262	Manual & Prescribed Fire	4b, 5c	2	52-95	Elk, Cultural Vegetation	70
2263	Manual & Prescribed Fire	4b, 5c	21	62-99	Elk, NSO, Trees of Interest, Cultural Vegetation, Pacific giant salamander	78
2267	Manual & Prescribed Fire	4a, 5c	2	46-81	Elk, Cultural Vegetation	58
2271	Manual & Prescribed Fire	4b, 5c	7	25-99	Elk, Trees of Interest, Cultural Vegetation, Pacific giant salamander	58
2274	Manual & Prescribed Fire	4b, 5c	10	47-99	Cultural Vegetation, Pacific giant salamander	78
2275	Manual & Prescribed Fire	4b, 5c	3	64-99	Cultural Vegetation, Pacific giant salamander	81
2276	Manual & Prescribed Fire	4a, 5c	4	91-99	Cultural Vegetation	86
2277	Manual & Prescribed Fire	4a, 5c	3	96-99	Cultural Vegetation	87
2278	Manual & Prescribed Fire	4a, 5c	5	41-98	Cultural Vegetation	61
2279	Manual & Prescribed Fire	4a, 5c	4	75-99	Cultural Vegetation, Pacific giant salamander	83

Unit ID	Treatment Category	Prescriptions	Acres	Pre-Treatment Canopy Cover (%)	TEK Resource	Post-Treatment Canopy Cover (%)
2280	Manual & Prescribed Fire	4b, 5c	3	73-99	Cultural Vegetation	82
2281	Manual & Prescribed Fire	4b, 5c	4	78-98	Elk, Cultural Vegetation	79
2282	Manual & Prescribed Fire	4b, 5c	4	84-99	Elk, Cultural Vegetation, Pacific giant salamander	84
2283	Manual & Prescribed Fire	4b, 5c	3	88-99	Elk, Cultural Vegetation	86
2284	Manual & Prescribed Fire	4b, 5c	17	46-98	Elk, Cultural Vegetation, Pacific giant salamander	66
2285	Manual & Prescribed Fire	4b, 5c	6	20-99	Elk, Cultural Vegetation, Pacific giant salamander	67
2286	Manual & Prescribed Fire	4b, 5c	7	94-99	Cultural Vegetation, Pacific giant salamander	87
2287	Manual & Prescribed Fire	4a, 5c	5	69-99	Elk, Cultural Vegetation	81
2288	Manual & Prescribed Fire	4b, 5c	12	62-99	Elk, NSO, Pacific fisher, Trees of Interest, Cultural Vegetation, Pacific giant salamander	78
2289	Manual & Prescribed Fire	4b, 5c	2	93-99	Elk, Trees of Interest, Cultural Vegetation	87
2290	Manual & Prescribed Fire	4b, 5c	20	85-100	Elk, NSO, Cultural Vegetation, Pacific giant salamander	85
2291	Manual & Prescribed Fire	4b, 5c	10	88-99	Trees of Interest, NSO, Cultural Vegetation, Pacific giant salamander	86
2292	Manual & Prescribed Fire	4b, 5c	2	83-99	Cultural Vegetation, Pacific giant salamander	84
2293	Manual & Prescribed Fire	4b, 5c	13	57-99	Elk, Trees of Interest, Cultural Vegetation, Pacific giant salamander	75
2294	Manual & Prescribed Fire	4b, 5c	5	71-98	Elk, Trees of Interest, Cultural Vegetation	79
2295	Manual & Prescribed Fire	4a, 5c	4	93-99	Cultural Vegetation	86
2300	Manual & Prescribed Fire	4b, 5c	61	84-99	Elk, Cultural Vegetation	84
2301	Manual & Prescribed Fire	4a, 5c	15	66-99	Cultural Vegetation, Pacific giant salamander	77
2302	Manual & Prescribed Fire	4a, 5c	4	51-99	Cultural Vegetation	76
2303	Manual & Prescribed Fire	4b, 5c	36	87-99	Cultural Vegetation, NSO	86
2305	Manual & Prescribed Fire	4a, 5c	5	92-99	Cultural Vegetation	87
2307	Manual & Prescribed Fire	4a, 5c	11	76-99	Cultural Vegetation, Pacific giant salamander	83
2308	Manual & Prescribed Fire	4a, 5c	22	73-99	Cultural Vegetation, Pacific giant salamander	83
2309	Manual & Prescribed Fire	4a, 5c	14	68-99	Cultural Vegetation, Pacific giant salamander	80
2311	Manual & Prescribed Fire	4b, 5c	11	75-99	Cultural Vegetation	82
2312	Manual & Prescribed Fire	4b, 5c	6	84-99	Cultural Vegetation, NSO	83
2313	Manual & Prescribed Fire	4a, 5c	5	71-99	Cultural Vegetation	82
2314	Manual & Prescribed Fire	4b, 5c	40	55-99	Cultural Vegetation, NSO, Pacific giant salamander	77
2316	Manual & Prescribed Fire	4b, 5c	4	40-95	Cultural Vegetation	67
2318	Manual & Prescribed Fire	4a, 5c	7	35-98	Cultural Vegetation, Pacific giant salamander	64
2319	Manual & Prescribed Fire	4a, 5c	18	68-99	Cultural Vegetation, Pacific giant salamander	79

Unit ID	Treatment Category	Prescriptions	Acres	Pre-Treatment Canopy Cover (%)	TEK Resource	Post-Treatment Canopy Cover (%)
2322	Manual & Prescribed Fire	4b, 5c	33	70-99	Elk, NSO, Pacific fisher, Trees of Interest, Cultural Vegetation, Pacific giant salamander	82
2323	Manual & Prescribed Fire	4b, 5c	47	78-99	Elk, NSO, Cultural Vegetation, Pacific giant salamander	85
2325	Manual & Prescribed Fire	4b, 5c	15	77-99	Cultural Vegetation, NSO, Pacific giant salamander	85
2326	Manual & Prescribed Fire	4a, 5c	14	93-99	Cultural Vegetation	87
2327	Manual & Prescribed Fire	4a, 5c	5	75-99	Cultural Vegetation	80
2329	Manual & Prescribed Fire	4b, 5c	14	84-99	Trees of Interest, Cultural Vegetation	85
2330	Manual & Prescribed Fire	4b, 5c	10	92-99	Pacific fisher, Trees of Interest, Cultural Vegetation	86
2331	Manual & Prescribed Fire	4a, 5c	6	77-100	Elk, Cultural Vegetation, Pacific giant salamander	82
2332	Manual & Prescribed Fire	4a, 5c	6	94-99	Cultural Vegetation	87
2333	Manual & Prescribed Fire	4b, 5c	26	92-99	Elk, Cultural Vegetation, Pacific giant salamander	87
2334	Manual & Prescribed Fire	4b, 5c	12	78-99	Elk, NSO, Cultural Vegetation	83
2335	Manual & Prescribed Fire	4b, 5c	30	74-99	Elk, Cultural Vegetation	81
2343	Manual & Prescribed Fire	4b, 5c	19	91-99	Cultural Vegetation, NSO, Pacific giant salamander	86
2345	Manual & Prescribed Fire	4b, 5c	3	87-99	Trees of Interest, Cultural Vegetation	86
2346	Manual & Prescribed Fire	4a, 5c	16	88-99	Cultural Vegetation	86
2347	Manual & Prescribed Fire	4a, 5c	2	95-99	Cultural Vegetation	88
2348	Manual & Prescribed Fire	4b, 5c	17	78-99	Elk, NSO, Cultural Vegetation	84
2351	Manual & Prescribed Fire	4a, 5c	2	47-90	Cultural Vegetation	60
2352	Manual & Prescribed Fire	4a, 5c	10	0-97	Cultural Vegetation	60
2354	Manual & Prescribed Fire	4b, 5c	20	59-99	Elk, NSO, Pacific fisher, Cultural Vegetation, Pacific giant salamander	82
2355	Manual & Prescribed Fire	4b, 5c	7	42-99	Cultural Vegetation	72
2356	Manual & Prescribed Fire	4b, 5c	38	63-99	Pacific fisher, NSO, Cultural Vegetation, Pacific giant salamander	82
2357	Manual & Prescribed Fire	4b, 5c	30	41-99	Cultural Vegetation, Pacific giant salamander	75
2358	Manual & Prescribed Fire	4b, 5c	25	85-99	Cultural Vegetation, Pacific giant salamander	84
2359	Manual & Prescribed Fire	4b, 5c	6	0-16	Willow, Cultural Vegetation, Pacific giant salamander	15
2360	Manual & Prescribed Fire	4a, 5c	7	58-99	Cultural Vegetation	73
2361	Manual & Prescribed Fire	4b, 5c	21	80-99	Cultural Vegetation, NSO, Pacific giant salamander	83
2403	Manual & Prescribed Fire	4b, 5c	9	84-99	Cultural Vegetation, Pacific giant salamander	85

Unit ID	Treatment Category	Prescriptions	Acres	Pre-Treatment Canopy Cover (%)	TEK Resource	Post-Treatment Canopy Cover (%)
2406	Manual & Prescribed Fire	4b, 5c	13	81-99	Elk, NSO, Cultural Vegetation, Pacific giant salamander	83
2408	Manual & Prescribed Fire	4a, 5c	4	67-98	Cultural Vegetation, Pacific giant salamander	76
2410	Manual & Prescribed Fire	4b, 5c	9	87-99	Cultural Vegetation, NSO, Pacific giant salamander	86
2415	Manual & Prescribed Fire	4a, 5c	11	80-98	Cultural Vegetation, Pacific giant salamander	80
2416	Manual & Prescribed Fire	4b, 5c	6	56-97	Cultural Vegetation	74
2417	Manual & Prescribed Fire	4b, 5c	29	78-99	Cultural Vegetation, NSO, Pacific giant salamander	83
2418	Manual & Prescribed Fire	4b, 5c	9	79-99	NSO, Cultural Vegetation	83
2420	Manual & Prescribed Fire	4a, 5c	7	89-99	Elk, Cultural Vegetation	86
2424	Manual & Prescribed Fire	4b, 5c	2	75-99	Cultural Vegetation	82
2429	Manual & Prescribed Fire	4a, 5c	1	88-97	Cultural Vegetation	84
2430	Manual & Prescribed Fire	4b, 5c	17	84-99	Trees of Interest, NSO, Cultural Vegetation, Pacific giant salamander	84
2432	Manual & Prescribed Fire	4b, 5c	13	86-99	Cultural Vegetation, NSO, Pacific giant salamander	85
2435	Manual & Prescribed Fire	4b, 5c	13	86-99	Cultural Vegetation, NSO, Pacific giant salamander	84
2436	Manual & Prescribed Fire	4b, 5c	5	87-99	Elk, Cultural Vegetation	84
2437	Manual & Prescribed Fire	4a, 5c	12	83-99	Cultural Vegetation	86
2438	Manual & Prescribed Fire	4b, 5c	3	57-96	Cultural Vegetation	68
2439	Manual & Prescribed Fire	4b, 5c	20	86-99	Cultural Vegetation	85
2440	Manual & Prescribed Fire	4b, 5c	22	90-99	Elk, NSO, Cultural Vegetation, Pacific giant salamander	86
2448	Manual & Prescribed Fire	4b, 5c	16	66-99	Cultural Vegetation, NSO, Pacific giant salamander	81
2449	Manual & Prescribed Fire	4b, 5c	5	74-99	Cultural Vegetation	81
2450	Manual & Prescribed Fire	4b, 5c	5	80-99	Cultural Vegetation	81
2451	Manual & Prescribed Fire	4b, 5c	2	96-99	Elk, Cultural Vegetation	87
2455	Manual & Prescribed Fire	4b, 5c	6	78-99	Cultural Vegetation	83
2458	Manual & Prescribed Fire	4b, 5c	11	71-99	Cultural Vegetation, NSO, Pacific giant salamander	82
2459	Manual & Prescribed Fire	4a, 5c	20	72-99	Cultural Vegetation	79
2464	Manual & Prescribed Fire	4a, 5c	16	73-99	Elk, Cultural Vegetation	81
2468	Manual & Prescribed Fire	4b, 5c	5	85-99	Cultural Vegetation	85
2469	Manual & Prescribed Fire	4a, 5c	16	82-99	Cultural Vegetation, Pacific giant salamander	83
2471	Manual & Prescribed Fire	4b, 5c	5	75-99	Cultural Vegetation, Pacific giant salamander	81
2472	Manual & Prescribed Fire	4a, 5c	26	70-99	Cultural Vegetation, Pacific giant salamander	79
2473	Manual & Prescribed Fire	4b, 5c	8	78-99	Cultural Vegetation, Pacific giant salamander	83

Unit ID	Treatment Category	Prescriptions	Acres	Pre-Treatment Canopy Cover (%)	TEK Resource	Post-Treatment Canopy Cover (%)
2476	Manual & Prescribed Fire	4a, 5c	4	79-98	Cultural Vegetation	83
2478	Manual & Prescribed Fire	4a, 5c	7	76-99	Cultural Vegetation, Pacific giant salamander	82
2479	Manual & Prescribed Fire	4b, 5c	31	85-99	Elk, NSO, Cultural Vegetation	83
2482	Manual & Prescribed Fire	4a, 5c	3	77-98	Cultural Vegetation	81
2483	Manual & Prescribed Fire	4b, 5c	3	90-99	Cultural Vegetation, Pacific giant salamander	86
2485	Manual & Prescribed Fire	4b, 5c	10	80-99	Elk, NSO, Cultural Vegetation, Pacific giant salamander	83
2488	Manual & Prescribed Fire	4a, 5c	7	64-99	Cultural Vegetation	78
2491	Manual & Prescribed Fire	4b, 5c	9	83-98	Elk, Cultural Vegetation	82
2495	Manual & Prescribed Fire	4b, 5c	17	83-99	NSO, Cultural Vegetation	85
2496	Manual & Prescribed Fire	4b, 5c	15	84-99	NSO, Cultural Vegetation, Pacific giant salamander	84
2497	Manual & Prescribed Fire	4b, 5c	3	90-99	Cultural Vegetation, Pacific giant salamander	86
2498	Manual & Prescribed Fire	4b, 5c	11	31-99	Cultural Vegetation, Pacific giant salamander	68
2499	Manual & Prescribed Fire	4b, 5c	19	67-99	NSO, Cultural Vegetation	81
2501	Manual & Prescribed Fire	4a, 5c	5	89-99	Cultural Vegetation	86
2502	Manual & Prescribed Fire	4a, 5c	13	76-99	Cultural Vegetation, Pacific giant salamander	83
2503	Manual & Prescribed Fire	4a, 5c	7	53-99	Cultural Vegetation	75
2504	Manual & Prescribed Fire	4a, 5c	4	66-99	Cultural Vegetation	80
2509	Manual & Prescribed Fire	4b, 5c	46	71-99	NSO, Trees of Interest, Cultural Vegetation, Pacific giant salamander	81
2510	Manual & Prescribed Fire	4b, 5c	15	78-99	NSO, Cultural Vegetation, Pacific giant salamander	84
2130	Mastication & Prescribed Fire	3, 4c, 5d	7	62-99	Elk, Cultural Vegetation	50
2212	Mastication & Prescribed Fire	3, 4c, 5d	14	86-100	Elk, Cultural Vegetation	84
2214	Mastication & Prescribed Fire	3, 4c, 5d	5	67-96	Elk, Cultural Vegetation	50
2229	Mastication & Prescribed Fire	3, 4c, 5d	12	80-99	Elk, Cultural Vegetation, Pacific giant salamander	50
2240	Mastication & Prescribed Fire	3, 4c, 5d	30	38-99	Cultural Vegetation, Pacific giant salamander	50
2413	Mastication & Prescribed Fire	3, 4c, 5d	6	90-99	Cultural Vegetation	50
2427	Mastication & Prescribed Fire	3, 4c, 5d	22	74-99	Elk, Cultural Vegetation	60
2428	Mastication & Prescribed Fire	3, 4c, 5d	3	87-99	Cultural Vegetation	50
2441	Mastication & Prescribed Fire	3, 4c, 5d	9	73-99	Elk, Cultural Vegetation	50
2457	Mastication & Prescribed Fire	3, 4c, 5d	7	85-99	Elk, Cultural Vegetation	50
2477	Mastication & Prescribed Fire	3, 4c, 5d	3	46-99	Cultural Vegetation	50
2484	Mastication & Prescribed Fire	3, 4c, 5d	9	82-98	Elk, Cultural Vegetation	50
2486	Mastication & Prescribed Fire	3, 4c, 5d	30	58-99	Elk, Cultural Vegetation	50
2487	Mastication & Prescribed Fire	3, 4c, 5d	7	74-99	Elk, Cultural Vegetation	50
2489	Mastication & Prescribed Fire	3, 4c, 5d	7	63-99	Cultural Vegetation	50
2490	Mastication & Prescribed Fire	3, 4c, 5d	15	85-99	Elk, Cultural Vegetation	50

Unit ID	Treatment Category	Prescriptions	Acres	Pre-Treatment Canopy Cover (%)	TEK Resource	Post-Treatment Canopy Cover (%)
2144	Prescribed Fire Only	5a	73	84-99	Elk, NSO, Cultural Vegetation, Pacific giant salamander	84
2201	Prescribed Fire Only	5a	12	87-99	Cultural Vegetation, Pacific giant salamander	86
2204	Prescribed Fire Only	5a	20	75-99	Cultural Vegetation, NSO, Pacific giant salamander	83
2205	Prescribed Fire Only	5a	15	89-99	Elk, NSO, Pacific fisher, Cultural Vegetation, Pacific giant salamander	86
2208	Prescribed Fire Only	5a	59	82-99	Cultural Vegetation, NSO, Pacific giant salamander	85
2209	Prescribed Fire Only	5a	31	84-99	Cultural Vegetation, NSO, Pacific giant salamander	85
2215	Prescribed Fire Only	5a	11	88-99	Elk, Cultural Vegetation, Pacific giant salamander	86
2232	Prescribed Fire Only	5a	4	87-99	Cultural Vegetation	85
2234	Prescribed Fire Only	5a	7	68-99	Cultural Vegetation, Pacific giant salamander	81
2238	Prescribed Fire Only	5a	4	89-99	Cultural Vegetation	85
2268	Prescribed Fire Only	5a	362	61-99	Pacific fisher, NSO, Cultural Vegetation, Pacific giant salamander	79
2269	Prescribed Fire Only	5a	18	45-99	Cultural Vegetation, Pacific giant salamander	74
2270	Prescribed Fire Only	5a	13	0-99	Cultural Vegetation, Pacific giant salamander	31
2296	Prescribed Fire Only	5a	6	68-99	Cultural Vegetation	81
2304	Prescribed Fire Only	5a	28	96-99	Cultural Vegetation	88
2306	Prescribed Fire Only	5a	19	96-99	Cultural Vegetation, Pacific giant salamander	88
2310	Prescribed Fire Only	5a	25	30-99	Cultural Vegetation	60
2315	Prescribed Fire Only	5a	16	53-99	Cultural Vegetation, NSO, Pacific giant salamander	76
2317	Prescribed Fire Only	5a	15	71-99	Cultural Vegetation, Pacific giant salamander	78
2324	Prescribed Fire Only	5a	19	0-98	Cultural Vegetation, Pacific giant salamander	27
2337	Prescribed Fire Only	5a	10	1-99	Cultural Vegetation	51
2338	Prescribed Fire Only	5a	31	87-99	Elk, NSO, Cultural Vegetation	86
2339	Prescribed Fire Only	5a	172	80-99	NSO, Cultural Vegetation	85
2340	Prescribed Fire Only	5a	129	64-99	Elk, NSO, Cultural Vegetation	77
2341	Prescribed Fire Only	5a	30	95-99	Elk, NSO, Cultural Vegetation	87
2342	Prescribed Fire Only	5a	72	84-99	NSO, Cultural Vegetation	85
2344	Prescribed Fire Only	5a	19	96-99	Cultural Vegetation	88
2349	Prescribed Fire Only	5a	2	81-99	Cultural Vegetation	85
2350	Prescribed Fire Only	5a	3	66-99	Cultural Vegetation	81
2353	Prescribed Fire Only	5a	9	90-99	NSO, Cultural Vegetation	85

Unit ID	Treatment Category	Prescriptions	Acres	Pre-Treatment Canopy Cover (%)	TEK Resource	Post-Treatment Canopy Cover (%)
2443	Prescribed Fire Only	5a	161	90-99	NSO, Pacific fisher, Cultural Vegetation, Pacific giant salamander	86
2444	Prescribed Fire Only	5a	3	77-98	Cultural Vegetation, Pacific giant salamander	82
2445	Prescribed Fire Only	5a	2	79-99	Cultural Vegetation, Pacific giant salamander	84
2446	Prescribed Fire Only	5a	51	83-99	NSO, Cultural Vegetation, Pacific giant salamander	84
2447	Prescribed Fire Only	5a	11	73-98	Cultural Vegetation, Pacific giant salamander	78
2506	Prescribed Fire Only	5a	18	81-99	Cultural Vegetation, Pacific giant salamander	83
2507	Prescribed Fire Only	5a	9	85-99	Cultural Vegetation, Pacific giant salamander	86

Connected Actions

The following section presents those actions required to access and implement the proposed treatments safely and efficiently.

Temporary Roads

Mechanically treated areas where a commercial by-product is anticipated require the use of temporary roads. New temporary roads were considered where the impact of creating new temporary roads is minor and rehabilitation techniques would effectively eliminate the effects of a new linear feature on the landscape. For example, a new temporary road that requires minimal clearing and has no stream crossings would be a scenario where this action was considered. All temporary roads would be winterized and closed to vehicle traffic every rainy season. Post project implementation would require that all temporary roads be left in a free draining condition, free of berms or obstacles that would concentrate water on the roadbed during storm events. Drainage structures would be removed and associated fill stored at stable locations on the roadbed. Roadbeds would be decompacted to improve infiltration where necessary. Disturbed areas would be mulched with native material found on site and may be seeded with native grasses. All temporary roads listed in Table 2-8 would be blocked to eliminate motor-vehicle access.

Table 2-8. Temporary roads necessary for project implementation.

ID	Mileage	Treatment Unit	Status	Treatment Method
7101	0.22	2105	Existing	Mechanical
7102	0.16	2112, 2113	Existing	Mechanical
7103	0.02	2112	Existing	Mechanical
7104	0.03	2110	Existing	Mechanical
7105	0.15	2116, 2117	Existing	Mechanical
7106	0.03	2117	Existing	Mechanical
7109	0.04	2213	Existing	Mechanical
7111	0.44	2127, 2129, 2128, 2130, 2132, 2151, 2154	Existing	Mechanical
7112	0.07	2101, 2105	New	Mechanical
7113	0.12	2131, 2132	Existing	Mechanical

ID	Mileage	Treatment Unit	Status	Treatment Method
7115	0.04	2119	Existing	Mechanical
7116	0.33	2127, 2128, 2154	New	Mechanical
7117	0.06	2116	Existing	Mechanical
7119	0.32	2127	Existing	Mastication
7201	0.22	2235, 2237	Existing	Mechanical
7202	0.66	2215, 2217, 2218, 2219, 2242, 2265	Existing	Mechanical
7203	0.08	2265	Existing	Mechanical
7204	0.02	2264	Existing	Mechanical
7206	0.13	2225	Existing	Mechanical
7207	0.15	2230	Existing	Mechanical
7208	0.15	2227, 2281	New	Mechanical
7209	0.14	2217, 2218	Existing	Mechanical
7210	0.07	2242	Existing	Mechanical
7211	0.07	2263, 2264, 2268	Existing	Mechanical
7212	0.11	2221	Existing	Mechanical
7213	0.03	2242	Existing	Mechanical
7214	0.23	2206	Existing	Mechanical
7215	0.03	2266	Existing	Mechanical
7216	0.09	2265	Existing	Mechanical
7217	0.25	2265, 2266, 2294, 2283	Existing	Mechanical
7218	0.04	2249	Existing	Mechanical
7219	0.03	2203	Existing	Mechanical
7220	0.69	2201, 2201, 2229, 2212, 2214, 2228, 2229	Existing	Mastication
7221	0.27	2240	Existing	Mastication
7222	0.05	2200	New	Mechanical
7300	0.03	2328	Existing	Mechanical
7401	0.33	2461	Existing	Mechanical
7402	0.16	2481	Existing	Mechanical
7403	0.12	2481, 2490	Existing	Mechanical
7404	0.08	2481	Existing	Mechanical
7405	0.28	2461, 2500, 2461	Existing	Mechanical
7406	0.21	2493	Existing	Mechanical
7407	0.23	2481, 2486	Existing	Mechanical
7408	0.10	2467, 2492	Existing	Mechanical
7409	1.03	2400, 2443, 2500, 2439, 2500	Existing	Mechanical
7410	0.14	2418, 2419	Existing	Mechanical
7411	0.11	2411	Existing	Mechanical
7412	0.14	2412, 2413	Existing	Mechanical
7413	0.10	2411, 2407	Existing	Mechanical
7414	0.10	2407	Existing	Mechanical
7415	0.26	2409, 2411	Existing	Mechanical
7416	0.37	2407, 2409, 2455	Existing	Mechanical
7418	0.04	2402	Existing	Mechanical
7419	0.10	2400, 2439, 2453	Existing	Mechanical
7420	0.09	2400, 2454	Existing	Mechanical
7421	0.15	2426, 2505	Existing	Mechanical
7423	0.04	2465, 2466	Existing	Mechanical
7425	0.07	2500	Existing	Mechanical
7426	0.14	2400, 2433, 2453	Existing	Mechanical
7427	0.02	2470	Existing	Mechanical
7432	0.12	2489, 2490	Existing	Mastication
7433	0.25	2481, 2490	Existing	Mastication

ID	Mileage	Treatment Unit	Status	Treatment Method
7434	0.19	2403, 2427, 2428, 2441, 2472	Existing	Mastication
7435	0.14	2427	Existing	Mastication
7436	0.13	2418, 2457	Existing	Mastication
7437	0.07	2457	Existing	Mastication
7438	0.07	2484	Existing	Mastication
7439	0.05	2403, 2427, 2428, 2441, 2472	Existing	Mastication
Total Mileage	***11.0***			

Table 2-9 displays log landings available for expediting timber harvest operations.

Table 2-9. Log landings available for expediting timber harvest operations.

Landing ID	Acres	Status	Landing ID	Acres	Status	Landing ID	Acres	Status
4101	0.50	Existing	4256	0.33	Existing	4440	0.50	Existing
4102	0.50	Existing	4257	0.25	Existing	4441	0.33	Existing
4103	0.50	Existing	4258	0.25	Existing	4442	0.50	Existing
4104	0.50	Existing	4259	0.25	Existing	4443	0.25	Existing
4105	0.50	Existing	4260	0.50	Existing	4444	0.25	Existing
4106	0.50	Existing	4261	0.50	Existing	4445	0.50	Existing
4107	0.33	Existing	4263	0.25	Existing	4446	0.50	Existing
4108	0.50	Existing	4264	0.25	Existing	4447	0.50	Existing
4109	0.50	Existing	4265	0.50	Existing	4448	0.50	Existing
4110	0.50	Existing	4266	0.25	Existing	4449	0.50	Existing
4111	0.50	Existing	4267	0.25	Existing	4450	0.50	Existing
4112	0.50	Existing	4269	0.50	Existing	4451	0.50	Existing
4116	0.75	Existing	4270	0.50	Existing	4453	0.50	Existing
4118	0.50	Existing	4301	0.25	Existing	4454	0.50	Existing
4123	0.50	Existing	4302	0.25	Existing	4457	0.75	Existing
4125	0.75	Existing	4310	0.50	Existing	4458	0.50	Existing
4127	0.25	Existing	4311	0.25	Existing	4459	0.50	Existing
4128	0.25	Existing	4312	0.25	Existing	4460	0.75	Existing
4129	0.50	Existing	4401	0.50	Existing	4461	0.50	Existing
4130	0.50	Existing	4403	0.75	Existing	4467	0.50	Existing
4132	0.33	Existing	4404	0.50	Existing	4468	0.50	Existing
4137	0.25	Existing	4405	0.33	Existing	4471	0.50	Existing
4143	0.5	Existing	4406	0.50	Existing	4472	0.75	Existing
4144	0.75	Existing	4408	0.50	Existing	4119	0.50	New
4201	1.00	Existing	4409	0.50	Existing	4134	0.33	New
4202	0.50	Existing	4410	0.50	Existing	4135	0.33	New
4203	0.50	Existing	4411	0.50	Existing	4136	0.50	New
4204	0.50	Existing	4412	0.50	Existing	4138	0.33	New
4205	0.25	Existing	4413	0.75	Existing	4140	0.75	New
4206	0.50	Existing	4414	0.33	Existing	4141	0.75	New
4208	0.75	Existing	4415	0.50	Existing	4142	0.75	New
4209	0.50	Existing	4416	0.50	Existing	4145	0.25	New
4210	0.50	Existing	4417	0.50	Existing	4146	0.50	New
4211	0.50	Existing	4418	0.50	Existing	4207	0.75	New
4212	0.75	Existing	4419	0.50	Existing	4237	0.50	New
4213	0.75	Existing	4421	0.50	Existing	4242	0.25	New
4214	0.50	Existing	4422	0.50	Existing	4243	0.25	New
4215	0.5	Existing	4423	0.50	Existing	4244	0.33	New
4216	0.75	Existing	4424	0.50	Existing	4245	0.50	New

Landing ID	Acres	Status	Landing ID	Acres	Status	Landing ID	Acres	Status
4217	0.50	Existing	4425	0.50	Existing	4246	0.50	New
4218	0.50	Existing	4426	0.50	Existing	4255	0.33	New
4219	0.50	Existing	4427	0.50	Existing	4271	0.50	New
4220	0.50	Existing	4428	0.75	Existing	4308	0.25	New
4223	0.50	Existing	4429	0.50	Existing	4309	0.25	New
4229	0.50	Existing	4430	0.50	Existing	4420	0.50	New
4230	0.50	Existing	4431	0.50	Existing	4462	0.33	New
4239	0.75	Existing	4432	0.50	Existing	4466	0.33	New
4240	0.25	Existing	4433	0.50	Existing	4469	0.25	New
4241	0.33	Existing	4435	0.50	Existing	4470	0.50	New
4249	0.50	Existing	4436	0.75	Existing	4474	0.33	New
4250	0.75	Existing	4437	0.75	Existing	4475	0.33	New
4251	0.33	Existing	4438	0.50	Existing	4476	0.33	New
4252	0.33	Existing	4439	0.75	Existing	4477	0.33	New

Maintenance Level 1 System Road Use

Maintenance Level (ML) 1 roads to be used during the normal operating period (dry season) are listed in Table 2-10. The ML 1 designation indicates a road that is closed to motor-vehicle traffic and is placed in "storage" until needed. These roads would be brought up to ML 2 standards when needed to facilitate access to treatment units. Bringing an ML 1 road up to ML 2 standards often requires some site-specific reconstruction and travelway reconditioning using heavy equipment (e.g., graders, excavators, and dump trucks). Road 13N14A needs a new culvert installed and placed in clean rock fill. The travelway on 13N14E and 13N14A has accumulated dirt and debris that will be removed and stored at designated locations. All roads would be brushed (using hand-held equipment) to improve visibility and travelways cleared of debris and vegetation.

Once brought up to ML 2 standards, these roads would receive routine road maintenance to facilitate access for equipment and workers for the life of the project in alignment with the *Six Rivers Road Maintenance Project*, authorized in January 2016. Incorporated by reference, all previously authorized road maintenance design and mitigation measures would apply. These roads would be closed annually to vehicle traffic during the wet weather season.

Table 2-10. Maintenance Level 1 (ML 1) system road use.

ID	Mileage	ID	Mileage
13N12A	0.9	13N14E	0.5
13N14A	1.2	13N18A	0.3
13N14C	0.2	13N18E	0.5
13N14D	0.5	14N15	0.5

Legacy Road Sediment Source Treatments

Restoration actions would occur at existing legacy sediment source sites, scheduled for treatment in compliance with the Clean Water Act as a condition of the North Coast Regional Water Quality Control Board waiver of waste discharge requirements (Order No. R1-2015-0021). No legacy sites are found adjacent to anadromous salmonid habitat or resident trout habitat. There are six (6) segments, totaling 1.1 miles of legacy roads found in the project area (Table 2-11) and include the following actions:

- Excavated road fill would be stored on site and in stable locations;
- Construct waterbar drainage features to prevent water from concentrating on the roadbed;
- Cover disturbed ground with native material gathered on sites (tree boughs);
- Install earthen log barrier at locations to effectively block motor-vehicle access; and
- Develop appropriate erosion control plans and incorporate best management practices (BMPs) into project plans prior to all ground-disturbing work that would occur during the dry season.

Table 2-11. Legacy road sediment source treatments.

Route ID	Miles	Route ID	Miles
9400	0.09	9103	0.19
9100	0.35	9402	0.11
9101	0.13	***Total***	***1.09***
9102	0.22		

Strategic Fuelbreaks and Handlines

Strategic fuelbreaks and primary handlines have been identified and would be constructed under minimal impact guidelines following a path of least resistance. Where feasible, natural features, such as ridges, rock screes, riparian areas, game trails, and vegetation breaks will be utilized. Only small-diameter trees (6 to 8 inches) would be cut during handline installation. A general description of the fuelbreak activity would be a 100-foot-chainsaw brushing cut supported by a 2-foot-wide handline cut down to bare mineral soil. For handlines, a 6-foot-chainsaw brushing cut supported by a 2-foot-wide handline cut down to bare mineral soil. Waterbars would be added as needed to reduce concentration of water. Refer to Figure 2-15, Figure 2-17, Figure 2-19 and Figure 2-21 for approximate locations of fuelbreaks and handlines.

Hazards Trees

Incidental felling would only occur in the event they pose an immediate safety risk to firefighters or a containment risk during implementation. Hazards trees posing a risk to loggers or operations would also be felled. Felled hazard trees would be left on site. Roadside hazard trees may be reserved for use for fisheries restoration, decked and stored, left on site, or sold.

Fireline Maintenance

The 1987 dozer line in Ti Bar, reused during the Ukonom Fire in 2017, is an example of an existing fireline that serves as an important strategic fireline for private land dwellings in the vicinity. This fireline would be maintained for multiple entries and as more of a “true fuelbreak” where most of the shrubs and small-diameter trees are thinned while preserving the larger trees to provide some shade/canopy cover. Handlines will be constructed with waterbars and left in a free-draining condition.

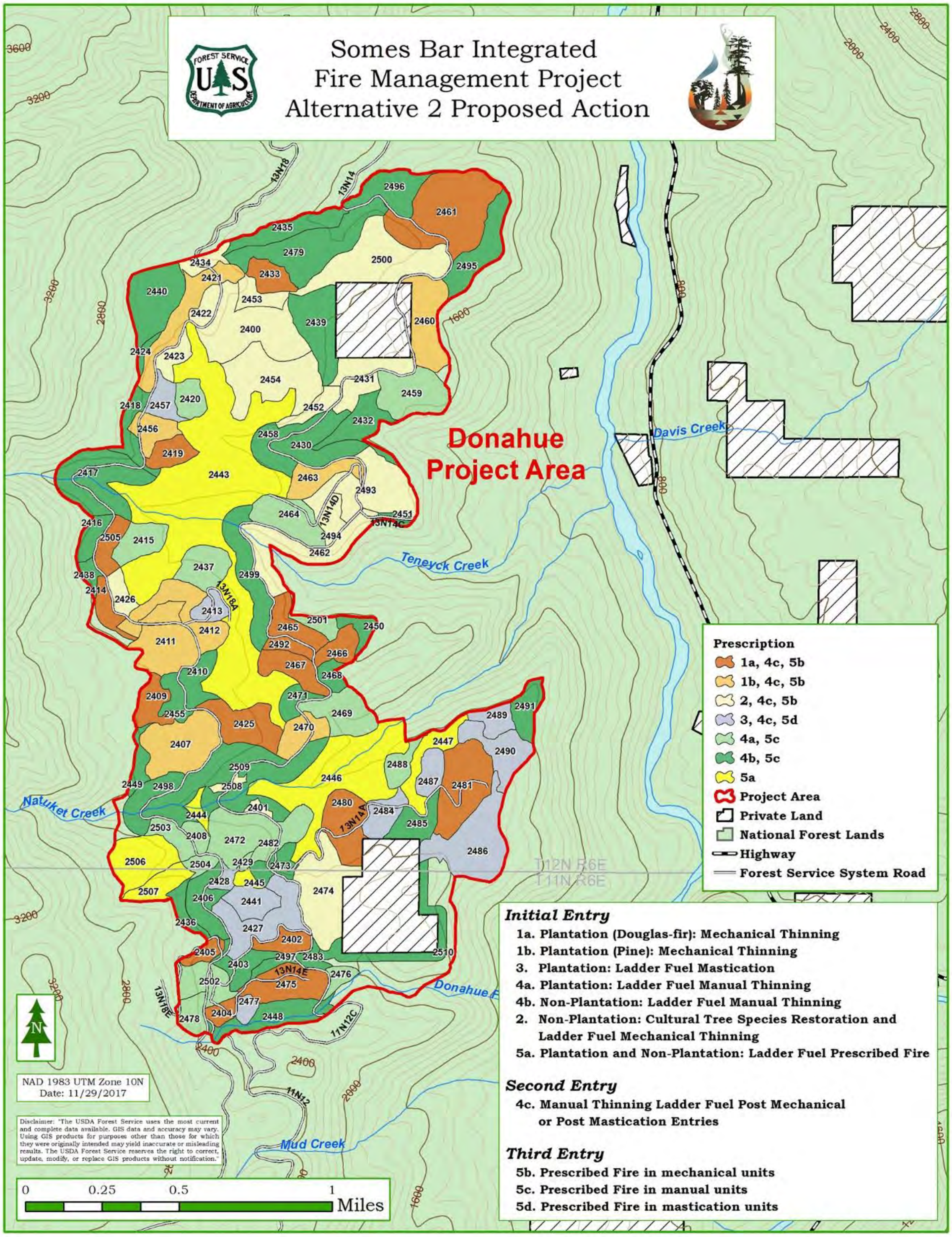

Figure 2-15. Donahue project area proposed action.

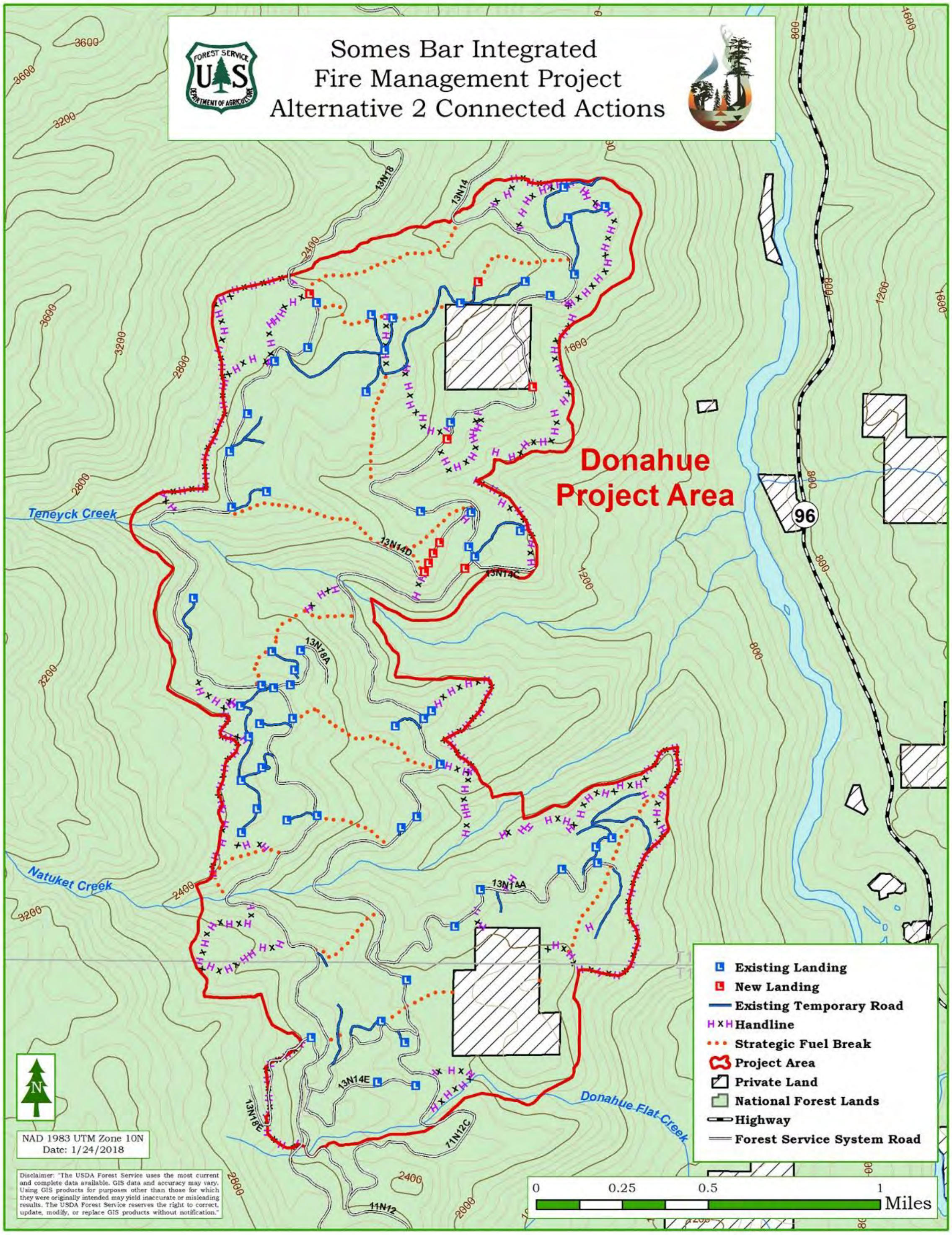

Figure 2-16. Donahue project area connected actions.

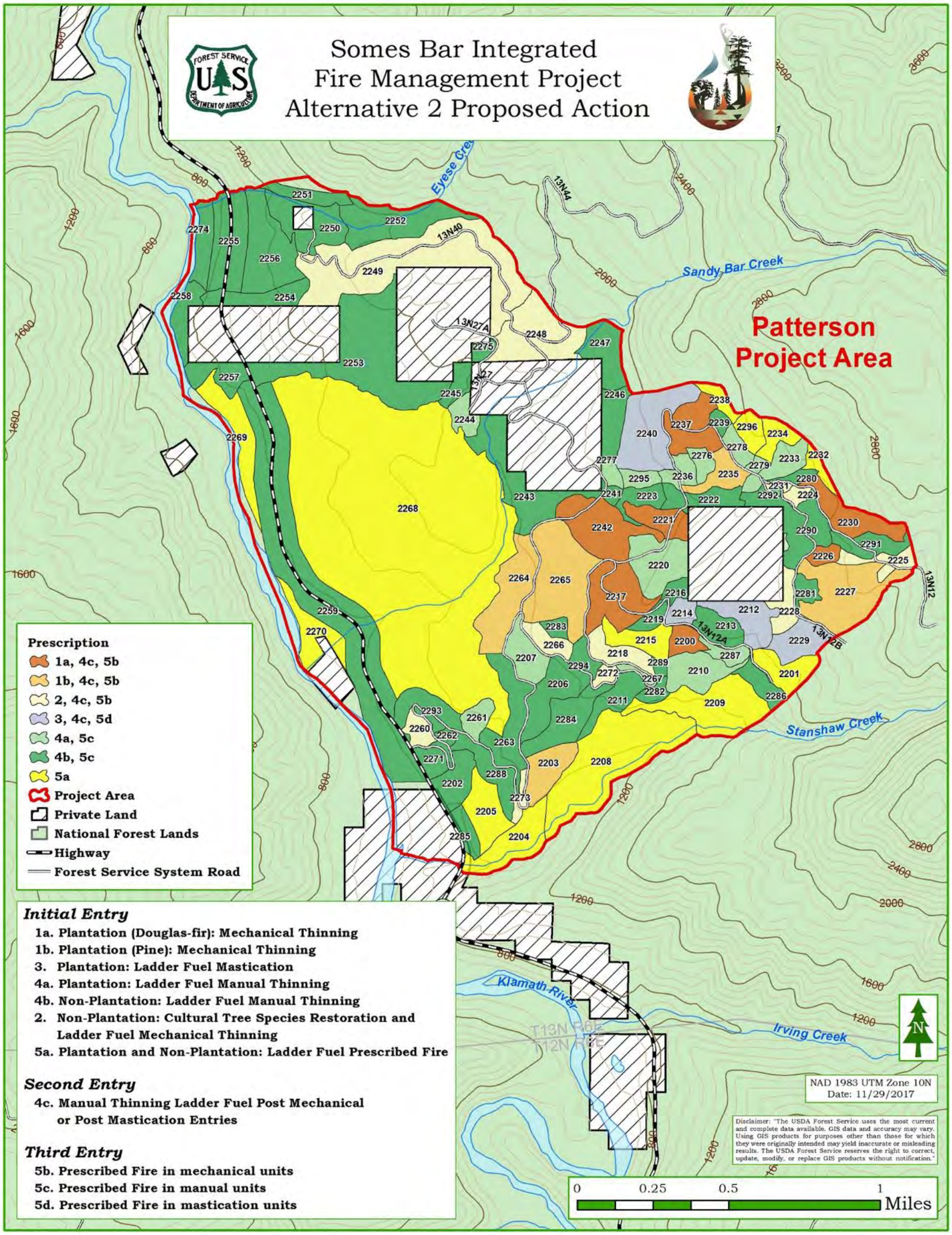

Figure 2-17. Patterson project area proposed action.

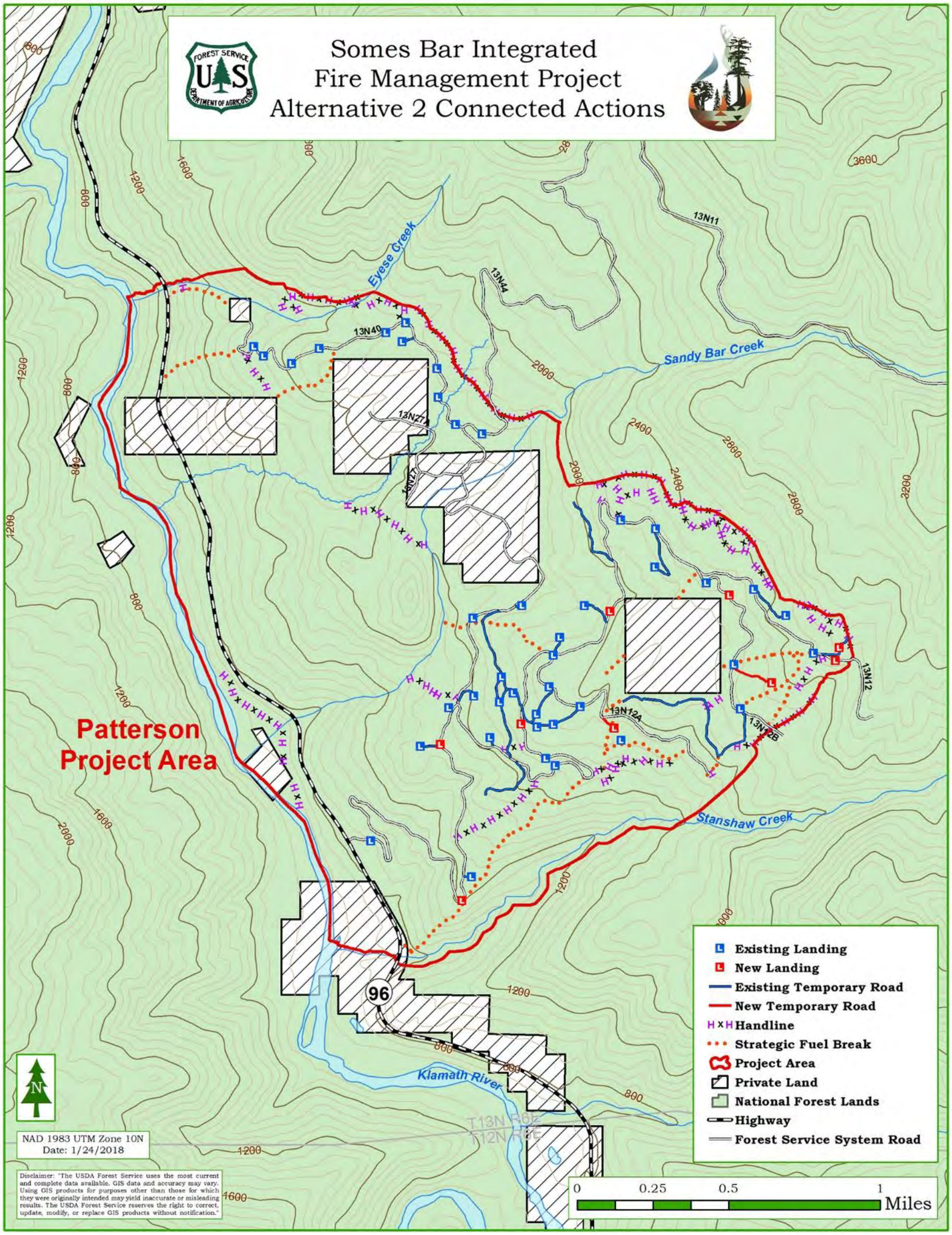

Figure 2-18. Patterson project area connected actions.

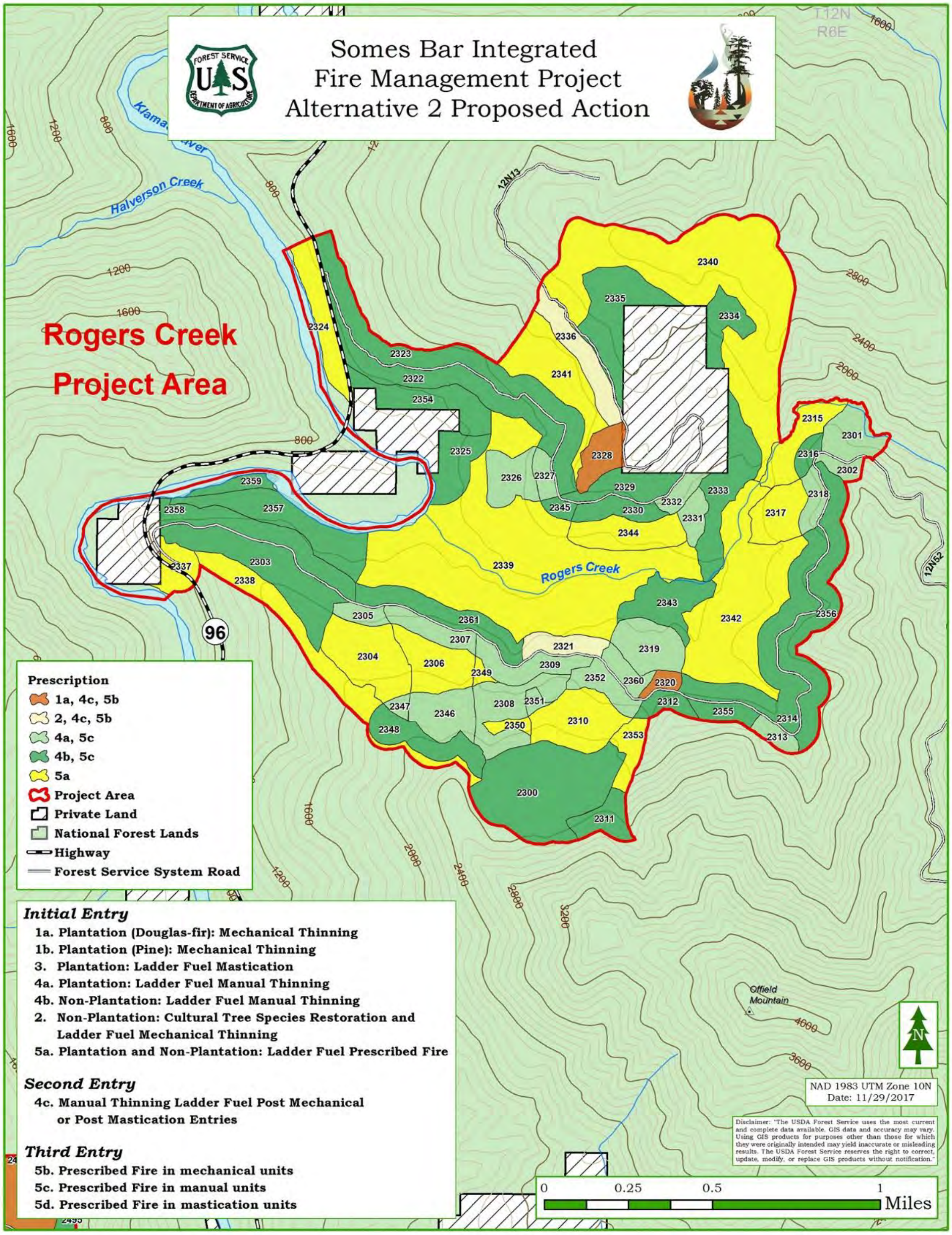

Figure 2-19. Rogers Creek project area proposed action.

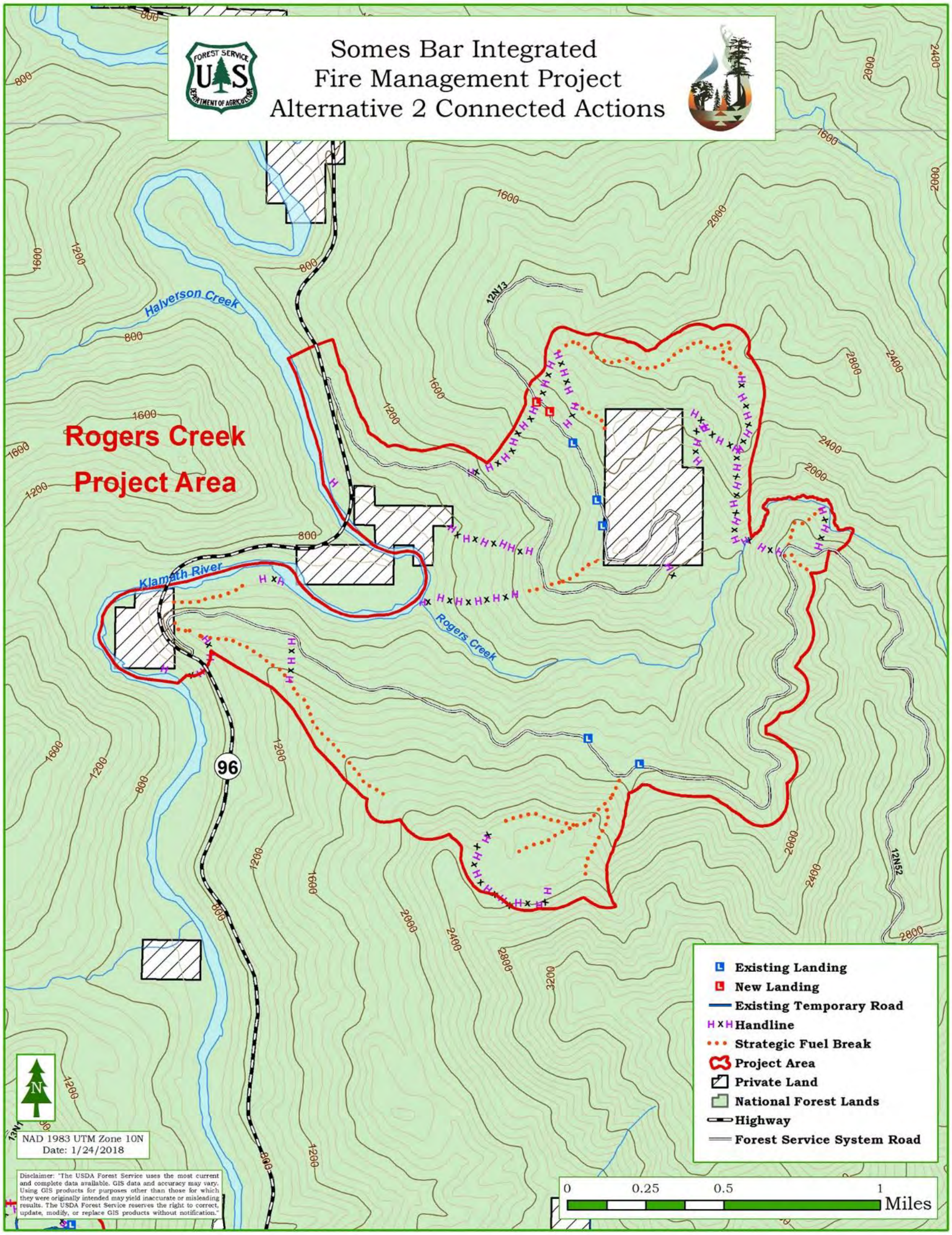

Figure 2-20. Rogers Creek project area connected actions.

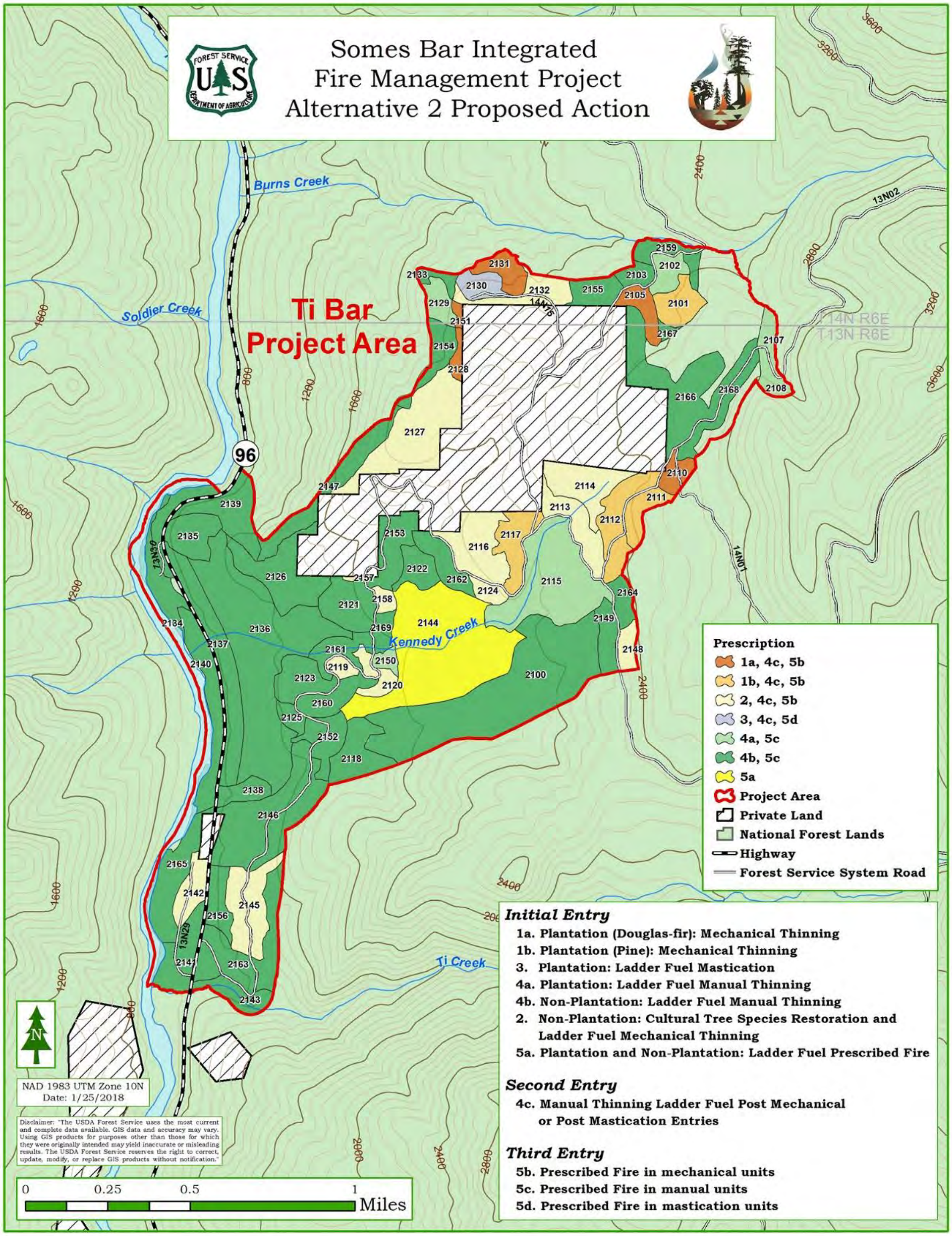

Figure 2-21. Ti Bar project area proposed action.

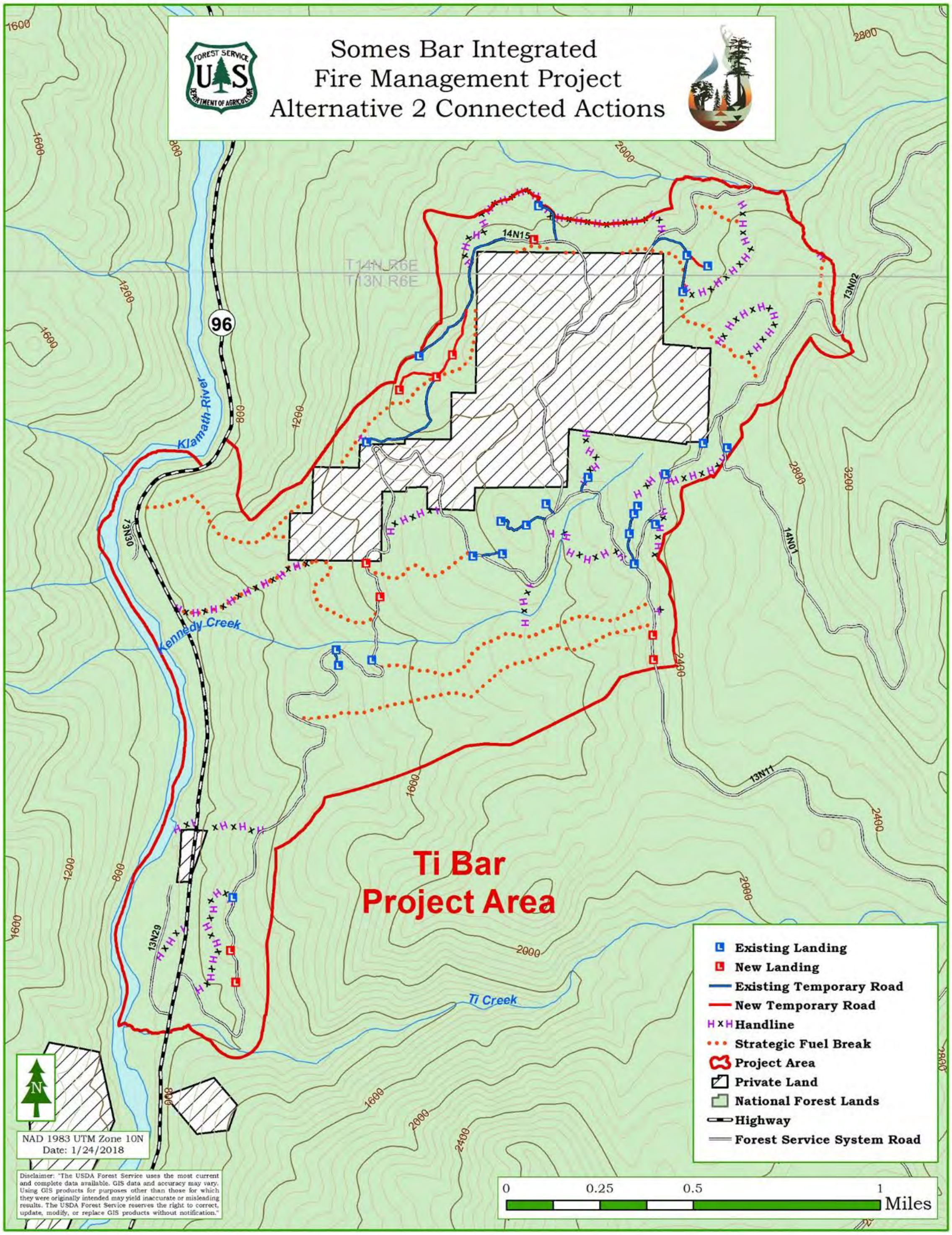

Figure 2-22. Ti Bar project area connected actions.

Project Design Features and Mitigation Measures

All activities would incorporate design features aimed at minimizing the potential for adverse effects to existing aquatic, semi-aquatic and associated terrestrial organisms and their environments. All applicable USFS National BMPs would be implemented for land disturbing activities that may impact water quality (*Appendix D*). Implementing these types of improvements may require the use of heavy equipment (e.g., self-propelled yarders, mechanical excavators, backhoes); however, hand labor would be used to accomplish manual restoration activities whenever safe and practical.

Landowner Notifications

- Keep landowners informed of the approximate timeline when implementation is planned to occur adjacent to private property. Contact landowners, in writing or other agreed to forms of communication, at least two weeks prior to when activities are planned. Post tentative schedules on the forest's Facebook page, at local stores and post offices.
- Measures when working adjacent to private property:
    - All water lines and storage tanks, fences, gates and other private land facilities would be fully protected during implementing the proposed actions. Low-lying structures, such as water lines that are difficult to see, would be flagged on the ground to ensure handpiles or equipment use would not disturb infrastructure. Flammable property would be protected by leaving adequate space between burn piles and facilities when working in the private and public land interface area. Table 2-12 displays treatment units with known water lines and associated infrastructure.
    - Portions of Unit 2250 that fall within the 300-foot private and public land interface boundary would limit prescribed fire treatments only to handpile construction and handpile burning.

Table 2-12. Units with known water-source infrastructure.

Project Area	Initial Entry Method	Unit	Project Area	Initial Entry Method	Unit
Donahue	Manual	2406	Patterson	Mechanical	2228
Donahue	Mastication	2427	Patterson	Prescribed Fire	2204
Donahue	Mastication	2428	Patterson	Prescribed Fire	2208
Donahue	Mastication	2441	Rogers Creek	Manual	2357
Donahue	Mechanical	2474	Rogers Creek	Prescribed Fire	2337
Patterson	Manual	2223	Ti Bar	Manual	2108
Patterson	Manual	2246	Ti Bar	Manual	2118
Patterson	Manual	2250	Ti Bar	Manual	2122
Patterson	Manual	2252	Ti Bar	Manual	2143
Patterson	Manual	2281	Ti Bar	Manual	2146
Patterson	Manual	2290	Ti Bar	Manual	2152
Patterson	Mastication	2240	Ti Bar	Manual	2153
Patterson	Mechanical	2224	Ti Bar	Manual	2156
Patterson	Mechanical	2226	Ti Bar	Manual	2166
Patterson	Mechanical	2227	Ti Bar	Manual	2168
Patterson	Mechanical	2230	Ti Bar	Mechanical	2110
Patterson	Mechanical	2248	Ti Bar	Mechanical	2113
Patterson	Mechanical	2249	Ti Bar	Mechanical	2114

- o Protect private property with boundary signs, corners, and tree blazes with ribbon flagging where needed to insure the delineation between private and public land is clear and obvious. Do this no more than two (2) weeks prior to implementation.

Cultural Resources

General – All Treatments

- All sites will be marked on the ground prior to implementation.
- All work within site boundaries shall be monitored by a Forest Service archaeologist or tribal monitor to ensure that the work is culturally desirable (i.e., for restoration purposes) and to ensure that ground disturbance is minimized and that features and artifacts are protected.
- All treatments within site boundaries will adhere to On-Site Historic Property Protection Measures as stipulated in the Region 5 Programmatic Agreement (R5 PA).
- In the event that cultural resources are discovered during implementation, all work in the area shall cease and the Forest Heritage Program Manager and Karuk Tribal Historic Preservation Officer (THPO) shall be notified immediately.
- Should inadvertent effects to or unanticipated discoveries of human remains be made on Region 5 lands, the County Coroner (California Health and Safety Code 7050.5(b)) shall be notified immediately. If the remains are determined to be Native American or if Native American cultural items pursuant to NAGPRA are uncovered, the provisions of NAGPRA and its regulations at 43 CFR 10 and ARPA at 43 CFR 7 shall be followed on federal lands (R5 PA Stipulation 7.9 (a)).

Prescribed Fire

- All sites in manual or prescribed burn (i.e., non-mechanical) units shall be marked on the ground with flagging prior to implementation.
- Construction of fire lines where sites are present will require a Forest Service archaeologist or tribal monitor to ensure fire lines avoid all archaeological features. Vegetation may be removed and fire lines or breaks may be constructed using hand tools, so long as ground disturbance is minimized and features are avoided.
- Vegetation to be burned shall not be piled within site boundaries of historic properties unless the location (e.g., a previously disturbed area) has been specifically approved by a Forest Service archaeologist. In general, slash piles will be placed at least 50 feet from any archaeological features or artifact concentrations.
- All fire-sensitive archaeological features or artifacts will be excluded from prescribed fire utilizing a variety of protective methods, such as use of flagging, fire line construction, specific ignition pattern, wetting agents, fire shelter fabric, and/or monitoring. Some sites will require hand removal of fuels prior to ignition to ensure that artifacts are not in direct contact with excess fuels.

Vegetation Management

- All sites in mechanical units shall be marked on the ground as general equipment exclusion zones prior to implementation.
- Coordinate marking of restoration by-products in designated equipment exclusion areas with the Karuk Tribe.
- Any trees cut near or within site boundaries will be directionally felled away from archaeological features or artifacts.
- Full suspension or one-end suspension will be the preferred method of tree extraction when conducting tree harvest near sites.
- One-end suspension may be utilized within site boundaries on a case-by-case basis, but only after a Forest Service archaeologist or tribal monitor determines that trees can be removed without impacting any archaeological features or artifact concentrations.
- For linear sites (e.g., mining ditches, historic trails), equipment may cross in areas where their features or characteristics clearly lack historic integrity. Crossings will be designated by a Forest Service archaeologist. The remainder of the site will be avoided, and traffic will be clearly routed through designated crossings.
- No new landings will be constructed within the boundary of any site.
- Re-utilizing existing landings may be allowable within the boundaries of some post-contact sites (not allowable for pre-contact sites), where a Forest Service archaeologist has determined: a) access to and from the landing is on a previously established route, b) only the current extent of the existing landing will be used, c) the existing landing is devoid of any archaeological features or artifacts, and d) no subsurface component is likely to be present.
- All new temporary roads or skid trails shall be constructed outside of site boundaries.
- Previous temporary roads or skid trails may be determined acceptable for re-use if vehicles stay on the previously disturbed roadbed.

Invasive Weeds

Treatment #1 – Small sites (Table 2-13).

1. Where Himalayan blackberry (blackberry) exists as a discrete site with few plants (<10 plants) or as a small patch (<0.01 acres/est. 435 ft^2),
    - Include treatment area in a retention mosaic for mechanical units OR retain an estimated 20 feet of native vegetation around treatment site for manual and prescribed fire units;
    - Avoid operating equipment or yarding logs across retention areas;

- Manually grub out the plant including root crown, (with Pulaski or similar tool) before plant flowers in the spring, taking care not to damage roots of any native vegetation at the site;
- Remove pulled plants from site, re-locate to a nearby burn pile;
- Monitor in the fall;
- Repeat treatment annually until eradicated; then,
- Implement prescribed burning activities.
- Based upon monitoring, adapt approach as needed to meet the intent of the design feature.

1a. Where tree-of-heaven exists as discrete site with a few stems:

- Include in retention area or retain an estimated 20 feet of native vegetation around the site;
- Manually remove trees when ground is moist or workable to best ensure root removal (dig or use trailer/towing winch);
- Monitor in the fall;
- Repeat annually until site is eradicated; and
- Implement prescribed burning activities.

Treatment #2 – Moderate sites (Table 2-13).

2. Where blackberry exists as a moderately sized patch (e.g., 0.02 acres/est. 1,152 ft^2):

- Include treatment area in a retention mosaic for mechanical units OR retain an estimated 20 feet of native vegetation around treatment site for manual, prescribed burn units;
- Avoid operating equipment or yarding logs across the retention area for mechanical units;
- Remove above-ground blackberry canes (weed whack or similar) before plant flowers in the spring;
- Pile blackberry canes where removed;
- Follow up in the fall with a prescribed burn over the removed canes;
- Monitor in the spring;
- Repeat annually (above-ground cane removal and burning or if a few plants, manual grubbing) until eradicated; then
- Implement prescribed burning activities.
- Based upon monitoring, adapt approach as needed to meet the intent of the design feature.

2a. Where blackberry exists as a linear feature along a short stretch of road (0.1 miles):

- Implement items above, but only repeat treatment if monitoring in the spring after weed whacking and burning indicates the cover of blackberry is reduced.

Treatment #3 – Landings (Table 2-13).

3. Before using the landing, where blackberry exists as a small site:

- Mechanically remove blackberry by blading down to ground surface, pile on site away from operations;
- Subsequently pile burn on landing;
- Follow up with blackberry cane removal (weed whack or similar) or if few plants, manually grub out blackberry before plant flowers OR prescribe burn over blackberry patch;
- Monitor a year after treatment; then
- Repeat annually until eradicated.
- Based upon monitoring, adapt approach as needed to meet the intent of the design feature.

3a. Before using landing, where blackberry exists as a large site:

- Mechanically remove blackberry by blading down to ground surface, pile on site away from operations, then
- Pile burn on landing.

Treatment #4 – Other settings (Table 2-13).

4. Where blackberry exists as a large site**,** along a stretch of road associated with mechanical units or manual burn units:

- Include 10 to 15 feet of native vegetation around blackberry on the road edge of units in the retention mosaic or for manual units, a 10- to 15-foot native vegetation buffer.

Table 2-13. Site-specific project design features for invasive weed treatments.

Project Area	Prescription	Unit #	Treatment
Ti Bar	Manual (4a), Prescribed Fire (5c)	2115	#1
Ti Bar	Manual (4a), Prescribed Fire (5c)	2115	#2
Ti Bar	Mechanical (1b)	2117	#1
Ti Bar	Mechanical (2)	2124	#1
Ti Bar	Manual (4b), Prescribed Fire (5c)	2162	#2
Ti Bar	Mechanical (2)	2116	#2
Patterson	Manual (4b), Prescribed Fire (5c)	2291 (3 sites)	#1
Patterson	Prescribed Fire (5a)	2290	#1
Patterson	Mechanical (1a)	2230	#1

Project Area	Prescription	Unit #	Treatment
Patterson	Mechanical (1a)	2230	#3 – landing
Patterson	Mechanical (1b)	2227	#3a – landing
Patterson	Mastication (3)	2229	#3a – landing
Patterson	Mechanical (1a)	2217	#3a – landing
Rogers	Manual (4b), Prescribed Fire (5c)	2361	#1
Rogers	Manual (4b), Prescribed Fire (5c)	2314	#1
Rogers	Mechanical (1a)	2320	#2
Rogers	Manual (4b), Prescribed Fire (5c)	2312	#2
Rogers	Mechanical (2)	2321	#2
Rogers	Manual (4a), Prescribed Fire (5c)	2352	#1
Rogers	Manual (4a), Prescribed Fire (5c)	2309	#1
Rogers	Manual (4b), Prescribed Fire (5c)	2361	#1
Rogers	Manual (4b), Prescribed Fire (5c)	2307/2361	#1 – both sides of road
Rogers	Manual (4b), Prescribed Fire (5c)	2322	#1
Rogers	Mechanical (2)	2336 (2 sites)	#3a – landing
Rogers	Mechanical (2)	2336	#2
Rogers	Manual (4b), Prescribed Fire (5c)	2358	#1a – tree-of-heaven
Rogers	Manual (4a), Prescribed Fire (5c)	2332	#2
Rogers	Manual (4a), Prescribed Fire (5c)	2327	#2
Rogers	Manual (4b), Prescribed Fire (5c)	2323	#2
Rogers	Manual (4b), Prescribed Fire (5c)	2355	#2
Rogers	Manual (4b), Prescribed Fire (5c)	2322	#2
Rogers	Mechanical (1a)	2328	#2
Donahue	Mechanical (1a)	2425	#1
Donahue	Mechanical (1b)	2412	#3
Donahue	Mastication (3)	2412	#3
Donahue	Mastication (3)	2413	#3
Donahue	Mechanical (2)	2434	#1
Donahue	Manual (4b), Prescribed Fire (5c)	2471	#1
Donahue	Mechanical (1b)	2463	#1
Donahue	Manual (4a), Prescribed Fire (5c)	2509	#1
Donahue	Mechanical (2)	2452	#3a – landing
Donahue	Mechanical (2), Manual (4b), Prescribed Fire (5c)	2452/2431/2458/2430	#4 – stretch of road
Donahue	Mechanical (2)	2452/2431	#3a – landing
Donahue	Mechanical (2)	2400	#4 – stretch of road

Riparian Reserves

- Endlining within the outer portion of riparian reserves would occur in the following mechanical units and as marked on the ground (Table 2-14):

Table 2-14. Endlining in riparian reserves.

Project Area	Unit	Treatment Method	Project Area	Unit	Treatment Method
Ti Bar	2101	Mechanical	Patterson	2273	Mechanical
Ti Bar	2105	Mechanical	Donahue	2400	Mechanical
Ti Bar	2111	Mechanical	Donahue	2401	Mechanical

Project Area	Unit	Treatment Method	Project Area	Unit	Treatment Method
Ti Bar	2112	Mechanical	Donahue	2402	Mechanical
Ti Bar	2113	Mechanical	Donahue	2404	Mechanical
Ti Bar	2114	Mechanical	Donahue	2405	Mechanical
Ti Bar	2116	Mechanical	Donahue	2407	Mechanical
Ti Bar	2117	Mechanical	Donahue	2411	Mechanical
Ti Bar	2119	Mechanical	Donahue	2412	Mechanical
Ti Bar	2120	Mechanical	Donahue	2419	Mechanical
Ti Bar	2127	Mechanical	Donahue	2421	Mechanical
Ti Bar	2131	Mechanical	Donahue	2422	Mechanical
Ti Bar	2132	Mechanical	Donahue	2423	Mechanical
Ti Bar	2142	Mechanical	Donahue	2425	Mechanical
Ti Bar	2158	Mechanical	Donahue	2431	Mechanical
Patterson	2200	Mechanical	Donahue	2434	Mechanical
Patterson	2203	Mechanical	Donahue	2452	Mechanical
Patterson	2217	Mechanical	Donahue	2454	Mechanical
Patterson	2221	Mechanical	Donahue	2456	Mechanical
Patterson	2224	Mechanical	Donahue	2461	Mechanical
Patterson	2225	Mechanical	Donahue	2465	Mechanical
Patterson	2226	Mechanical	Donahue	2466	Mechanical
Patterson	2227	Mechanical	Donahue	2467	Mechanical
Patterson	2230	Mechanical	Donahue	2470	Mechanical
Patterson	2231	Mechanical	Donahue	2474	Mechanical
Patterson	2235	Mechanical	Donahue	2475	Mechanical
Patterson	2237	Mechanical	Donahue	2480	Mechanical
Patterson	2242	Mechanical	Donahue	2481	Mechanical
Patterson	2248	Mechanical	Donahue	2492	Mechanical
Patterson	2249	Mechanical	Donahue	2505	Mechanical
Patterson	2260	Mechanical	Donahue	2508	Mechanical
Patterson	2264	Mechanical	Patterson	2265	Mechanical

- When operating heavy equipment in designated riparian reserve buffers (Table 2-15), and as marked on the ground, work in linear strips to avoid unnecessary turning and subsequent soil displacement.

Table 2-15. Equipment use in outer riparian reserves.

Project Area	Unit	Treatment Method	Project Area	Unit	Treatment Method
Ti Bar	2101	Mechanical	Patterson	2240	Mechanical
Ti Bar	2105	Mechanical	Patterson	2242	Mechanical
Ti Bar	2111	Mechanical	Patterson	2248	Mechanical
Ti Bar	2112	Mechanical	Patterson	2249	Mechanical
Patterson	2113	Mechanical	Patterson	2264	Mechanical
Patterson	2119	Mechanical	Patterson	2265	Mechanical
Patterson	2130	Mechanical	Patterson	2400	Mechanical
Donahue	2131	Mechanical	Donahue	2402	Mechanical
Donahue	2142	Mechanical	Donahue	2404	Mechanical
Donahue	2200	Mechanical	Donahue	2405	Mechanical
Donahue	2212	Mechanical	Donahue	2407	Mechanical
Ti Bar	2214	Mechanical	Donahue	2411	Mechanical

Project Area	Unit	Treatment Method	Project Area	Unit	Treatment Method
Ti Bar	2217	Mechanical	Donahue	2419	Mechanical
Ti Bar	2221	Mechanical	Donahue	2421	Mechanical
Ti Bar	2226	Mechanical	Donahue	2422	Mechanical
Ti Bar	2230	Mechanical	Donahue	2427	Mechanical
Patterson	2235	Mechanical	Donahue	2428	Mechanical
Patterson	2237	Mechanical	Donahue	2441	Mechanical
Donahue	2456	Mechanical	Donahue	2452	Mechanical
Donahue	2467	Mechanical	Donahue	2456	Mechanical
Donahue	2477	Mechanical	Donahue	2481	Mechanical
Donahue	2480	Mechanical	Donahue	2486	Mechanical
Donahue	2487	Mechanical	Donahue	2489	Mechanical
Donahue	2505	Mechanical			

- Feather manual treatments within the inner riparian reserve buffers by retaining 30 to 40 percent of the vegetation available to cut in a mosaic pattern.
- Direct ignition would occur upslope of riparian reserve buffers so fire intensity remains low and backs into the riparian reserve buffer.
- Minimize burning of handpiles adjacent to stream channels and seek a balance between number and distribution of piles to reduce sedimentation. Place burn piles away from existing coarse woody debris to project Pacific giant salamander habitat.
- Utilize stream courses for prescribed fire control features.
- Construct handlines in riparian reserves only where necessary to minimize undesired fire effects.

Fisheries

- Water drafting will occur only at designated sources, away from coho critical habitat, as shown in Figure 2-23.
- Follow National Core BMPs, Operations in Aquatic Ecosystems (AqEco-2 pp. 21-23) and Water Uses Management Activities (WatUses-3 pp. 145-146) – *www.fs.fed.us/biology/resources/pubs/watershed/FS_National_Core_BMPs_April2012.pdf*.
- Conduct operations at water source developments in such a manner as to avoid, minimize or mitigate adverse effects to aquatic species and habitats from water drafting. Consult with a forest fisheries biologist with any questions concerning this water drafting protocol.
- Adhere to National Marine Fisheries Service (NMFS) water-drafting specifications and guidelines at designated water sources – *www.westcoast.fisheries.noaa.gov/publications/hydropower/water_drafting_specification_guidelines.pdf*.
- Pumping rate will not exceed 350 gallons-per-minute or 10 percent of the flow in anadromous reaches. Otherwise pumping rate will not exceed 50 percent of surface flow.

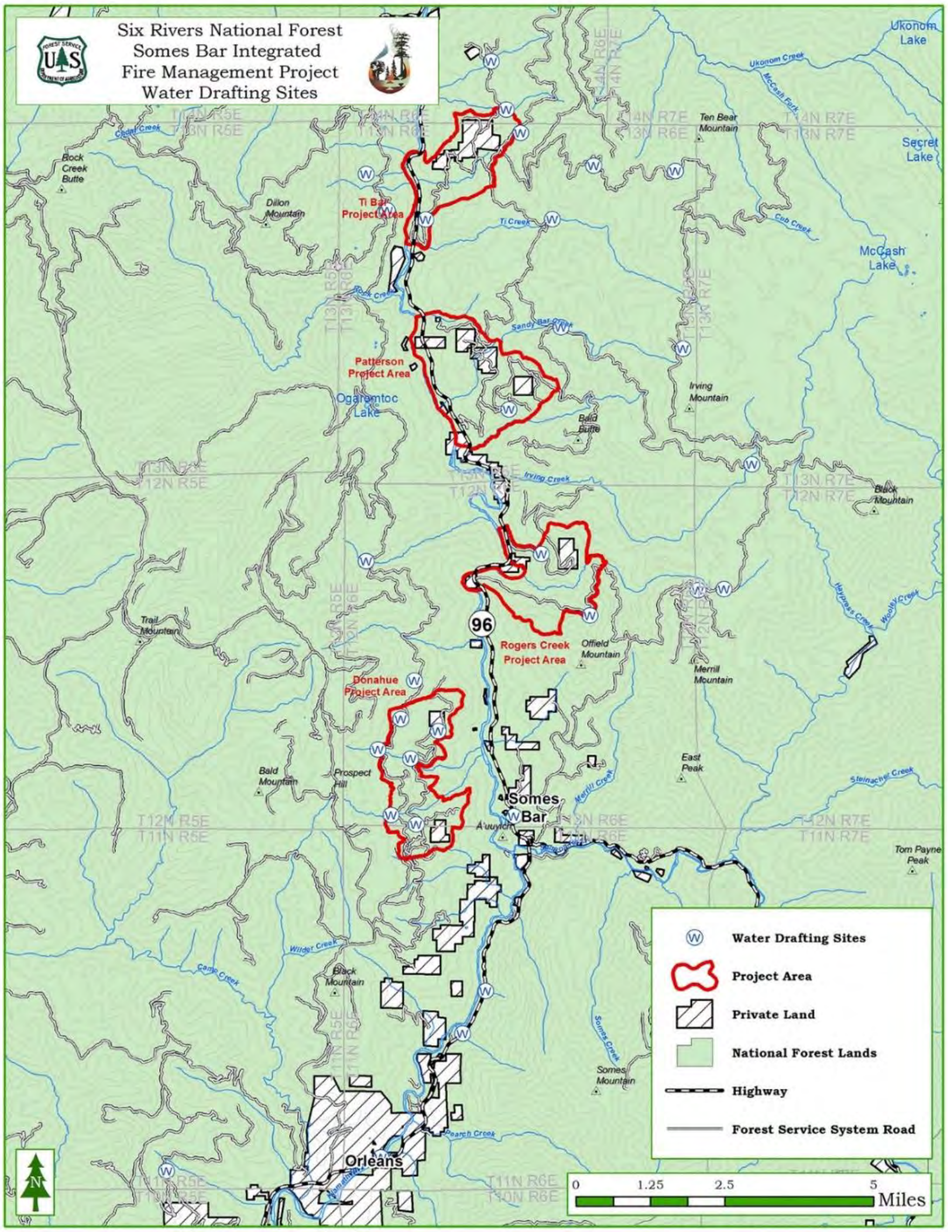

Figure 2-23. Water drafting site locations.

Wildlife

- No project activities that modify NSO nesting/roosting and foraging habitat from February 1 to September 15, unless protocol surveys determine no nesting activity. If surveys result in determining no NSO nesting activity, this restricted project operations time period would be lifted for the year in consultation with the US Fish and Wildlife Service (USFWS).
- No project activities that result in creating noise above ambient levels within 0.25 miles of nesting/roosting and foraging habitat or within known NSO activity center cores from February 1 to July 9 on the KNF (Ukonom RD). No project activities that create smoke within 0.25 miles of

nesting/roosting and foraging habitat within known NSO activity centers from February 1 to July 31 on the KNF (Ukonom RD). If surveys result in determining no NSO nesting activity or non-occupancy, this restricted project operations time period would be lifted for the year. This project design feature is not intended to be applied to motor-vehicle travel on roadways.

- No project activities that result in creating smoke or noise above ambient levels within 0.25 miles of nesting/roosting and foraging habitat or within known NSO activity center cores from February 1 to July 31 on the SRNF (Orleans RD). If surveys result in determining no NSO nesting activity or non-occupancy, this restricted project operations time period would be lifted for the year. This project design feature is not intended to be applied to motor-vehicle travel on roadways.
- No commercial treatments in any NSO nest groves (Ti Bar and Donahue).
- No project activities that result in creating noise above ambient levels within 0.25 mile of nesting/roosting and foraging habitat or within known NSO AC cores from February 1 to July 9. If surveys result in determining no NSO nesting activity, this restriction may be lifted for the year. This project design feature is not intended to be applied to motor-vehicle travel on roadways.
- *NSO habitat treatments:* Maintain an average overstory canopy cover of 60 percent in treatment units mapped as nesting/roosting habitat. Maintain an average overstory canopy cover of 40 percent in treatment units mapped as foraging habitat.
- During project design with the Level 1 team and the USFWS, it was determined that four NSO ACs (1250, 1073, 58 and 53) cores (0 to 0.5 mile) were deficit in habitat. The following units in the deficit cores (Table 2-16) would receive an 18-inch-dbh limit. These units would maintain post-treatment average overstory canopy cover of 60 percent in treatment units mapped as nesting/roosting habitat and would maintain an average overstory canopy cover of 40 percent in treatment units mapped as foraging or dispersal habitat.

Table 2-16. Units with 18-inch-dbh cutting limit.

Project Area	Unit	NSO Activity Center Number	Treatment Method
Donahue	2421	58	Mechanical
Donahue	2456	58	Mechanical
Donahue	2474	53	Mechanical
Donahue	2480	53	Mechanical
Ti Bar	2105	1250	Mechanical
Ti Bar	2110	1250	Mechanical
Patterson	2225	1073	Mechanical
Patterson	2227	1073	Mechanical

- High-quality nesting/roosting habitat as mapped within the project area will receive manual fuels treatments. The proposed treatment for high-quality nesting/roosting habitat would be cutting, piling, burning material less than or equal to 4 inches, and a low-intensity underburn. A high-quality nesting/roosting habitat polygon may occur in more than one unit (Table 2-17) and only the portion of high-quality nesting/roosting habitat within the unit will be treated with this prescription.

Table 2-17. High-quality nesting/roosting habitat polygons that overlap treatment polygons.

Treatment Type	Unit #	Project Area	Treatment Type	Unit	Project Area
Manual Prescribed Burn	2100	Ti-Bar	Manual Prescribed Burn	2103	Ti-Bar
Manual Prescribed Burn	2121	Ti-Bar	Manual Prescribed Burn	2122	Ti-Bar
Manual Prescribed Burn	2149	Ti-Bar	Manual Prescribed Burn	2153	Ti-Bar
Manual Prescribed Burn	2161	Ti-Bar	Manual Prescribed Burn	2162	Ti-Bar
Manual Prescribed Burn	2169	Ti-Bar	Manual Prescribed Burn	2250	Patterson
Manual Prescribed Burn	2252	Patterson	Manual Prescribed Burn	2288	Patterson
Manual Prescribed Burn	2291	Patterson	Manual Prescribed Burn	2410	Donahue
Manual Prescribed Burn	2424	Donahue	Manual Prescribed Burn	2430	Donahue
Manual Prescribed Burn	2432	Donahue	Manual Prescribed Burn	2440	Donahue
Manual Prescribed Burn	2455	Donahue	Manual Prescribed Burn	2509	Donahue
Mechanical Ground-Based/ Manual Prescribed Burn	2119	Ti-Bar	Mechanical Ground-Based/ Manual Prescribed Burn	2225	Patterson
Mechanical Ground-Based/ Manual Prescribed Burn	2249	Patterson	Mechanical Ground-Based/ Manual Prescribed Burn	2493	Donahue
Mechanical Road-Based/ Manual Prescribed Burn	2120	Ti-Bar	Prescribed Burn	2144	Ti-Bar
Prescribed Burn	2443	Donahue			

- Goshawk surveys in the project area are in progress. During surveys, a nesting pair was detected—the units listed in Table 2-18 include the limited operating periods (LOPs) for this site. If nesting goshawks are found within 0.25 miles of any treatment unit, no noise- or smoke-generating activities (e.g., timber harvest, heavy equipment use, chainsaw use, burning) would occur within 0.25 miles of the occupied site between March 1 and August 31 (Table 2-18).

Table 2-18. Northern goshawk limited operating period (LOP) for all entries.

Project Area	Unit	Treatment Method
Rogers Creek	2323	Manual & Prescribed Fire
Rogers Creek	2328	Mechanical, Manual & Prescribed Fire
Rogers Creek	2334	Manual & Prescribed Fire
Rogers Creek	2335	Manual & Prescribed Fire
Rogers Creek	2336	Mechanical, Manual & Prescribed Fire
Rogers Creek	2340	Prescribed Fire
Rogers Creek	2341	Prescribed Fire

- Bald eagle nest surveys are in progress. During surveys, a nesting pair was detected—the units listed below include the LOPs for this site. If bald eagles are detected in or adjacent to the project area, no noise- or smoke-generating activities (e.g., timber harvest, heavy equipment use, chainsaw use, burning) would occur within 0.25 miles of the occupied site from January 1 and August 31. This applies to Units 2134, 2135 and 2139.
- Fisher, marten and wolverine surveys have been conducted with camera stations. Detections of marten and fisher have been documented in the project area. Although no den sites have been located, if a den is found, no project activities associated with loud noise above ambient levels and smoke-producing activities would occur within 0.25 miles from February 1 to May 31 adjacent to an active den site.

- Protect other known or discovered raptor nest sites from management activities and human disturbance until fledging has been documented. Levels of protection vary by the requirements of the species involved. A Forest Service biologist will be notified if a raptor nest is discovered during implementation and appropriate steps will be taken.
- Snags and logs would be retained per KNF LRMP S&Gs Table 4-4, and KNF LRMP FEIS Table I-1 provides standards for snag retention. The KNF LRMP guidelines recommend five (5) snags per acre averaged across a 100-acre area. This site-specific recommendation (FEIS Table I-1) advises that NSO high-quality habitat would have eight (8) snags per acre on an average area basis. Each acre need not meet these standards. Five (5) to eight (8) snags per acre is safe with the higher standard being applied to high-quality habitat.
- Maintain five (5) to 20 pieces of coarse woody debris (CWD) per acre in various stages of decay, and leave large logs (conifer and hardwood) at least 20 inches in diameter and about 40 cubic feet in volume when they are available.
- No snags will be cut during implementation, unless they present a particular safety issue that cannot be avoided.
- Slash will not be piled against large trees or snags to reduce loss of structural elements during prescribed burning.
- The project would not remove potential threatened, endangered, and sensitive species (TES) nest trees or affect the canopy around potential nest trees in suitable habitat. Directional falling would be used to protect all predominant trees and any tree forming a canopy around the predominant tree.
- Roadside fuelbreaks (300 feet each side of the road) would retain approximately 30 percent of uncut understory vegetation to provide cover for other wildlife species. Leave about 30 percent of existing understory vegetation in a mosaic pattern that feathers more leave patches in the latter half (150 feet to 300 feet) of the fuelbreak.
- Shaded fuelbreak construction may occur in suitable TES habitat. No overstory trees or overstory canopy would be removed; however, in areas where the existing overstory canopy closure is low (but greater than 40%) treatments in secondary or understory canopy layers should maintain a minimum overall canopy closure of 60 percent.

Visual Resources

- Created gaps or forest openings shall be placed a minimum of 75 feet from open public roads (ML 2 and 3) and private properties.
- Avoid painting trees along open, public roads where visible from the road, river, or residence.

Temporary Roads

- Minimize proposing new temporary use roads.

- All temporary roads shall be winterized and closed to vehicle traffic every rainy season, typically October 30 to June 1, for the life of the project.
- When no longer needed for operations, remove culverts and associated fill. Rehabilitate roads and landings by decompacting, outsloping, and mulching with slash or seeding with native grasses. Physically close to vehicle access.

Sensitive Plants – Vascular Plants

- *Cypripedium fasciculatum*
  - Ti Bar Unit 2162 (manual and prescribed fire treatment), 30-foot treatment buffer:
    - Conduct prescribed burning when plant is dormant (fall-winter seasons).
    - Locate handpiles outside of buffer.
- *Thermopsis robusta*
  - Donahue Units 2431, 2459, 2461, 2463, 2454 and 2500:
    - Equipment exclusion buffer marked on the ground, typically along the edge of the units listed above.
- Lichen (*Sulcaria badia*)
  - Patterson Unit 2249, two (2) equipment exclusion buffers marked on the ground, less than 0.1 miles apart:
    - Maintain existing overstory canopy cover.
    - Consider incorporating sites within retention patches.
    - For follow up treatments, manual/prescribed burn treatments are recommended within equipment exclusion buffer.
    - Locate burn piles outside of buffers.
  - Patterson Unit 2268 (prescribed fire), one (1) site:
    - Manual treatments are conducted within the buffer prior to reintroducing fire to ensure a low-intensity understory burn.
    - Avoid direct ignition within buffer area. Allow low-intensity prescribed fire to back or flank buffer.
    - Conduct prescribed burning maintenance at intervals no less than five (5) years.
- Bryophyte (*Buxbaumia viridis*)
  - Patterson Unit 2247 (manual and prescribed fire treatments):
    - Locate handpiles outside of buffer marked on the ground.
    - Within the buffer, implement prescribed burning maintenance at intervals no less than five (5) years.

- Donahue Unit 2457 (manual and prescribed fire treatments), riparian area:
    - Given the moderate ladder fuels and moderate to high stems per acre in the area corresponding to this species, manually thin small-diameter trees/shrubs within the stretch of a riparian area buffer, which has been demarcated in the field.
    - Locate burn piles outside of the buffer.
    - Within the buffer, implement prescribed burning maintenance at intervals no less than five (5) years.

Soils

- Heavy-equipment operations shall occur when soils are dry enough to avoid deep rutting or puddling; operate over a duff and slash “mattress” if possible.
- Maintain 50- to 70-plus-percent soil cover in units, as prescribed on unit cards; duff and fine litter less than 3-inch diameter are the most desired soil cover components, but rock and larger wood also technically count as cover.
- Limit temporary roads and landings, and skid trails to less than 15 percent of the unit area.
- Existing utilized skid trails would require ripping to mitigate compaction in the following units:
    - Ti Bar: 2117, 2119 and 2127
    - Patterson: 2242
    - Rogers: none
    - Donahue: 2409, 2467, 2493 and 2500.

Monitoring

The overarching goal of monitoring the *Somes Bar Project* is to evaluate the effectiveness of treatments in achieving desired condition and function, including reintroduction of fire as a step towards restoring and maintaining resilient ecosystems, communities, and economies in the interest of revitalizing balanced human relationships with our dynamic landscape.

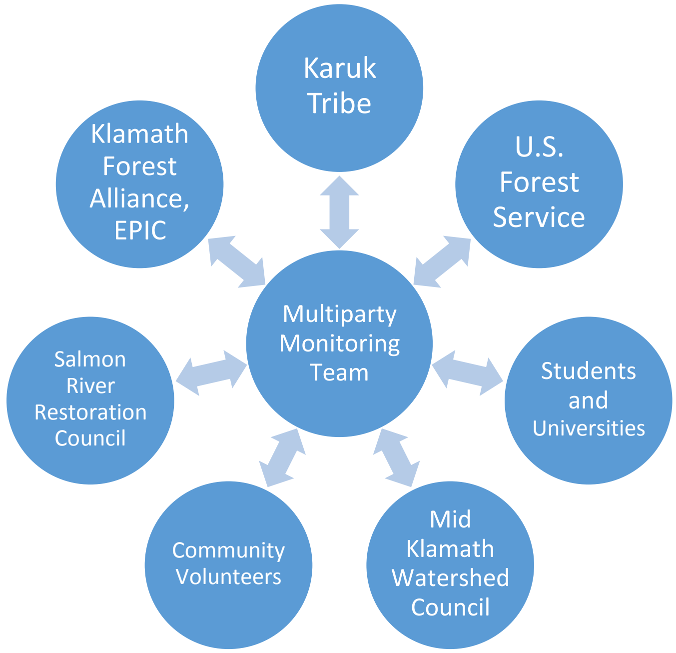

Figure 2-24. Schematic of multi-party monitoring strategy.

Because the WKRP is dedicated to shared-learning, the *Somes Bar Project's* multi-party monitoring (MPM) strategy is the primary way for the partnership and the community to learn about—and from—the project. The monitoring effort will be led by the MPM team comprised of diverse participants that may include representatives from the Karuk Tribe, Forest Service, Klamath Forest Alliance/Environmental Protection Information Center (KFS/EPIC), Salmon River Restoration Council, MKWC, local K-12 students, Humboldt State University or other university students, and community volunteers (Figure 2-24).

The partnership has identified two (2) types of monitoring that will take place throughout the project: 1) *implementation* and 2) *effectiveness*. Although *validation* monitoring is beyond the scope of this project, the partnership will pursue this type of monitoring with the help of researchers. The MPM team will meet annually to determine monitoring priorities. Based on team capacity, there are several components within each monitoring type that may be included. This capacity is largely dependent on funding availability. The question(s) related to each component link to the Purpose and Need, as well as the three goals of the Cohesive Strategy. The data for monitoring will be housed by the WKRP data steward and available upon request.

Table 2-19 lists the types of monitoring and the components that may be monitored.

Table 2-19. Types of monitoring and the components that may be used for the *Somes Bar Project*.

Monitoring Type	Component	Component
Implementation: Did we do what we said we were going to do?	Prescribed burning	Invasive weeds
	Temporary roads	Collaborative process
	Landings	Implementation mechanism(s)
	Equipment exclusion zones	Workforce
	Canopy cover	Project protocols and contract specifications
	Skyline corridors	Riparian Reserves
	Ground disturbance	Aquatic Conservation Strategy objectives
	Accomplishments (e.g., acres)	
	Prescribed burn effects	Canopy cover
	Oak enhancement	Ingress/egress

Monitoring Type	Component	Component
Effectiveness: Did our treatments meet the purpose and need?	Food species	Youth Involvement
	Basket materials	Collaboration
	Heterogeneity	Social acceptance of fire
	Invasive weeds	Notifications for work
	Fire Function	Fuels reduction on private land
	Fuel hazards (private properties, ingress/egress, ladder)	Public satisfaction
	Northern spotted owl habitat	Access to food and materials
	Elk habitat	Restoration byproduct revenue
	Fisher habitat	Demographics of workforce
	Salamander habitat	Jobs created
	Willow habitat	Jobs retained/sustained
	Snags	Training opportunities
	Ladder fuels	Avoided costs
	Tree-size composition	
Validation: Larger questions that are outside the scope of this project, but may be pursued concurrently.	Tree growth/basal area	Sustained cultural practices
	Structural heterogeneity	Fisher as spotted owl surrogate
	Wildlife habitat connectivity	Elk population viability
	Bird assemblages	New resource areas
	Adverse effects	

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating alternatives that were not developed in detail (40 CFR 1502.14). Public written comments received during the scoping period on the proposed action included suggestions for alternative methods to achieve the Purpose and Need.

Alternative 3: Consider NSO as Driving Force in Project Development

The purpose of the *Somes Bar Project* is to demonstrate how fire restores and maintains resilient ecosystems, communities, and economies to revitalize balanced human relationships with our dynamic landscape. Alternative 2 (Proposed Action) is designed to reinstate the use of TEK fire integrated with emergent restorative fire practices at the landscape scale. The commenter's proposal to consider NSO as the driving force in project development does not align with the early WKRP community planning efforts, which underpin the purpose for the project. The WKRP selected various focal species representing different components of the landscape, rather than managing with preference for a single species, such as NSO. The WKRP approached management from a broader landscape scale. Alternative 2 was designed so as components are put together, management for the focal species would provide a realistic and holistic approach to whole landscape management.

Although not the driving force in project development, NSO was identified as a TEK focal species integral to treatment design and season of implementation. Recognizing the NSO as regulated species under ESA, its decline from a cultural perspective serves as an indicator of a sick or dying environment. The Pacific fisher was identified as a potential surrogate, for which the NSO could serve as an indicator regarding varying components of its habitat dynamic. The Pacific fisher was also identified as a regalia species tied directly to TEK principles. During preliminary analysis, it was found that Pacific fisher habitat closely aligns with the habitat characteristics critical to the NSO food web.

However, consideration was given to limiting removal of 18-inch dbh or greater size crown fuels (intermediate and dominant trees) in natural stands, and avoiding all mechanical treatments in cable units and within riparian reserves, proposed under Alternative 2 (Proposed Action). As considered under Alternative 3, to allow for safe ignition as an initial entry, prescribed burning would be limited to areas where pre-treatments would occur and a 133-acre area with low amounts of ladder and crown fuels. Table 2-20 presents a treatment summary of Alternative 3.

Table 2-20. Treatment summary for Alternative 3.

Treatment Methods	Sum of Acres
Manual, Prescribed Burn	502
Mastication / Manual, Prescribed Burn	154
Mechanical – Ground-based / Manual, Prescribed Burn	496
Prescribed Burn	133
Grand Total	***1,286***

Under Alternative 3 as illustrated in Figure 2-25, the 2,658 acres of manual treatments, followed by prescribed burning units and additional 1,491 acres of prescribed burning only units proposed under Alternative 2 were not considered. Although these treatments are within the framework of consideration for Alternative 3, implementation would not be feasible and would require a high cost investment (manual treatments) with flame lengths exceeding the desired four (4) feet. Landscape-scale prescribed burning may only occur *once* perimeter containment and interior control line fuelbreaks are in place. Without this pre-treatment of hazardous fuels across the landscape proposed under Alternative 2, application of introducing fire under Alternative 3 could not be safely contained and controlled without substantial augmentation of suppression reinforcements. As Alternative 3 does not respond to fundamental elements of the Purpose and Need to revitalize balanced human relationships within our dynamic landscapes and would only reduce vegetative fuel hazards along roughly 50 percent of the critical ingress/egress routes to private land inholdings, this alternative was considered but eliminated from detailed study.

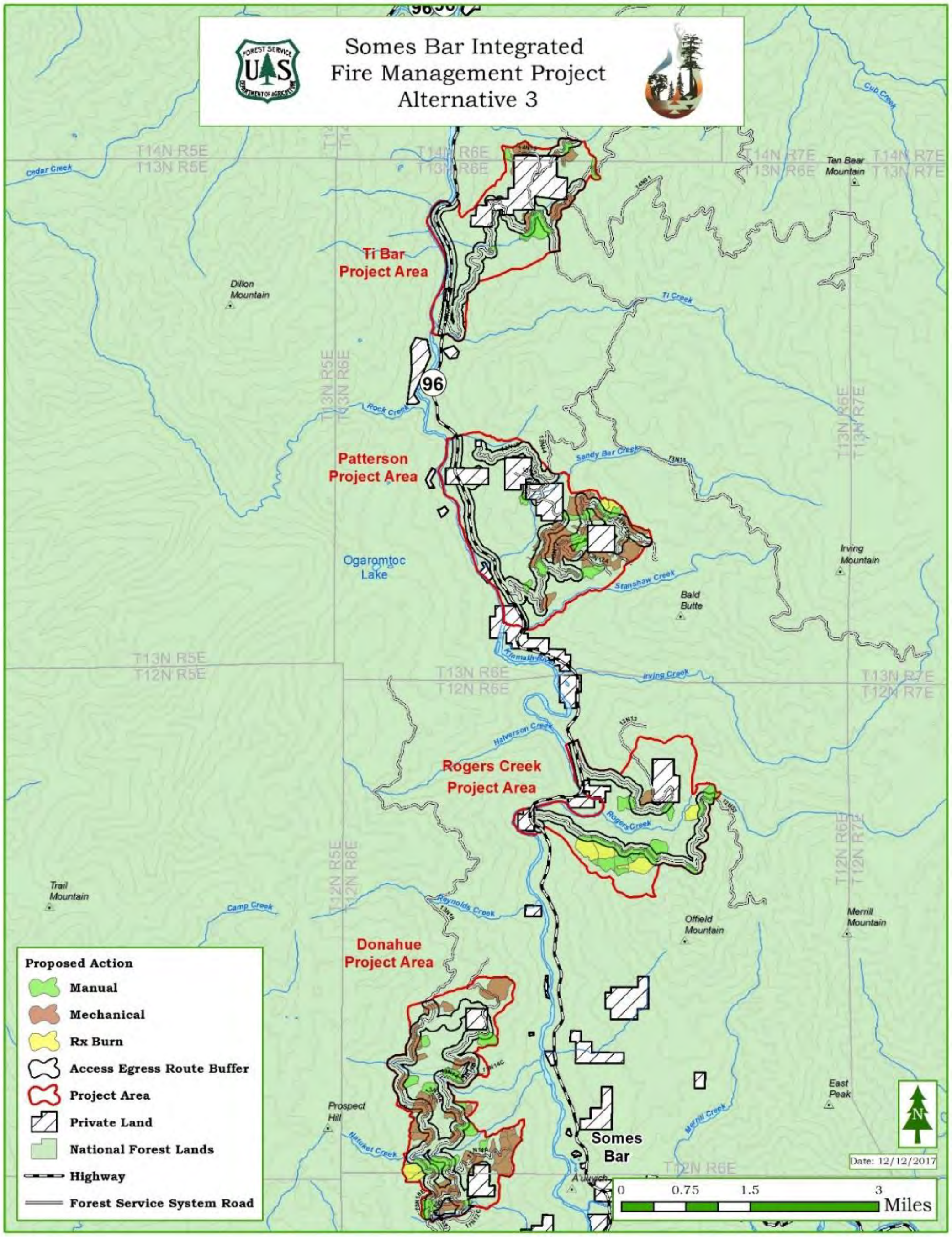

Figure 2-25. Alternative 3 – proposed treatment methods and locations.

Comparison of Alternatives Considered in Detail

Table 2-21 provides a comparison of No Action Alternative (Alternative 1) and the Proposed Action (Alternative 2) displayed by measurement indicators, organized by elements of the purpose and needs to provide a clear basis for the decision to be made by the Responsible Official.

Table 2-21. Comparison of alternatives – Purpose and Need.

Purpose	Needs	Measurement Indicators	Alternative 1 (No Action)	Alternative 2 (Proposed Action)
Demonstrate how fire restores and maintains resilient ecosystems, communities, and economies to revitalize balanced human relationships with our dynamic landscape.	Restoring and Maintaining Resilient Landscapes	Flame length	Model results of current fuel conditions indicate flame lengths would be 18.3 feet in plantations (Table 3-4) and 7.3 in non-plantations (Table 3-5).	Model results of future stand condition following thinning and prescribed fire treatments flame lengths would range from 4.7-5.3 feet in plantations (Table 3-8) and 5.4-6.1 in non-plantations (Table 3-9) over the life of the project.
			Modeling of flame length in plantations (Table 3-4) and non-plantations (Table 3-5) over 50 years show an increase in the average flame length from the current condition to highs of 22.9 and 10.8 respectively. At the end of the 50 years, average flame lengths would be around 9-11 feet in both.	Modeling of flame length post treatments over 50 years show a decrease in average flame length from 18.3 to 4.2 in plantations (3-8) and in non-plantations from 7.3 to 3.7 (Table 3-9) over the life of the project. At the end of the 50 years, average flame lengths would be 6 to 7 feet in both.
		Stand density index (SDI)	SDI is a measure of inter-tree competition. Current condition of SDI (See *Vegetation* section) is estimated at 80% in plantations and non-plantations. At this level, trees in the stand compete heavily for light and resources, resulting in stressed trees and increased rates of mortality, which also results in increased surface fuel loading. This stage of stand development often lasts a century or longer (Oliver and Larson 1996).	SDI would be reduced to about 40% through the life of the project (See *Vegetation* section). Decreasing stand densities would result in increased health and resilience as there would be less inter-tree competition for water, and light, and other resources. The resultant increase in tree vigor would allow for trees and stands to be more resistant to disturbance agents such as insects, disease, and drought (Fettig et al. 2007, Vernon 2017). Western pine beetles already present in the project area, they would continue to attack potential host trees, but healthier more vigorous trees have a far better chance of surviving an attack than those that are stressed (Fettig et al. 2010, 2007).

Purpose	Needs	Measurement Indicators	Alternative 1 (No Action)	Alternative 2 (Proposed Action)
		Basal area mortality	High rates of average basal area mortality is predicted to be 81% to 92% (Table 3-4) mortality in plantations and 49% to 70% (Table 3-5) in non-plantations.	The average percent of basal area mortality would be reduced to approximately 40%-50% in plantations (Table 3-8) and non-plantations (Table 3-9) through the life of the project.
	Resilient Communities	Potential rate of spread (chains per hour)	Modeled output under wildfire scenarios in previously managed strands is 6.7 chains per hour (Table 3-10).	Future stand condition following thinning and burning treatments and under a wildfire scenario increases slightly to 7.3 chains per hour (Table 3-11).
		Change in fire type	Torching	Surface: The model predicted that flame lengths would be reduced by half and that the associated fire type would change "torching with a potential transition to crown fire" to "surface fire with no crown fire transition".
	Resilient Economies	Cultural use flora and fauna habitat restoration acres enhanced	Karuk identity, and cultural use flora and fauna remain at risk due to growing risk of uncharacteristic high intensity wildfire and lack of a human interacted fire regime based on TEK principles.	Treating the landscape with fire achieved twin goals: protection against wildfire and promotion of cultural use species. This report sets out in detail how the Somes Bar IFMP will bring back cultural burning to revitalize and preserve Karuk culture.
		Local workforce qualification training number of wage grade jobs providing environmental planning and hands-on field experience	The Klamath TREX is an annual two-week training in the use of controlled burning in the western Klamath Mountains to reduce the future danger of wildfires. Currently 50 training opportunities.	Combining local, tribal, and federal resources would be utilized in scaling up to implement fire management actions as described in the *Somes Bar Project*. 75 to 100 training opportunities.
		Fire management and forestry related employment number of potential living wage seasonal or full time jobs	Approximately six (6) full-time-equivalent (FTE) jobs have been created through the Klamath TREX	During the initial project period, it is estimated that WKRP, including contractors, would employ almost 20 FTE local living-wage employees each year. When the projects moves into maintenance and monitoring, that number may decrease again to 10 FTEs.
		Commercial forest products in million board feet	0 MMBF	6 MMBF

Table 2-22 provides a comparative presentation between the No Action Alternative and the Proposed Action concerning the potential effects and outcomes relative to the Relevant Issues.

Table 2-22. Comparison of alternatives – Relevant Issues.

Relevant Issues	Measurement Indicator	Alternative 1 (No Action)	Alternative 2 (Proposed Action)
Threat to Native and Cultural Use Plants: Ground disturbance from prescribed fire and timber harvest, may damage native plant species, while increasing solar radiation favoring the spread of invasive weeds.	Quality and quantity of cultural use plant species	No change to current conditions. Lack of frequent fire processes would continue to compromise the quality and quantity of cultural use plant species within and adjacent to the Katimiin CMA.	Elements to the larger cultural landscape would be enhanced by reinstatement of cultural burning to improve the state of certain sites, objects, features or properties. Over eighty percent of the plants utilized by Karuk people depend on restorative fire for germination, as well as the use quality and quantity of the plant materials (Anderson 2006). For example, basketry materials are required to be specific sizes for various types of baskets (Lake 2007). Acorn abundance and quality are also dependent on regular burning (Anderson 2005).
	Risk of introduction or spread	No change	Implementation of invasive plant control measures would reduce the risk of introduction and spread in relation to the proposed actions. Satellite occurrences with relatively few individuals (e.g., Himalayan blackberry and Dyer's woad) would be eradicated.
Human Disturbance: Operational noise, presence of field crews and smoke generated from prescribed burning may periodically disturb neighbors.	Recreational Opportunity Spectrum (ROS)	ROS social setting would continue to provide for moderate to high frequency of user contact on roads and low to moderate frequency of backcountry use, away from roads in ROS Roaded-Natural and Semi-Primitive Motorized classes.	ROS social setting would continue to provide for moderate to high frequency of user contact on roads and low to moderate frequency of backcountry use, away from roads in ROS Roaded-Natural and Semi-Primitive Motorized classes. Road access may be temporarily restricted during active logging operations (decking and hauling) for short durations to ensure public safety.
	Visual Quality Objectives (VQOs) Retention and Partial Retention classes	No change to landscape character	Moderate and dominant alterations would occur from mechanical and manual treatments The alteration to landscape character, designed to mimic healthy forest conditions, would remain visually subordinate within the Retention and Partial Retention VQO classes.
	Scenic Stability and Integrity	Scenic stability and integrity would continue to be at-risk, as current hazard and risk ratings for wildfire would remain status-quo. Loss and/or degradation of natural resources from wildlife would likely affect other natural resource amenities.	Scenic integrity in these areas, along with the presence of field crews during and immediately after prescribed burning, operational slash, reflective tree stumps and smoldering debris would likely draw the attention of motorized observers in the short term.

Relevant Issues	Measurement Indicator	Alternative 1 (No Action)	Alternative 2 (Proposed Action)
	Noise (dBA)	No change in ambient noise level.	Operational noise from equipment and presence of field crews may periodically disturb neighbors. The extent of noise disturbances from phased timber harvesting and use of equipment would be seasonal, concentrated ns along transport or log truck haul routes. The initial phase involving tree felling (65 dBA) within line of sight noise measurement distance of 150 feet, skidding and stacking logs (65 dBA) and loading (58 to 65 dBA).
	Smoke (Air quality)	In the event of a wildfire, recreational use would likely disperse to alternate unburned areas and areas void of smoke, until vegetative recovery and the air quality and visibility is restored post control.	As each entry may be implemented over several seasons, smoke disturbance may impact nearby residents and visitors by lowering visibility and from the burning smell.
Habitat Disturbance: The removal of select crown fuels along with ladder fuels and surface reduction treatments including prescribed burning, may act to simplify forest stand structure in the short-term, impacting habitat quality and TEK focal species.	Stand density index (SDI)	SDI is a measure of inter-tree competition. Current condition of SDI (see *Vegetation* section) is estimated at 80% in plantations and non-plantations. At this level, trees in the stand compete heavily for light and resources, resulting in stressed trees and increased rates of mortality, which also results in increased surface fuel loading. This stage of stand development often lasts a century or longer (Oliver and Larson, 1996). Stands would remain in overstocked conditions with a lack of structural diversity and decreased prey base for NSO foraging.	SDI would be reduced to about 40% through the life of the project (see *Vegetation* section). Reducing SDI helps to promote a mosaic of habitat types across the landscape and re-introduction of wildfire back on the landscape would reduce conifer encroachment in hardwoods, increase perennial grass diversity and increase structural diversity providing cover for calving and calves. In the long-term late successional habitat would be more resilient to large-scale disturbances. The trees of interest would have the necessary resources to increase the size of their crowns, allowing them to produce more carbohydrates, which will lead to increased quality and quantity of acorns. Important structural elements would be maintained within the stand (large snags, trees and hardwoods) post-treatment. This would enhance resiliency of oak woodlands, and establish resilient heterogeneous forests at multiple scales. In addition, the Proposed Action provides mosaics of interior habitats and edges to provide for the diversity of prey for NSO.
Soil Erosion: Ground disturbance associated with tree harvest and associated logging operations (skidding, temporary road and landing construction) in riparian reserves may increase sedimentation downstream.	Risk to quality of streamflow (Sedimentation through acres of ground disturbance in riparian reserves)	No change to current sediment regime. 0 acres of new ground disturbance in riparian reserves.	182 acres of ground disturbance would occur within riparian reserves. Very low to no risk of sediment delivery based on integration of minimization design and mitigation measures.

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Chapter 3. Environmental Consequences

Introduction

This chapter describes the best available science, legal framework and analytical basis for comparing potential biological, social (cultural) and economic effects and outcomes associated with the No Action Alternative (Alternative 1) and the Proposed Action (Alternative 2), presented in *Chapter 2. The Alternatives*. The National Environmental Policy Act (NEPA) requires the agency to take a "hard look" at the potential effects of alternatives.

No Action (Alternative 1): *What if we did nothing at all?*

According to ancestral practice, treating the landscape with fire would achieve twin goals: protection against wildfire and promotion of cultural use species. If the status quo were to continue and a wildfire runs across the land, an uncharacteristically high-intensity wildfire is certain to happen, and is very likely to happen in the near future.

Given the Proposed Action was collaboratively developed in response to concerns about the ecosystem health, risks to the communities and the desire to bring restorative and cultural fire processes back to the landscape, the No Action Alternative was developed in detail.

Proposed Action (Alternative 2): *What if we reinstate fire process beginning with pre-treatment of the land?*

Tribal knowledge is driving the planning of the *Somes Bar Integrated Fire Management Project* (*Somes Bar Project*) using traditional ecological knowledge (TEK) on par with tenets of western science. Within Karuk aboriginal territory, people still follow the same practices for which evidence exists on and in the ground. Archaeology is conventionally practiced as though the information sought pertains to a dead culture. In the Karuk worldview, there is a deeper meaning that has to do with the relationship with those that came before. Archaeology is practiced in conjunction with talking to people, and in conformity with those deeper meanings.

This chapter is organized into the following sections:

- **Place-based Setting:** The first section summarizes a compilation of resource topic highlights of the place-based setting in light of the current living and physical environment holistically. This section is unique from the presentation of the alternatives that follows as it highlights patterns that would continue without implementing change.
- **Resource Topics by Alternative Considered in Detail:** This section presents individual resource topic summarizing project-specific reports, assessments, consultation and input prepared by the Western Klamath Restoration Partnership (WKRP). Information from these "specialist reports" (botanical biological evaluation and noxious weed risk assessment, biological assessment/biological evaluation (BA/BE) for fish and wildlife, geology report, soils report, and heritage resources report) pertinent to the analysis are incorporated by

reference into this EA. The full reports or memoranda are part of the project record on file at the Six Rivers National Forest (SRNF or forest), in Eureka, California (see *References* section for those resources with specialist reports).

The disclosure of the No Action and Proposed Action alternatives described in separate resource topic sections, begins with a disclosure of the legal framework, description of analysis methodology, a comprehensive presentation of the affected environment, followed by a description of environmental consequences. The presentation of the environmental consequences address the potential for direct, indirect, and cumulative effects as defined below:

- ***Direct effe*****cts** are caused by the action and occur at the same place and time as the action.
- **Indirect effects** are caused by the action and are later in time, or further removed in distance, but are still reasonably foreseeable.
- **Cumulative effects** are those that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. 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). The cumulative effects analysis area is described under each resource, but in most cases includes the private and other public lands that lie within the analysis areas. 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. Past activities are considered part of the existing condition.

Place-based Setting

The WKRP developed the Proposed Action through the Open Standards for the Practice of Conservation process based on shared values and identification of six conservation targets, values and threats (see *Chapter 2*). Through a collaborative IDT process, measurement indicators were analyzed to provide the cultural, biological and physical components of the affected environment for this draft EA.

Archaeology and Living Environment

Stories are the primary means for passing down TEK, and govern its interpretation and use. They are told in winter and require complete attention when they are told. They also function as medicine in themselves. Stories have positive, healing properties. They recite the origins of medicine, and link the people today to *Ikxareyavs*, the Spirit People. Everything in the world—the mountains, the trees, the animals, came from the Spirit People. Only some of them became modern-day people. The stories link people of today to the ancestral ties of duty towards the whole environment and to the practices that sustain the bonds that tie all pieces of the environment together. Karuk ceremonies are for F*ixing the World*—the people, the animals, the plants, and the air and water. In that sense, everything is a cultural resource. Accounts of the prayers offered by people in land management or hunting roles—not just priests of sacred ceremonies—demonstrate the way all resources are unified.

The Karuk living culture is expressed not only in people's beliefs and practices, or in the plants and animals that make up the landscape, but also in the things that have been touched and used by people in the past. For these reasons, excavation goes against Karuk beliefs and traditions. What is in the soil should stay there. The Tribe does implement archaeological survey, documenting features, artifacts, cultural vegetation characteristics and associated wildlife habitats. Cultural resources still have a life, as do the people using them, all of which have a link with spirits of old. If you find an old artifact out in the field, you touch it with a stick: it still has something of the people who have touched it before. You need to get rid of any bad feeling in that rock. It has an intention: it wants to lie where it is and it should be left alone. Similarly, regalia items have a spirit too. They are made to be danced: they do not want to languish in museums and archives, but want to dance. You should let them be used, and be worn. Taking a longer view than most archaeologists, one can see how these resources have come to rest in the place they lie.

The focal and indicator species provide direct and culturally specific information about the overall health of the landscape. The policy of fire exclusion has resulted in great damage to the landscape: many resources have been left to grow unmanaged, with the result that they are being overtopped with conifers, primarily Douglas-fir and are choked with brush. Because of these factors, the overall landscape is on a trajectory that leads to uncharacteristically high-intensity wildfires, loss of local focal species populations, and ecosystem collapse. A key component of the landscape that is in dire threat are the black oak woodlands, which are easily overtopped and out-competed by Douglas-fir. This reduces habitat for focal species such as Roosevelt elk. As was seen with the loss of salamander in 2014[11], these focal species can serve as a warning that the bonds holding people, animals, and plants together that we all depend on are loosening, and the loss of one element is likely to result in the loss of significant parts of the ecosystem. Just as surely as the loss of salmon in the rivers and creeks, the loss of key regalia species would lead to the devastation of the people and all the other species that depend on them.

Fire, Fuels and Community

In the Happy Camp Complex fires of 2014, as in the fires of 2008, several areas were noticed that burned at sufficient temperatures to kill all the plants and to prevent any significant regeneration. This danger is especially acute because of the overall lack of fire across the WKRP planning area. Few areas have seen five fires in the last century, and large areas have seen none at all (Harling and Tripp 2014).

The pattern has been set for infrequent, uncharacteristically high-intensity fires, instead of the traditional practice of introducing frequent, designed, and regular fires at low intensity. By not taking action on the project landscapes, the continued lack of fire would drive stands further and further from their historic conditions:

[11] In 2014, over 800 dead Pacific giant salamanders were counted in the Salmon River watershed during snorkel surveys.

- Forest resiliency to wildfire in the project area would continue to decline and accordingly, through the coming years, mortality of large hardwoods would generally increase in stands, which would in turn increase the fuel loading.
- Fire return intervals could continue to become more and more departed.
- Most importantly, the process of fire would not be restored back onto landscapes, which have been missing that as an ecological component.
- This in turn would impact their ability to build resiliency function such as encouraging the development of fire prone species, which can shade out native fire adapted species.
- Natural fuel accumulations would continue to increase as more trees begin to succumb to overcrowding, drought, insect and pathogens thereby increasing the rate of mortality.
- This additional accumulation in ground and surface fuels would gradually begin to shift the potential fire behavior to a more severe stature including increased smoke production.
- Communities would continue to be at risk, as the extremely valuable strategic fuelbreaks would not be constructed. This in conjunction with the increased fuel loading, firefighting resources would continue to focus strategies and tactics on reducing the threat to life and property impacts of the communities, protecting infrastructure and private property as the highest priority followed by protection of natural resources.
- Suppression efforts would gradually become more difficult as wildfires could grow to larger unmanageable sizes much quicker. Therefore, direct attack in most cases could no longer be used as an initial tactic in suppressing a fire, but have to be changed to more indirect tactics, where more area has the potential to be affected by fire, in some cases high intensity and more severe fire.
- With the increases in fire behavior generated by these surface fuel changes, fire suppression forces would have higher resistance to control due to fuel loading and by more intensive fire behavior.
- Aerial retardants would be less effective due to closed continuous canopies. If a fire were to start in or burn into the project area, ground and aerial initial attack operations as well as extended attack would become less effective and firefighter and public safety would be more difficult to ensure.

Fire Behavior and Fire Effects

Without the restoration of fire, forest health would continue on its current trajectory:

- Fire-adapted species would continue to flourish on the landscapes outcompeting more fire-resilient species and native species, which are vital to many cultural perspectives.

- Historically, non-native flora species would continue to present higher levels of stand densities and associated fire behavior potential representing higher fire hazards on the landscapes (Taylor and Skinner 2003).
- If a wildfire ignites in the project area without action on the landscape, the ecosystem and communities would be subject to potentially stand-replacing results as seen in recent years in the Klamath Mountains region.
- Without frequent fire to clean the understory of stands, excessively dense stands lead to drought stress and bark beetle outbreaks, resulting in wide spread mortality of trees in many areas and the potential for extensive mortality. This leads to a large increase in the amount and continuity of both live and dead forest fuels, resulting in a substantial increase in the probability of large, severe wildfires (Weatherspoon 1996).

Vegetation

- With currently high stand densities throughout the project area comes increased susceptibility to damage and mortality resulting from such stressors as insects, disease, fire, and drought diseases.
- Many trees are currently experiencing high levels of competition for soil moisture, nutrients, and available light.
- Natural thinning is occurring to some degree in almost every stand of the proposed project, and additional stressors can trigger pulses of significantly increased mortality.
- Once a stand reaches 55 percent of the maximum stand density index (SDI), the stand is in the zone of self-thinning. At that level, the trees in the stand compete for light and resources, and the stand thins itself, resulting in increased fuel loading and stressed trees. All of the treatment groups presented in start in 2017 with an SDI around 80 percent of the maximum, and do not change much through the 50-year modeling period.
- The No Action Alternative keeps stands along their current trajectory of being vulnerable to significant mortality during a wildland fire under severe conditions
- Some stands would suffer stand replacing wildland fire under severe conditions; however, when taken into consideration and averaged across the proposed project area, those figures show that we are not looking at an entirely high severity affected landscape after a wildland event under severe conditions. No landscape is completely dead post-fire, in fact high severity patches are often the most biodiverse post-fire compared to unburned areas.
- Those stands that are proposed for commercial thinning under the action alternative shows the lowest potential basal area loss under severe conditions as almost all been previously thinned from below, have a dense canopy and very high canopy base height. The dense overstory has kept the ingrowth of brush to a minimum.

- Young plantations are highly vulnerable to significant basal area loss in a wildland fire under severe conditions, and continue along that trajectory through time until stand densities are altered through some sort of disturbance.

Wildlife and Traditional Ecological Knowledge Species and their Habitats

- Under current conditions, forested stands in the area of proposed treatments, which can be generally described as uniform and heavily stocked, are not meeting desired condition for structural heterogeneity, nor the desired number of large trees, snags, or hardwood basal area. These conditions are expected to remain as such without the proposed treatment.
- Fire behavior modeling predicts about half of the project area would experience low intensity fires and half would be considered as very high, likely resulting in a significant loss or degradation of late successional habitats. The lack of natural mixed-severity fires in the landscape retains a continuum of stand homogeneity and limits a primary process, which results in the formation of unique habitat features (e.g., basal hollows, snags) and stand diversity.
- Habitat suitability for late successional species (or lack thereof) would remain the same; however, stands would trend toward increased homogenization due to declining tree growth and continued stand density.
- This, in turn, would prolong the time required to attain or retain the desired large tree and complex stand components and there would be a gradual loss of important features (such as large California black oak) due to competition and stress.
- This continued decline in ecological diversity would affect habitat suitability for many species including late-successional species in the long term. In addition, early-seral habitats would continue to decline as a result of lack of management and fire suppression.
- Overall, the No Action Alternative increases the potential for fire to shift to more of a high intensity fire regime rather than a mixed fire regime and remove more of the desired structural components within the project area, while areas that do not experience fire would continue to provide lower quality wildlife habitats with low structural and species diversity.

Watershed Values

- Under the No Action Alternative, no fuel reduction treatments or associated connected actions would be implemented. There would be no direct effects to water quality or coho salmon under the No Action Alternative, as it maintains the current condition in riparian reserves.
- Short-term indirect effects to fire-excluded landscapes would likely increase vegetation cover and woody debris inputs to riparian reserves, decrease stream temperatures, and delay and reduce peak flow runoff.

- In the event of a large storm event, there is the risk that the stream crossings in the legacy roads could fail and deliver up to 1,100 cubic yards of sediment. Threatened and sensitive fish species occupy habitat between 1.0 and 1.7 miles downstream of these legacy road treatment sites.
- Forest density, and surface and ladder fuels, are expected to increase, and forest health within Riparian reserves is expected to continue to decline. The project area would remain vulnerable to having a stand replacement wildfire, especially on upper and mid slopes, and east and southeast facing aspects.
- The predicted fire behavior indicators related to rate of spread, flame length and intensity are expected to increase if this landscape were left untreated, with the potential for wildfire to spread across multiple drainages causing additional impacts to more riparian reserves and aquatic habitats.
- Under this No Action Alternative, Southern Oregon Northern California Coast (SONCC) Coho Recovery Plan restoration actions identified as MKR.7.1.9 and 8.1.2, which were prioritized to conserve and recover this species, would not occur. Therefore, the elevated high severity fire threat to this Middle Klamath coho population is expected to increase over time.

Soils

- Direct effects of the No Action Alternative would be of no immediate effect at all on the soils, as soil disturbing project activities would not take place. Soil cover for erosion protection would not change. Present compaction levels would remain the same in the short-term, with very slow long-term natural recovery. Surface organic matter components would continue to accumulate faster than decomposition. Soil organic matter would be unaffected. Soil hydrologic function would be unaffected.
- Indirect effects of the No Action Alternative would be the increased accumulation of organic matter in terms of surface and ladder fuels, with a corresponding continual increase in fire hazard. Fire hazard is not the probability of a fire ignition, but that a fire ignition (human or lightning caused) would result in a successful fire start and spread, and fire behavior would be more severe. Fire hazard already represents an unacceptable threat to specified values at risk within the project area due to present vegetation composition.
- The No Action Alternative would do nothing to alleviate the hazard, or manage risks associated with watershed values.
- The threat of wildfire to the soil resource should not be underestimated. As fire intensity increases, the potential for soil organic matter destruction, nitrogen volatilization, microbial mortality, structure and porosity destruction, inducement of water-repellency, and erosion are greatly elevated. High soil burn severity can severely damage soils and cause long-term declines in soil productivity and hydrologic function. Post-fire erosion is probably the single greatest risk to long-term productivity of soils in this Region. In extreme cases, soils cannot

be revegetated without management intervention, or type conversion of vegetation communities may occur. Low to moderate severity fire is not usually considered a serious threat to soil resources, so to the extent that management activities can reduce the occurrence of high severity fire, soil resources benefit in the long term. High severity fire does have resource benefits, but high severity fire resulting in hydrophobic soil conditions harm this essentially non-renewable and irreplaceable resource.

Botany

- The ecology of all native plants and fungi in the Mid-Klamath bioregion (and beyond) includes wildfire as a natural disturbance. Even the Sensitive species in the project area associated with mature forests, including *Buxbaumia viridis* which is found within riparian settings, have evolved with fire at some intensity and interval. Historical cultural burning also played a role by enhancing conditions for growth and reproduction of an array of focal plant species—indicators of forest health.
- Where fuels have accumulated beyond their natural range of variability; the risk of losing occurrences of Sensitive species with very limited dispersal capability, requirements for shade and specific heat/humidity conditions, requirements for large coarse woody debris (CWD) as well as forest floor organics, is real when faced with potentially extensive high intensity wildfire.
- Fire intensity is also a factor for *Cypripedium fasciculatum*, but damage to a given occurrence is affected by fire scale as well as the number of plants present at the time of fire. Localized, intense fire may only affect a portion of an occurrence with a relatively large number of plants. Dispersal is less limiting for *Cypripedium* than for *Buxbaumia* as the former can disperse through asexual means (rhizomes) and air dispersed seeds.
- For *Thermopsis robusta,* an early successional species, while this species may expand to occupy post-wildfire settings and thus possibly benefit from the No Action Alternative, human-caused disturbance (i.e., roads and road maintenance) appears to serve as a surrogate to the effects of wildfire to stimulate the seed bank and clear competing vegetation; therefore; indirect effects of the No Action Alternative are not considered in relation to this species.
- While the lack of fire leading to potential for high intensity burn is identified above as having a negative indirect effect to those species associated with mature and older stands under the No Action Alternative, it is also related to cumulative effects as past land management practices involving clear cutting, with little to no management (thinning) after logging has led to excessive fuel loading within sections of the focal areas (or project areas).

Invasive Species

- Road use and road maintenance activities, private land activities and development, as well as the potential for high intensity wildfire are ongoing activities that could affect the introduction and spread of invasive plants beyond their current distribution.
- Invasive species are tolerant of disturbance, most of the species shade intolerant (e.g., yellow starthistle, Dyer's woad, Scotch broom) and easily disturbed, high intensity wildfire—a situation the Proposed Action is attempting to ameliorate—would create a setting conducive to the spread and establishment of invasive species beyond their current location. Relative to the growth habit of Himalayan blackberry in particular, removal of woody native species by wildfire, followed by relatively rapid growth of blackberry could result in its spread from road edges down or upslope into the forest interior and serve as a ladder fuel for subsequent wildfires.
- High intensity wildfire that removes the canopy and understory cover would create an environment conducive to spread of invasive plants, especially Himalayan blackberry, from its current location, into forest interior environments.

Resource Topics by Alternative Considered in Detail

This section presents the potential effects and outcomes for Alternatives 1 and 2, discussed by resource topic. The *Environmental Consequences* section summarizes in narrative format the scientific and analytical basis for comparing alternatives, summarized at the end of *Chapter 2*.

Cultural Resources

Introduction

The *Somes Bar Project* is a demonstration project for the WKRP. The WKRP is a combined *agency–local organization–tribal* initiative designed to promote cultural environmental management practices for the restoration of the landscape to its ancestral state. The *Somes Bar Project* is the first concrete step towards restoration along those principles. The treatment of the focal areas would allow the reintroduction of prescribed burning. The accomplishment of this goal would in turn revitalize TEK, practice, and belief systems. The reintroduction of fire as a cultural environmental management practice promises to mitigate if not remediate the era of wildland fire exclusion and past management or clearcut logging practices, as well as to promote the cultural use species traditionally utilized across the landscape.

This section is based on the *Somes Bar Project* Cultural Resources Specialist Report, which describes the archaeological/cultural resource surveys done as part of the NEPA regulatory process. These surveys have been co-directed by the SRNF and the Karuk Tribe (Tribe / "we"), and have been designed collaboratively by the SRNF and the Karuk Resources Advisory Board in order to identify the cultural use values to be promoted by the project, and to assess any potential environmental impacts or adverse effects to potential historic properties. The Tribe and the SRNF are key partners in the WKRP. The report explains the survey methodology, the affected environment, and outlines the environmental considerations and potential effects of the proposed actions. It considers two alternatives: the No Action Alternative and the Proposed Action. The latter part of the report reviews the potential impacts of the project actions; the first part of the report sets out in some detail how the cultural resource considerations link to the proposed actions and the purpose and need of this project.

A Karuk – Six Rivers National Forest Collaborative Approach

The archaeological/cultural resource surveys conducted by the Karuk and US Forest Service (USFS or Forest Service) archaeological crew were rather different from those practiced elsewhere in the state. The National Historic Preservation Act (NHPA) §106, as conventionally interpreted, tends to make the assumption the archaeological resources represent a dead culture. The surveys employed for this project aim toward the goal of preserving a living culture. They are designed around cultural revitalization and landscape restoration objectives, rather than the minimum requirements of historic preservation law. The identification phase included cultural resources areas that may benefit from the actions of this project.

The survey strategy has been formed jointly by the Karuk Tribe and the Forest Service to meet the fundamental goals of the project, while working within the framework of historic preservation law—in particular, analyzing whether or not any adverse effects would occur to known historic or pre-contact (prehistoric) sites. Historic preservation law is premised on protecting resources from federal actions. A primary assumption behind historic preservation laws is that a project has the potential to cause harm to archaeological resources. Our approach in the *Somes Bar Project* calls for actions that would benefit rather than harm the cultural and natural resources.

The surveys were designed to identify cultural resources that may end up being considered elements of a potential future TCP that may be larger than the areas covered within the focal areas. Broadening the scope of the archaeological surveys to cultural vegetation characteristics and resources that may become elements of a future TCP is more effective in meeting the intent of the NHPA.

The concept of Traditional Cultural Properties (TCPs) and their consideration within historic preservation law has allowed for a deeper understanding of what needs to be identified and protected. TCPs are places that tie the practices of a living community with ancestral use; vegetation features, landscape features, the setting, and the feeling of a place may all be concrete contributory elements in the designation of a TCP. This brings to the fore a broader understanding of Historic Preservation law that allows consideration of historic activities within a given area that link to contemporary practices. Those contemporary practices would include the active management of sites that have been used for countless generations and are still used by people today. The purpose and need of this project opens up the possibility that the management actions would benefit and revitalize those sites. In this way, the NHPA can be employed to preserve the living culture of the Karuk people.

The assessment factors below open up the possibility that certain projects, such as fuels reductions and the reintroduction of cultural burning, would in fact improve the state of certain sites, objects, features or properties. It is important to consider traditional principles, practices, use factors, and associated wildlife habitats that link the action to the spiritual, living environment, and human responsibility through respect and reciprocity, especially concerning food, fiber, medicinal and regalia species.

These practices include management by fire, spiritual uses, gathering uses, hunting, and evidence of temporary or long-term habitation. Thus, the survey crew assessed cultural resources that may not fit the strict definition of an historic property, but with a more holistic look may in the future become elements of a landscape-scale TCP, cultural landscape, or cultural district. This information was gathered to be correlated with TEK and is incorporated into the design of the Somes Bar planning effort.

The broader vision for the WKRP planning area is to enable restoration of cultural burning practices on Offield Mountain and in the adjacent landscape, utilizing tenets of TEK as an indigenous science that works together with Euro-American models of science, hence revitalizing our cultural responsibilities to this place, and protecting the Karuk people from the loss of our cultural identity.

Cultural resources are recorded in a manner that reflects Tribal values and perspectives. In addition to identifying historic properties, the archaeological/cultural resources crew identified evidence for how the land was used and managed in the past, with a view to revitalizing those practices in their traditional places.

The cultural resources identified and TEK expressed through this project provide a living memory of human use and responsibility in context of place and can help us realize the stories of the past in the formulation of our contemporary future. By reconnecting the human role to the whole landscape, we can strengthen the spiritual, subsistence and management practices that the place calls the people to perform.

Affected Environment

The affected environment is being considered in the light of the cultural practices that produce it and sustain it. The surveys provide a window into the current conditions of the landscape. The incorporation of tribal participation in the surveys, with extensive experience in ceremonial and gathering practices and TEK, has enabled the consideration of broader range of cultural resources and associations that deepen our understanding of present and past use of the landscape. The survey results would be utilized in the project prescriptions and project design features (PDFs) to benefit and enhance culturally utilized plants, promote gathering and other cultural practices, and re-establish cultural burning.

Traditional ecological knowledge considerations should be given at least equal weight to the findings of Western science in designing projects. The principles of TEK arise from the fact that the Tribe is a place-based culture. The Karuk Tribe has occupied the same land for countless generations, and Tribal tradition includes a remarkable continuity of environmental management knowledge. While western science findings may be found in standard references, many of the key principles of TEK are encapsulated in the responsibility to the land, passed down and learned in contact with the environment. These considerations would express themselves as automatic, instinctive, and intuitive ideas the mind of an indigenous person when thinking about land management.

Cultural Context

The Karuk Tribe has practiced World Renewal Ceremonies around Panamnik and Katimiin since time immemorial. These ceremonial centers are located respectively near the modern Orleans and Somes Bar. The ceremonies themselves have been passed down intact since the beginning of time, and make up a key part of the social fabric of those communities. They link up families and guide spiritual, hunting, and gathering, and land management activities. The whole landscape needs to be considered to understand the links between village sites, gathering places, spiritual trails, and places that have been managed in accordance with ancestral principles, use and responsibility. Tribal people continue to practice a close relationship with the land and value many resources throughout the landscape as sacred. The relationship between the people and the land, as well as the sacred duty to take care of it for all animals and plants, has endured through countless generations. People still gather, hunt, fish, prune, burn, and coppice, and carry on their cultural practices throughout the Karuk Aboriginal Territory. In many cases, locational information and other sensitive information needs to be kept confidential in order to protect this relationship. However, in order to preserve this relationship, it must be enabled to thrive as a continual living culture in place through traditional knowledge, practice, and belief systems.

Traditional Ecological Knowledge and Landscape Character

Stories are the primary means for passing down TEK, and govern its interpretation and use. They are told in winter, and require complete attention when they are told. They also function as medicine in themselves. Stories have positive, healing properties. They recite the origins of medicine, and link the people today to *Ikxareyavs*—the Spirit People. Everything in the world—the mountains, the trees, the animals, came from the Spirit People. Only some of them became modern-day people. The stories link people of today to the ancestral ties of duty towards the whole environment and to the practices that sustain the bonds that tie all pieces of the environment together. Karuk ceremonies are for *Fixing the World*—the people, the animals, the plants, and the air and water. In that sense, everything is a cultural resource.

Accounts of the prayers offered by people in land management or hunting roles—not just priests of sacred ceremonies—demonstrate the way all resources are unified. The prayer to the mountains links the uplands with the water and the fish. As the stories tell, the prayer is based on the presence or absence of the Pacific giant salamander. This species indicates the health of the environment and revered as the water purifier. It is said that when the Pacific giant salamander is in peril, the entire system is on the verge of collapse. According to the stories that prayer is carried on: from the salamander to the frog, from the frog to the Pacific garter snake; from the snake to the springs and the salmon; from the salmon down the river and out to the sea. Then the sea will produce fog and clouds, and make rain in the mountains to restore balance in the world. The salamander is a key part in the cycle of rejuvenation covering the whole landscape.

Recent observations demonstrate the crucial ongoing part the salamander plays in indicating the health of the landscape. In 2014, over 800 dead Pacific giant salamanders were counted in the Salmon River watershed at the same time as mortality exceeded 15 percent in the spring Chinook salmon run. It was ultimately fire, and correlating smoke shading of the river corridor that cooled the river and halted this die-off.

Below is an example of a story connecting the time of the Spirit People or *Ikxareyavs* to contemporary times. What we could learn from it in current conditions, is that we may need to increase our use of fire in order to protect salmon stocks using the smoke to maintain water conditions to below the temperature threshold for Pacific giant salamander mortality.

The Story of how Coyote Stole Fire

Karuk stories commonly tell of the relationship of people today to the *Ikxareyavs*, and on the role of Coyote in establishing that transition. Coyote is a trickster figure and helper of mankind. This story tells of how Coyote stole fire. In the Western tradition, a similar essential premise may be noticed in the story of Prometheus stealing fire from the gods, inside a fennel stalk. But the very significant differences in this story demonstrate its cultural significance. The Spirit People were the original beings in the world, before people existed. They changed into the beings in the world—the animals, the fish, the trees, and the rocks, as well as people. Coyote's trickery represents the essential inventiveness and resourcefulness of people. Mankind has something of the quality of those Spirit People. But people also inherited a sense of duty. Only some of the Spirit People chose to become humans, and part of that choice was to make the promise to care for the land, the plants, and the animals within it. All those beings were siblings in the time of Spirit People, and the familial bonds persist to this day.

Coyote wanted to steal fire, which had been lost in a bet. He collected various animals, and placed them at intervals from the river to the mountains. Frog was in the first place—closest to the river. There was forest fire in the mountains, and he stole it by diverting the children who were in charge of it, and then pretending to fall asleep by the fire, having placed oak bark between his toes. At the right moment, he ran away with a piece of burning charcoal. The ember was passed from one animal to the next as each got tired. Turtle was able to escape by rolling down from a mountaintop towards the river, and then gave it to Frog. Frog hid the fire in his mouth, dived in the river and swam to the other side, and spat the fire out under a Willow. Dogs howled as the fire rose up, and mankind came into existence.

In this story, several key themes emerge. The story represents the transition from the time of Spirit People to the time of people, and it defines their relationship to the world. This transition is marked by the howling of dogs. Three things happen simultaneously: the appearance of fire by the river, the transformation of the Spirit People, and the emergence of mankind. They are linked. Fire is crucial to who people are, and what they do. It enables them to live. It is a central component of that duty of care for the whole world, which is inherited from their common ancestry as Spirit People. People need to work with all the animals, and to manage the landscape from the lowest points to the highest. Care of the environment covers all the plants and animals, and is an obligation for the humans who live there.

These interconnected threads of landscape management and duty are articulated in the stories that elders tell their children. Utmost attention is required, because they represent the cultural inheritance of wisdom and values. In the story of Coyote stealing fire, it is very significant that willow is the species in which fire comes to reside. The story emblematizes good management practices that are carried down to this day. There are two broad aspects to this management: enhancing positives and minimizing negatives. On the positive side is the use of fire. In this story, Frog ultimately hides fire at the base—in the roots—of the Willow plant. Willow is the plant used for fire making: rubbing sticks together, and later, using a bow. It is used for cooking and heating, and many other uses. Willow is to be found down by the river, and grows with the rhythms of the river. But in order to be useful, Willow needs to be managed by people. Willow is also a key resource in itself: it is a key species for basketmaking. The new stalks are harvested early in the year, are stripped of bark, dried for keeping, and then wetted for weaving purposes. The roots are also used for this purpose. As with Hazel, another basketmaking resource, the use of fire changes the cellular structure and makes it grow straighter and stronger. On the negative side, trees and shrubs can grow out of control, and inhibit access and contribute to risks of wildfire. Down by the river, village sites, gathering sites, fishing places, and dance grounds need to be protected from fire by reducing excess fuels, making fuelbreaks, and promoting buffer species such as live Manzanita. Up in the mountains too, fire has traditionally been used to manage the complete landscape, drainage by drainage. While the fire that Coyote found in the mountains was natural wildfire, management involves human intervention to ensure that fire burns though at regular enough intervals to promote cultural use species and to lessen the danger of wildfire. When Frog hid fire in Willow root that provided access to humans and enabled the responsibility to be upheld while providing clues leading to identification of additional indicators that would trend the balance of nature toward abundance without triggering unsupported population explosions, followed by species starvation and decline.

Stories in many cases revolve around Coyote as the one who helped bring humans into being. It is told that Coyote had seven wives whom at the time of the great transformation turned into the constellation Pleiades. It is said that when this constellation is not visible (April through June) their spirits come back to earth to help all things through their reproductive cycle. At this time, people were to have the utmost respect for this process by using fire only for the purposes of heating and cooking. In addition to this, place based indicators with some degree of spatial variability extended this time earlier into spring in respect for the reproductive rights of individual species.

This worldview establishes a belief system that protects the balance in nature, while remaining rooted in practice and enabling observational knowledge accumulation through intergenerational change.

Traditional Ecological Knowledge and Focal Species

The story of Coyote stealing fire provides an example of how stories encapsulate aspects of TEK and outline the combination of responsibility, respect, and reciprocity that links the people to their environment. It demonstrates how teachings from the beginning of time inform current practice.

The main efforts in the cultural resource surveys focus on these cultural use species. In the present context, it needs to be borne in mind how the indicator species link the cultural uses to the focal species and the whole landscape. What follows is a top-level analysis of how the focal species play a key role in the health of landscape segments. Awareness of this interconnectivity lies at the heart of TEK. It is also crucial for the revitalization of traditional knowledge, practice, and belief pathways through the adaptive management framework adopted by the WKRP.

The story of Coyote stealing fire also illustrates the crucial place of Willow within human culture. One can correlate the human use and responsibility to the plants and animals to a cyclic interaction among all living things. This interaction operates among TEK, practice, and belief pathways. The willow grows around and at the edge of the river, often close to the sites of traditional villages. Willow is used to make fire, and is a crucial basket-weaving resource. It is particularly important in terms of female responsibility. Willow also harbors the river mussel. The mussel shell is used by women to carry fire when upholding the traditional female fire use responsibility to the plants.

Legal regulatory frameworks mandate that the northern spotted owl (NSO) must be considered in the NEPA process in planning projects. In Karuk culture, the Pacific fisher represents NSO habitats in the environment. Though owls are known as messengers of sickness and death, it is the great horned and screech owls that are told to carry these specific messages. These two species are known to have specific names in the Karuk language. The NSO is not known to have a specific name, but has been found in practice to be one of the first species to decline when the habitat dynamics deteriorate owing to fire exclusion and other contemporary management practices.

While the interpretation could be made that the NSO is a messenger of a sick forest habitat dynamic, that function is traditionally associated with another species, the Pacific fisher, which is not only legally regulated but is also a regalia species. The fisher in fact covers a wider array of habitat dynamics, which in turn are more representative of fire process and function. The fisher is not just associated with the conifer forests, but also with the upland oak stands, which are traditionally more open and contain bunch grasses. The fisher plays a very central role in ceremony and culture—it is carried through the World Renewal Ceremonies by way of holding the arrows used to pierce the earth and wake up the world.

To build upon the open end of the fisher habitat dynamic, Roosevelt elk was also identified as a focal species. Though neither the fisher nor the elk were mentioned explicitly in the summarized story, they have a unique place in ceremonial practice, use and management that helps to start building a story leading us into a contemporary future while maintaining the traditional foundations of Karuk living culture. With elk specifically, we get into the traditional male responsibility of taking care of the animals. In fulfilling this male role in fire management, fire is carried in an elk horn. In integrating the habitat needs of large ungulates and other species needing more open space, we start to enhance the entire spectrum of habitat needs. With fisher covering the dense habitats transitioning to the more open and the elk transitioning from the wide open back to the more dense, there is plenty of overlap in habitat use that can help to frame site-specific variation when it comes to formulating a proposed action or need for adaptation and we start to recover the habitat dynamics and ecosystem processes required by the spotted owl.

This leaves an additional component of regulatory consideration without complete coverage under our focal species. Riparian areas require special focus in the current regulatory environment. This is not unfounded in traditional Karuk practice. The Pacific giant salamander is the traditional focal species that is to be treated with the utmost respect. This species has its own prayer in Karuk World Renewal Ceremonies, and is the sacred water purifier. Though water quality parameters can be measured as an indicator of water quality, Karuk culture requires that no harm come upon this species and in turn, riparian habitats receive special focus, and water from the source to the ocean and back again is protected as the primary directive.

As per the 2012 planning rule, focal species and specific questions that we would use in our monitoring efforts should be identified in the planning process. In consideration of these initial five focal species, the following questions may help to formulate a monitoring plan:

1. Can we treat enough willow and other basketry materials to supply basket weavers with enough gathering opportunity and materials to sustain this cultural practice?

2. How often and to what extent should willow be cut, burned or washed down the river to ensure quality basket materials are being produced while associated species habitat components are maintained or enhanced?
3. Can the Pacific fisher become a surrogate species for NSO in landscape scale planning efforts while allowing oak woodland maintenance/recovery efforts to take place?
4. Can elk winter range and calving habitat restoration increase the population viability for elk and other large ungulates?
5. What additional focal species and indicators should be integrated into site-specific prescription adaptations (lesser effect than analyzed) and future planning efforts?

Additional biological information about the focal species and how the Proposed Action may affect populations and their habitats can be found in the *Wildlife Resources* discussion further in this chapter. Some species, like the NSO, have legal disclosure requirements that focus on the individual species, however, this disclosure and potential impacts does not negate the overall intent of the focal species goals and objectives.

Human Practices across the Landscape

The Tribe takes account of the relationships between various phenomena that tie together all earthly and astronomical spirits. A landscape perspective is crucial for interpreting the information cultural resources may hold in the context of the culture itself. Broadly speaking, the cultural surveys initially focus on five main uses of the landscape by people: habitation, gathering, management, hunting, and spiritual.

Habitation means houses and villages. Houses are usually found on terraces elevated above the river. They would be indicated by pit houses, porch stones, midden soil, and graves. Other resources such as white and blue clay deposits and Port-Orford-cedar (POC) stands are also associated with these houses and ceremonial structures. Houses at higher elevations for the most part have historically been constructed with bark and poles.

Gathering refers principally to basketmaking materials, food and medicine. Many gathering activities would take place close to the houses in the watersheds above the rivers and creeks. The favored gathered foods are acorns from tanoaks. Acorns from black oaks are also used, as are mushrooms, nuts, berries and teas of many kinds. Grinding stones, mortars, pestles, etc., are often found in or near to these environments. Traditional archaeological site definitions, if applied strictly, would have limited scope for identifying and documenting these areas. However, when considered in the context of their relationship with the other four factors, the story of a living culture begins to emerge. Families largely manage their own gathering areas, and these are generally respected by others. Tools historically left in place can still be found today, though different tools are used today. Fire is integral to an active gathering culture.

Hunting resources include trails, blazes, arrowheads, hunting camps and cultural species associated with hunting practices. These include yew, mock orange, Douglas-fir, Ironwood, as well as birds and furbearers. Fishing and fish processing sites would also be included in this category. The habitats of the creatures that are hunted, or used for tools and ceremonial regalia, are in themselves integral to the associated management practices and to the spiritual human responsibility. Fire used in the context of the male responsibility was carried in an elk horn. The use of fire as a tool in Karuk culture provides for both protection and for enhancement of resources.

Management by fire, is in practice integral to the other four factors, but is worthy of a special category. The landscape is managed principally by burning, and the frequency of those interventions depends on the intended purpose and whether it is a male or a female responsibility. Fire management provides one of the more abundant kinds of evidence that can be found on the landscape today. In ancestral practice, Sugar Pines were the most prized ignition source, especially because of their yield of pitch and needles. Black pitch was indeed one of the most prized monetary resources available. Pine trees in general bridge both the male and female responsibility. Pine roots and needles are also used in basket making and are represented in ceremony as the tree of life. The presence of pines in specific landscape situations shows human management. In many cases, these remnant pine stands are located in areas central to landscape/resource specific ignition patterns. It takes hundreds of years to manage the lifecycle of pine to assure you always have an adequate pitch supply. If these places were not managed for this resource, they would not be found in this pattern on the landscape today. Indicators such as this are prevalent upon the landscape. They can be assessed through the identification of different species that correlate to products of fire management, and through the distinct human responsibility associated with a given piece of knowledge around a particular practice and/or belief.

Spiritual sites would include sweathouses, dance grounds, ceremonial structures, sacred places, sacred landscapes, spiritual trails, fireplaces and prayer seats. Setting, location, and feeling are crucial elements when interpreting the teachings that have been handed down, and are therefore very firmly tied to specific places. Stories and expressions handed down for millennia are often not completely realized by an individual until put into practice. You can tell a person to carry out a task, and why they should do it, but then they may not notice when a new variable comes into play. If the action one is asked to do is rooted in a purpose for which one has been exposed to a profound respect for the indicators through their entire life, they are more likely to come to realize the smallest of nuance on their own. While spiritual factors may be interpreted in a physical/locational sense, it needs to be borne in mind that there are intangible factors, as they are also founded in the responsibility under which one should or should not perform any action. A good example of this is burn timing and responsibility toward reproductive cycles as founded in an utmost respect for only using fire for heating and cooking during the time Pleiades is not visible in the sky (April to June). As explained above, the Pleiades are associated with a regenerative function within the universe, and represent Coyote’s wives. Such restrictions are applicable on a broad level. Site-specific indicators expand this responsibility to particular situations.

Cultural Resource Recording Procedures

The Karuk Tribe and the Forest Service are partners in the planning and implementation of the cultural resource surveys. Because of this, the surveys fit the requirements for archaeological survey on public land administered by USFS, and meet the principles of cultural resources survey outlined above. The USFS guiding document for archaeological survey is the Region 5 Programmatic Agreement (R5 PA) with State Historic Preservation Officer (SHPO) and ACHP. All documented archaeological sites are treated as historic properties potentially eligible for listing on the National Register of Historic Places (NRHP), unless determined otherwise; consequently, sites were recorded on standard California DPR forms with discrete site boundaries.

Archaeological sites are defined as "A location of purposeful prehistoric or historic human activity. An activity is considered to have been purposeful if it resulted in a deposit of cultural materials beyond the level of one or a few accidentally lost artifacts." Natural resources with signs of human manipulation are considered as ecological artifacts or features. An example would be a site that includes vegetation associated with past fire management practices (e.g., sugar pine) and other fire-dependent resources (e.g., tanoak, hazel, and beargrass) in association with artifacts. Traditional ecological knowledge forms were created for every pre-contact archaeological site to provide a broader context for the artifacts found across the landscape. Our understanding of past management practices is deepened by combining analysis of documenting artifacts with TEK considerations. This wider analysis allows consideration as sites of single artifacts, conventionally called "isolates", if they are found within a wider context of ecological or landscape setting, and cultural use species that indicates purposeful human activity in that location. All archaeological sites documented in the project area are considered historic properties that are potentially eligible for listing on the NRHP.

In addition to recording sites, resource areas were recorded on TEK forms, developed and field-tested by the Tribe and the Forest Service to articulate TEK considerations necessary to inform management decisions. The TEK forms provide information on the natural resources showing signs of past or contemporary use/management (i.e., cultural vegetation characteristics), associations with the broader landscape (known villages, trails, hunting grounds, old camp sites, spiritual trails, springs, ridgetops, view sheds, ceremonial areas), and management recommendations to enhance cultural use quality.

Resource areas are locations that provide evidence about past human use or management. They may or may not have artifacts present. Resource areas may or may not qualify as archaeological sites. Their boundaries frequently overlap with archaeological sites, and in some cases are coextensive with them. Resources areas would often be tied to the five types of human use listed, and they may include landscape features, vegetation, or artifacts in significant and agreed concentrations or combinations. The cultural use vegetation elements are called cultural vegetation characteristics, as defined below.

Cultural vegetation characteristics make up a special category of Tribal archaeological data. They are main constituents of resources areas that provide evidence of human management. They are defined as vegetation assemblages that are indicative of historic human use, management, or occupation. They are indicators that provide historically relevant information, which may justify their designation as a site, property, or as a feature in determining the eligibility of a larger district.

Examples of vegetation that show evidence of management include huckleberry, sugar pine, and tanoak. Tanoak groves require fire and removal of younger trees to ensure the heath, vitality and productivity of the main trees. A high-quality grove would have mature, well-spaced trees. Huckleberries need to be managed in order to produce useful berries for people and animals. Both of these become unproductive if left to grow unchecked. Sugar pines, as stated above, are often found in strategic places on ridges, and would have been managed to serve as ignition sources. Accordingly, they are commonly found in conjunction with other plants that thrive in areas well managed by fire, such as tanoak, hazel, or beargrass.

The resource areas were given boundaries for this project to define a discrete grouping of cultural vegetation as verified by ground surveys. These areas are considered to be contributing elements to the larger cultural landscape. The broader management context for these resource areas would inevitably turn out to be larger than this project area. The surveys provide valuable information for a future designation of a much larger TCP, Historic District, or Cultural Management Area (CMA). Because of the potential for confusion of the focal areas with the already-established Katimiin CMA, the preferred aim for the resource areas is for a future TCP and or cultural landscape designation.

Regulatory Framework

The WKRP aims at transforming the fire exclusion paradigm to one of holistic landscape management practice in alignment with the *National Cohesive Wildland Fire Management Strategy* (Cohesive Strategy)[12]. Archaeological surveys for the *Somes Bar Project* have been implemented in accordance with the requirements of the NEPA and NHPA §106. Compliance with these laws is required to gain the agency environmental approvals for implementation of this project, which calls for manual, mechanical, and prescribed fire treatments. NHPA §106 requires that 1) any adverse effects to historic properties be considered, analyzed, mitigated, and disclosed before initiating an undertaking, and 2) the Advisory Council on Historic Preservation (ACHP) be given the opportunity to comment on any such potential adverse effects.

For the *Somes Bar Project*, standard protection measures would be applied to sites in and near the area of potential effect in accordance with Appendix E of the R5 PA. If all measures are completed, it is anticipated that no historic properties would be adversely affected by this project.

For the purposes of NHPA §106 analysis (outlined at 36 CFR 800), the area of potential effects (APE) of the project were identified as the external boundaries of our four focal areas at Ti Bar, Patterson, Rodgers Creek, and Donahue Flat. This APE also corresponds in NEPA terms to the area of direct effects. It is more productive to consider the APE of the project in NEPA terms as the area of direct effects. This is because NHPA §106 regulations are premised on the assumption that "potential effects to historic properties" are negative in nature, and need to be mitigated or avoided. This project aims at enhancing these areas. The analysis in this section documents that there would be no significant impacts to cultural resources in the NEPA framework, and no adverse effects in the NHPA framework.

This analysis (also found in the *Cultural Resources Specialist Report for Somes Bar Project, 2017*) does not address site-specific effects from the perspective of the NHPA. Site-specific effects would be addressed in compliance documentation completed for the inventory, evaluation and resolution of effects on cultural resources to meet the requirements of NHPA §106. Therefore, this specialist report does not meet the requirements of NHPA §106 for approving cultural resource clearance.

An archaeological survey was conducted on the project area and recorded in a Cultural Resources Inventory Report (CRIR R2015051000018), which is on file in the Heritage Department of the SRNF Supervisor's Office and at the Tribal Historic Preservation Office (THPO) of the Karuk Tribe.

[12] *www.forestsandrangelands.gov/strategy/thestrategy.shtm*

Archaeological surveys were conducted in accordance with the requirements set forth in Appendix H (Region 5 Hazardous Fuel Protocol) of the R5 PA, as well as the survey protocol developed by the Karuk Resources Advisory Board in collaboration with the SRNF. Since the project aims at the revitalization of community and cultural values, the surveys were designed to identify resource areas with high potential for improving the viability of cultural resources and tribal uses impacted by a century of fire exclusion and related past management practices.

Much of the land in the *Somes Bar Project* is administered by the Forest Service, and all of it is within Karuk Aboriginal Territory. There is a statutory obligation to engage in NHPA §106 and tribal consultation processes for projects on this land. Government-to-government tribal consultation has been on going between the Tribe and SRNF since the project's inception in 2013. The Karuk Resources Advisory Board and Department of Natural Resources has been fully involved and has led all aspects of project design and planning.

Information regarding sensitive cultural resources and all locational data will be protected from public disclosure and will not be subject to FOIA. Relevant federal statutes include the 2008 Farm Bill, the FOIA identification of exemptions (5 USC §552 (b) (3)), and NHPA confidentiality (16 USC §470 hh).

The project was designed in concert with the Katimiin Memorandum of Understanding (MOU) between the Karuk Tribe, Six Rivers and Klamath (KNF) national forests, which establishes a working partnership between those entities with respect to management activities and opportunities within and adjacent to the Katimiin CMA. This document recognizes the central importance of the Katimiin CMA in the Tribe's culture and beliefs. The project also puts into practice some of the principles from the Karuk Tribe's draft Eco-Cultural Resources Management Plan (ECRMP), which is an over-arching planning document that aims at establishing a unified approach to managing the human, cultural/natural resources, and interests of the Karuk Tribe. The ECRMP specifies resource concerns, goals, objectives, current conditions, and future desired conditions, in a variety of environmental areas including cultural resources.

A TCP "… can be defined generally as one that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community" (Parker and King 1998). Being eligible for the NRHP is the way federal agencies evaluate the significance of cultural resources on a national scale. In a more common sense, TCPs are places that are culturally significant to living communities.

An historic property is any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on the National Register, including artifacts, records, and material remains related to such a property or resource (NHPA Title III §301).

To be considered eligible for the National Register, a property must meet the National Register Criteria for Evaluation. This involves examining the property's age, integrity, and significance:

- **Age and Integrity.** Is the property old enough to be considered historic (generally at least 50 years old) and does it still look much the way it did in the past?

- **Significance.** Is the property associated with events, activities, or developments that were important in the past? With the lives of people who were important in the past? With significant architectural history, landscape history, or engineering achievements? Does it have the potential to yield information through archaeological investigation about our past?

Historic properties can include archaeological sites and TCPs. Federal agencies determine the significance of cultural resources on a national scale by determining their eligibility for the NRHP. Being eligible for the National Register means a property has acquired significance in light of its contribution to the past, and meets one of the criteria of eligibility for the National Register.

Criteria of eligibility refers to the quality of significance in American history, architecture, archaeology, engineering, and culture present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

- Are associated with events that have made a significant contribution to the broad patterns of our history;
- Are associated with the lives of persons significant in our past;
- Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- Has yielded, or may be likely to yield, information important in prehistory or history (36 CFR 60.4).

Environmental Considerations

The focal areas cover approximately 5,570 acres across the locations designated at Donahue Flat, Rogers Creek, Patterson, and Ti Bar. Of those locations, a large portion has been designated as prescribed burn as some things, such as girdling, pull back and firelines, etc., may be needed to contain the cultural burning within set areas. No potentially ground-disturbing work would be projected for those areas. The surveys were conducted on the firelines and those designated for mechanical thinning, which total 2,475 acres. Together with roadside, hand thin and mechanical cable areas, and additional fireline prep in burn only areas, the total comes to 3,900 acres. The 2015 field season surveys concentrated on roadside locations and covered approximately 1,900 acres. In 2016, an additional 2,000 acres were surveyed, including all units proposed for mechanical timber harvest. All the previously known archaeological sites within the project area were identified and updated as part of this project. The majority of these were historic mining sites. All identified resource areas were assessed using TEK forms. In addition, the most intact resource areas identified during the survey process were also surveyed. The 3,900 acres includes approximately 700 additional acres that were surveyed within resource areas in the event heavier management treatments were proposed.

Resource areas are locations where a significant concentration or combination of resources, including cultural vegetation characteristics, artifacts, and features such as trails and ridges justifies an assessment of past human use and management. These assessments are made with a view to treating them for future use due to their short-term resource potential through the introduction of fire and other ancestral management practices. As typical in traditional knowledge, practice and belief systems, it would be through post-fire monitoring and reassessment of ecosystem response to treatment that additional resource areas might be identified or adjusted according to the site-specific situation.

There are 90 documented archaeological sites in the focal areas. These sites are discussed in the restricted CRIR.

Direct Effects

As described above in the *Collaborative Approach* section, the primary intent of the project's Proposed Action is to benefit cultural resources. Fuels reduction treatments and the reintroduction of cultural burning would in fact improve the state of certain sites, objects, features or properties. It is important to consider traditional principles, practices, use factors, and associated wildlife habitats that link the action to the spiritual, living environment, and human responsibility through respect and reciprocity, especially concerning food, fiber, medicinal and regalia species.

The proposed activities in the *Somes Bar Project* include prescribed burning, hand thinning with chainsaws, mastication, and several types of ground-disturbing activities, such as ground and cable-based tree harvesting. These activities have the potential to affect cultural resources, including historic properties, archaeological sites, TCPs, sacred sites, and traditional use areas. However, with the application of PDFs and Standard Protection Measures, it is anticipated that none of the proposed activities would adversely affect cultural resources.

How does this all tie together to frame the direct and indirect effects to the human environment? In accordance with the regulatory environment, one typically begins by defining the direct and indirect APE. In this case, the APE has been determined to be the four focal areas. There is a direct connection between the planned activities and the Purpose and Need of the project. The cultural resource surveys have been designed in such a way as to assess current conditions and to design management prescriptions that would lead towards a desired future condition more considerate of perpetuation of living Karuk culture.

Indirect Effects

In taking the approach of TEK integration and in consideration of the fact that we are preserving a living culture while enabling expansion of fire adapted community concepts. The management practices achieved in the currently proposed *Somes Bar Project* would lead to the introduction of fire, and would start the process of landscape recovery from years of neglect, fire exclusion, road building, use of chemical/biological agents, logging practices and spread of invasive plant, tree and shrub species. The reintroduction of management by fire may have indirect beneficial effects over a much wider area than the direct APE covered by this analysis. Since the project takes a holistic landscape approach and employs five focal species that together cover the main landscape components, it is appropriate to realize that we may have indirect beneficial effects in the context of the entire WKRP planning area and beyond. These actions have the potential to enhance the focal species and integrate other TEK considerations across that whole area as well as in building relationships with additional tribal groups. Indirect effects beyond the scope of the WKRP effort are also underway as many people at regional, national, and international scales are expressing interest in the processes and considerations being established and undertaken in this demonstration project. A key indirect effect of this project is the potential for enabling the restoration of important ceremonial burning practices on Offield Mountain. By treating large areas around residential structures, and building social license for increasing the scope and scale of fire use, ceremonial burning can be restored, as well as managed wildfire decisions enabled on adjacent landscapes.

Alternatives

This analysis considers two alternatives: the No Action and the Proposed Action. It is worth noting that the cultural resources surveys have been designed to cover the most intensive treatments, or those that are most likely to produce significant impacts. Any other actions outlined in the draft EA, therefore, would involve less treatment and would already have cultural resources survey coverage and meet analysis requirements by assessment of these two alternatives.

No Action Alternative

The project actions need to be viewed in the context of, and in comparison to, wildfire. One of the main objectives of the project is to make the land more fire resilient (“resilient communities”). If the neglect continues and a wildfire runs across the land, uncharacteristically high intensity wildfire is very likely to happen in the future. In the Happy Camp complex fires of 2014, as in the fires of 2008, several areas were noticed that burned at sufficient temperatures to kill all the plants and to prevent any significant regeneration. This danger is especially acute because of the overall lack of fire across the WKRP planning area. Few areas have seen five fires in the last century, and large areas have seen none at all (Harling and Tripp 2014). The pattern has been set for infrequent, uncharacteristic high intensity fires, instead of the traditional practice of introducing frequent, designed, and regular fires at low intensity. As is well established, both the costs and the direct effects to cultural resources from wildfire suppression are far higher than those of prescribed fires in the same area.

The focal species and the indicator species provide direct and culturally specific information about the overall health of the landscape. The policy of fire exclusion has resulted in great damage to the landscape: many resources have been left to grow unmanaged, with the result that they are choked with brush. Black oak woodlands, a key component of the landscape in dire threat, are easily overtopped and out-competed by Douglas-fir. This reduces habitat for focal species such as Roosevelt elk.

Because of these factors, the overall landscape is on a trajectory that leads to uncharacteristic high intensity wildfire, loss of local focal species populations, and ecosystem collapse. The focal species have been selected because they are regulated or as regalia species, and because they are important in discrete segments of the landscape. As was seen with the loss of salamander in 2015, these focal species serve as a warning to people that the bonds holding together people and animals, and plants that we all depend on are loosening, and the loss of one element is likely to result in the loss of significant parts of the ecosystem. Just as surely as the loss of salmon in the rivers and creeks, the loss of key regalia species would lead to the devastation of the people and all the other species that depend on them.

While it is difficult to associate a project with any specific climate change effects, some well-accepted climate change considerations can be outlined. A great increase in the frequency and intensity of wildfires has been observed in the last three decades, concomitant with increased riparian and riverine erosion. The landscape and all of its rich cultural resources are at great risk.

The *Somes Bar Project* is a pro-active and holistic approach to restoring cultural fire to a landscape preparing communities and neighborhoods for fire readiness. This section documents the central importance of the Somes Bar area, which is the center of the Karuk universe. According to ancestral practice, treating the landscape with fire achieved twin goals: protection against wildfire and promotion of cultural use species. This section sets out in detail how the *Somes Bar Project* would bring back cultural burning to revitalize and preserve Karuk culture.

Proposed Action Alternative

Direct effects for the preservation of Karuk living culture aim at whole landscape enhancement. The identification of the focal species and indicator species served to show interconnections of mutual dependency between one species and another. They provide a rational, coherent explanation of how saving or enhancing one value would contribute to the environment as a whole. Traditional ecological knowledge does not focus, as modern regulations tend to, on single species management, but on the health and productivity of the whole.

The immediate aim of the treatment and burning of the *Somes Bar Project* is to enhance the diversity and productivity of the vegetative species. These values tie directly to the identified Purpose and Need of the project as a whole. It has been observed that the landscape is so heavily vegetated that the reintroduction of burning cannot be accomplished in all places without prior treatment work. Moreover, there is an overabundance of Douglas-fir on the landscape, whereas in the past, evidence shows that there was a much more significant variety of hardwoods on the landscape. These can still be seen in certain places.

One of the most threatened species is the California black oak (*Quercus Kelloggii*), which is vulnerable to being overtopped and crowded out by Douglas-fir. All the same, the oaks that remain are old and serve as indicators of an ancestral state. One of the biggest deficits on the landscape is the old upland oak woodland. The development of the TEK forms has helped summarize most of the characteristics of these remnant stands. As has been demonstrated by Jeffrey N. Crawford in a University of Nevada, Reno dissertation, the evidence from sediment, charcoal and pollen records demonstrate the development of these oak uplands just after the end of the last Ice Age, and—crucially—that this development was of anthropogenic origin (Crawford 2012). Additionally Taylor et al. (2016) further identifies the level of fire activity in the Pacific Northwest to be anthropogenic in nature vs driver by climate. Therefore, in founding our reference condition as pre-condition landscape condition pre-historic fire vs practice would be considered of natural origin.

These woodlands would usually be southeast to southwest facing, on relatively gentle slope, have relatively open canopy conditions, and would have grasses, forbs, foods, medicines, and fibers among them. These stands are sometimes found on northerly aspects with higher insolation values and make for good fire management features when restored and burned frequently. The people would manage this and adjacent habitats by introducing fire prior to bud set in spring triggering immediate response in ground resources that provide high quality food for animals and people alike. While most other burning is done in early summer though fall, this late winter/early spring practice also provides a valuable teaching component in and near areas of permanent habitation through bringing together elders and youth to teach and learn about the dynamics of fire practice in a low fire risk setting. The conditions in early spring are just right to run fire at low intensity through open canopies covering cured grasses and leaf litter and to enhance the habitat for other animals while reducing vulnerability to overstory trees during in-season fire events. In particular, this habitat is crucial for elk and for the Pacific fisher, two of the focal species. These oak uplands provide crucial connections for the elk between their calving habitat in the woods and their upland summer range. Elk horns are often found in these areas, and they in turn are crucial for management by fire. These habitats provide both browse and the necessary open conditions for elk to thrive. More research is ongoing about their migration patterns across the landscape. The fisher, while it burrows in the hardwood and conifer forest, often comes out to forage and rest in or adjacent to the more open conditions provided by oak woodlands. These habitats provide rodents and other prey for the fisher. In several cases, management decision should take into account providing food for prey for focal species. Such considerations have assisted in designing prescriptions that benefit the ecosystem as a whole.

The black oak woodland is just one component of the landscape that is in deficit. As can be observed in various places, when clear-cut logging has occurred, certain species would grow back naturally. Tanoak, a crucial cultural species, can grow thick and unchecked, and would produce a hillside with many thin stems. This is unproductive for humans and animals alike. Tanoak groves, such as those identified in the cultural surveys, have mature trees, which are well spaced. Management by fire would usually be low intensity because ground cover is generally quite low apart from the litter and duff on the ground. Fire should run through these stands and not harm the trees. The groves would also have been managed by cutting trees to favor others. As has been set out in the previous sections, pine and manzanita spines have a crucial role to play in the management by fire, for introducing controlled burning, and for community protection.

The discussion above provides an account of the positive effects of the management work and some of the aims of reintroducing fire. One should also discuss some potential negative effects.

In some cases, there is the potential for direct effects to archaeological values. Wooden features such as cabins would be protected according to the processes outlined in the R5 PA. Standard Protection Measures are designed to avoid adverse effects to these kinds of resources. Moreover, PDFs and Standard Protection Measures call for the exclusion of heavy equipment in certain zones, for instance where mushrooms grow. These are important gathering resources and would be harmed through damage to the mycelium layer from heavy equipment use. Hand treatment would be recommended in many of those equipment exclusion zones. If hand treatment is practiced sensitively, and burn piles are located at a safe distance from sensitive resources, hand treatment would not produce significant direct effects.

Many areas within the APE were designated as prescribed burn and were surveyed only along proposed fireline routes. They were so designated because they were steep and inaccessible—both for cultural surveys and for project implementation activities. This does not mean to say that they were inaccessible to people who came before: there may be resources in these areas. Although all areas planned for other potentially ground-disturbing treatment have been surveyed, there would likely be inadvertent discoveries through project implementation. Previously unrecorded properties that are encountered during implementation shall be documented and protected in the same manner as other properties.

It is worth considering potential effects from fire to a pre-contact archaeological site that contains stone artifacts. High-intensity fire may be sufficient to crack rock. Most archaeologists would take the viewpoint that when an artifact is present it must not be disturbed or the planned action may cause damage. In this project, a new approach is being taken. Stone artifacts are linked to cultural vegetation characteristics, which this project means to enhance. In general, the intensity of prescribed burning would be low to moderate, while the intensity of wildfire can reach high intensity and can cause severely negative effects. By contrast, cultural indicator species, beargrass and hazel, grow back particularly strongly after low to moderate-intensity fire.

When fire occurs via a lightning ignition, it would burn in conditions that are likely to crack rock. Through recovering fire process, function and resource use, including the human use of fire, resources traditionally enhanced by fire can be once again and the tools of the past that are left behind can be more easily located, even though they may have some fire effect relevant information in fact remains. The potential impacts need to be viewed in comparison with the potential effects of wildfire, and in the context of the overall enhancement of the surrounding resource area as a whole. This kind of impact to an artifact, while not necessarily desirable in itself, does not in NHPA §106 terms mean “adverse effects” to a historic property, and still less in NEPA terms does it mean “significant impacts” to cultural resources. Any potential for damage done by fire reintroduction would be lessened by burning in selective climatic conditions. Mitigations such as survey coverage during fireline construction and following burning may be good practice.

Manual Treatments

Important cultural and ecological plant species would be targeted for enhancement wherever feasible. Manual treatments involve minimal ground disturbance, and usually have low likelihood of causing significant impacts to archaeological sites. Intensive surveys were conducted along all roadside units and any areas where it is high probability for archaeological sites to be present. Subsequent treatments utilizing prescribed fire do have the potential to affect archaeological sites. Therefore, no slash piles shall be allowed within site boundaries.

Mechanical Treatments

Mechanical treatments involve varying levels of ground-disturbance and can cause the following effects on cultural resources, including compaction, movement, breakage, or total destruction of artifacts, features, site stratigraphy (subsurface cultural deposits), or the entire site. These effects can range in intensity and, in some instances, can lead to significant loss of data potential and diminishment of the characteristics that make historic properties eligible to the NRHP. Timber harvesting activities, for instance, have the potential to disturb cultural resources when logs are dragged across the ground, skid trails are created, and logs are piled at landings. Additionally, heavy equipment used for timber harvesting operations can cause rutting and compaction, resulting in increased erosion, creating both direct and indirect effects on cultural resources.

Intensive surveys were conducted in all units where mechanical treatments were proposed. Site avoidance strategies and/or site protection measures would be used to address all of these potential effects. Specifically, site boundaries would be flagged as equipment exclusion zones. If it is determined that removing some trees would be beneficial to a site (e.g., restoring an acorn processing site where conifers have encroached upon a mature oak stand), timber harvest may be allowable where the forest heritage program manager has determined that work can be conducted without causing significant impacts to the site, utilizing On-Site Historic Property Protection Measures (specified in the R5 PA). All work within site boundaries would be monitored and directed by Forest Service archaeologists and/or Tribal representatives. Therefore, the potential effects are not considered adverse.

Prescribed Burning

Prescribed burning has the potential to damage archaeological sites directly and indirectly. Intensive surveys were conducted along all primary fire control lines and other areas where there was high probability for archaeological sites to be present. Fire-sensitive sites (i.e., sites that contain organic materials, exposed wooden architecture, etc.) are at the greatest threat from fire, and can be completely consumed even at low intensities. Sites without flammable features (i.e., prehistoric and historic sites with deeply buried cultural deposits; prehistoric and historic artifact scatters; and prehistoric and historic sites with non-flammable surface features) are less vulnerable to fire, but can be damaged when exposed to high-intensity fire. Fire effects on less fire vulnerable sites include, but are not limited to, cracking of stones, spalling (peeling or separating of outer layer of rock), and sooting.

Fire-sensitive sites with flammable features, such as culturally modified trees, dendroglyphs, blazed trees, cabins, and homesteads, would be protected from fire. Fire-sensitive sites would be protected using a variety of methods, including but not limited to: removing fuels, foaming wooden structures, constructing firelines around structures, backfiring, and avoiding burning near sites if no other means of protection can be accomplished. Fire control lines (handlines) would be located such that they do not disturb archaeological features.

Sites with non-flammable resources, including those with stone or metal artifacts, would be considered for prescribed burns. It is not anticipated that significant fire effects would occur to sites with non-flammable resources during a low-intensity prescribed fire. These sites would be included in prescribed burning where the forest heritage program manager anticipates that work can be conducted without causing significant impacts to the site, utilizing On-Site Historic Property Protection Measures (specified in the R5 PA). All work within site boundaries would be monitored by Forest Service archaeologists and/or tribal representatives.

Burning could indirectly create a higher susceptibility to erosion if a substantial amount of plant cover (i.e., grasses, forbs, pine duff) is burned off the archaeological sites. However, reducing fuel loads and implementing low- to moderate-intensity prescribed burns does not cause soil sterilization or hydrophobic soils (as do high-intensity wildfires). Low-intensity prescribed fires leave some vegetation in place and re-vegetation occurs soon afterwards if soils are not sterilized. The overall effect to the archaeological sites from loss of plant cover is expected to be minor and short term because vegetation would be expected to regrow across the sites quickly and in a way that enhances their cultural uses.

Temporary roads and landings

Every effort would be made to utilize existing temporary roads, skid trails and landings to minimize new ground disturbance. Intensive surveys were conducted for all proposed temporary roads and landings. No new temporary roads or landings shall be allowed within site boundaries.

Road repair

Road maintenance has the potential to affect cultural resources similar to those mentioned above for ground-disturbing activities in general. Intensive surveys were conducted along all major roadways, especially on egress/ingress routes. All of these potential effects are addressed through site avoidance strategies and implementing site protection measures. As such, the potential effects are not considered adverse.

Legacy road sediment source treatments in project area

Several previously used temporary logging roads in the project area have been identified as active/chronic sediment sources in the Ti Bar and Donahue Focal Areas. These locations would be treated with heavy equipment to promote positive drainage of the old roadbed and to physically block motor-vehicle use. No heavy equipment shall be allowed within site boundaries.

Water Drafting

In support of fuel reduction treatments, drafting would be discouraged in occupied coho streams segments with required fish screens at appropriate drafting sites. No heavy equipment shall be allowed within site boundaries.

Handlines

Fire control lines (hand lines) shall be located such that they do not disturb archaeological features. All fire control lines along ridges, and other high probability areas for sites, were intensively surveyed. If additional fire control lines are necessary, fire personnel would work closely with the heritage program manager to determine whether field verification is needed prior to implementation.

Cumulative Effects

When considering past, present, and foreseeable future actions (e.g., mechanical cutting, prescribed burning, etc.), all of the action alternatives have the potential to increase the amount of ground-disturbing activities and prescribed fire across the landscape. Past and present projects that are in and around the current project footprint include *Roots and Shoots Cultural Burn Project* (*Roots and Shoots Project*)), *Orleans Community Fuels Reduction Project* (OCFR), and *Katimiin Thin Project*. The only known future project is the *Six Rivers Aquatic Restoration Project* (*Aquatic Restoration Project*), which is under development. Within the project area, most actions are within the active stream channel and or surveys would be done to prevent effects to cultural resources. All past, present, or foreseeable future undertakings that have the potential to affect cultural resources and TCPs have gone (or would go) through the NHPA §106 process. Mitigation measures have been or would be implemented to keep ground-disturbing activities out of site boundaries; fuels reduction treatments have been or would be implemented to minimize fire effects on archaeological sites and TCPs during prescribed burns. As such, the potential cumulative effects on cultural resources and TCPs are not considered adverse. In fact, on-going and future collaborative-based ecological restoration projects would benefit the cultural resources across the larger landscape.

Fire and Fuels

Overview

The purpose of this section is to explain the effects of the Proposed Action from a fuel management perspective, while equally addressing effects of a "no action" alternative. Both the affected environment and the results of the proposed actions would be examined through qualitative as well as quantitative descriptions.

The project area encompasses four project areas or focal areas, which would be referred to as Ti Bar, Patterson, Rogers Creek, and Donahue. All of the project areas are within lands designated in the KNF LRMP as Wildland Urban Interface (WUI). These areas range in elevation from approximately 2,618 feet at the top of the ridges down to around 984 feet at the bottom of the lowest proposed units. The different elevational gradients, aspects and past management activities, are generally all the conditions which have developed a variety of species compositions. Existing vegetation can be described as diverse depending on a combination of site conditions (biophysical settings) and past management history. One commonality that all areas share is their lack of wildfire occurrence and absence of fire process in individual ecosystems.

The diversity of stands in the project area can lead to a variety of fire behavior effects (elevated potential fire hazard) but overall they are dense in conifer species and represent high levels of competition (see *Vegetation* section for more information). Each stand type promotes different fire behavior characteristics, which would be examined in detail in the following *Existing Condition* section. One goal for the project areas would be the development of strategic control features, in addition to key ridge features and established road systems, in order to reintroduce fire on the landscapes and achieve desired effects.

Fire modeling of current conditions for the project areas show the potential of high fire hazard (the hazard ranges from low to high but there is a significant percentage of moderate to high). Recent fire history, in areas with conditions similar to those within the project area, has resulted in uncharacteristically large wildfires that demonstrate negative stand replacing fire effects. Therefore, management action must be taken to alter the potential fire effects by thinning and burning in order to reduce fuel loading and improve the growing condition of the residual stands. Small steps are being taken on private land working with landowners and The Nature Conservancy to reintroduce prescribed fire using the model of the Prescribed Fire Training Exchange (TREX) program but these efforts stop at the jurisdictional property boundaries. The *Somes Bar Project* would aim to blend treatments on federal land with treatments conducted on private lands through TREX efforts or others in an effort to build resiliency at local as well as landscape scales.

Introduction

Across the project area landscapes, there is a variety of conditions present. Some stands are densely stocked plantation stands where other areas have large dominant hardwoods, which have a thick component of conifer in the understory. Douglas-fir, in some cases, has become the co-dominant species to the large hardwoods, outcompeting native species, which in turn affects their ability to survive and reproduce. In many instances, one can observe large hardwood CWD scattered on the forest floor, which has succumbed to death as it was outcompeted for sunlight or nutrients by fast growing species. The common factor that all areas share is that they have not seen fire as a process in the ecosystem for nearly a century and the buildup of fuel (both living and dead) has created dangerous conditions pertaining to potential wildfire ignitions.

Existing Condition

The project area lies in the heart of the Klamath Mountain region. The Klamath region is noted for its high diversity of conifers and unique mixtures of taxonomic species (Whitlock et al. 2003). Fire is recognized as a keystone process that has influenced the composition, structure, and heterogeneity of forested landscapes in the western North America for millennia (Swetnam 1993, Whitlock et al. 2003, Scholl and Taylor 2010). While fire represents one of the greatest threats to public safety due to the excessive amount of burnable materials available for ignition, it also represents one of the strongest allies in efforts to protect and sustain human and natural resources in California (Taylor and Skinner 2003). Residents and visitors alike are well aware of the threats posed by both natural and human ignited wildfires and any ignition in the forest today poses a threat to a multitude of values at risk.

Historically, wildfire and cultural burning have played major roles in the development and maintenance of our local ecosystems. Wildfire is often the primary natural disturbance influencing vegetation structure, species composition, soil properties, nutrient cycling, and ecosystem processes (Odion et al. 2004). Most native plants evolved with fire and many are adapted to or dependent on fire’s periodic occurrence. However through the exclusion of fire (cultural burning), more fire prone species have become established encroaching in on more fire adapted native species or the sheer abundance of individuals have created a situation where there is no longer a process regulated by natural disturbance events that maintain historic pre-European conditions (Hessburg et al. 2015).

On the Ukonom and Orleans ranger districts (RD), lightning along with cultural burning has shaped the mixed coniferous, hardwood forests and woodlands present today. However, the lack of fire as an ecological process within the project area boundaries has created high tree densities, elevated fire hazard risk and potentially high rates of mortality.

Fire Suppression

Fire’s role in shaping forest structure and composition changed in the mid-to-late 19th century with Euro-American settlement and then implementation of a federal policy of suppressing fire in 1905 (Agee 1993). Following the new fire suppression policy, the “10 a.m. rule” became the mantra of the Forest Service in that any fire detected should be extinguished by 10 a.m. the following day. The elimination of fire in the wildland, especially the suppression of lightning ignitions, allowed the forest to become “unnaturally dense”.

Natural wildfires may have shaped the landscapes in western United States for millennia; however, the importance of utilizing and manipulating fire is one that seems to be just coming into a broader countrywide state of acceptance. Within the project area, this concept of restoring beneficial fire is one of the main goals of the WKRP collaborative group. However, before prescribed fire can play its natural/ecological role in shaping a more fire resilient landscape, many areas need to be thinned and ladder fuels reduced, utilizing tested fuel management techniques, before the reintroduction of beneficial fire can begin.

Analysis of the project areas indicate potentially hazardous conditions pertaining to anticipated fire behavior therefore steps need to be taken to minimize fuel loading and decrease the frequency of ladder fuels (small diameter trees and shrubs) before elements of resiliency can be restored on the landscapes. Individual areas which have had various management actions in the past (i.e., extensive timber management versus no timber management) would be assessed for thinning treatment needs prior to understory burning so that desired fire effects may be achieved. An area’s current condition may also be a factor of growing conditions, aspect and elevation, how long fire has been excluded in its stand or the length of time since the last fire has occurred in the area.

The effects of reduced fire frequency have been greatest in forests with surface fires that had burned frequently. Excluding fires has increased forest densities, surface and aerial fuels, increasing the risk of large high-intensity wildfires, including crown fire (Scott and Reinhardt 2001). In recent years, some national forests across the nation have experienced more frequent fires exhibiting extreme fire behavior than ever before, in recent history. These large uncharacteristic high intensity fires demonstrate the need to take action quickly with a variety of mechanisms (mechanical, manual and prescribed fire) and develop landscapes and communities, which can become more fire resilient.

Within the project area boundaries, fuel buildups have become so great that many stands are unnaturally dense, as wildfires have been missing from the ecological equation for an extended period. This perspective is also a key component as to the selection of these areas for project developments since all factors point to the reality that a majority of ignitions occur in close proximity to urban areas, so it is just a matter of time and circumstance before an ignition within the landscape occurs. Prior to the recent history described, little information is available by the forest to describe what fire history was like in the Klamath Mountains. Large-scale wildfires prior the early 1900s are not well documented and much of the land was being managed with fire by Native Americans who inhabited the area.

Through incorporating information other than “western scientific studies” such as those gathered from TEK, we are able to better understand historic conditions from those whose families are practitioners of fire. Traditional ecological knowledge provides personal accounts of how landscapes were managed by fire through generational teachings, which passes the knowledge providing guidance on fire application. Cultural burning has long been a part of forest ecosystems in the Klamath Mountains and should be considered an embedded process in the historic fire regimes.

Fire Regime

The fire regimes within the project area are extremely departed from their historic range. Fire exclusion and management activities have altered these fire regimes in many areas across the forest. During the period before significant European influence, natural fires and cultural burning in the Klamath Mountain region were generally low intensity, roughly between 10 and 35 years (USDA Forest Service 2003). A fire frequency study of the SRNF (Adams and Sawyer 1980) showed an average recurrence of lightning caused fires to be 16.2 years in mixed evergreen forests just south of the project area, on the Lower Trinity RD.

Local TEK indicates that more frequent burning occurred at lower elevations, where people inhabited areas manipulating the ground for multiple purposes, in order to control more of the annual fuels and higher elevations burned less frequently in order to maintain the landscapes. Lower elevations may have burned perhaps every 2 to 5 years where higher elevations may have been burned at a slightly longer interval such as every 10 to 35 years.

However, depending on site-specific considerations more frequent burning could have occurred to address needs on the landscape such as food, medicinal or basketry gathering sites or perhaps to address a different condition on a landscape. Pre-Columbian (indigenous) peoples fired along routes of travel, and they burned patches where flame could help them extract some resource—camas, deer, huckleberries, maize. The outcome was a kind of fire foraging, even fire cultivating, such that strips and patches burned as fuel became available. Places that escaped anthropogenic fire likely escaped fire altogether (Pyne 2000). These types of fires produced fire effects of low to moderate severity throughout the ecosystem.

Figure 3-1 depicts recent fire activity across the project area according to ranges of time since last fire. It also shows that nearly no lands in the project areas have experienced a wildfire in over 95 years. There has been some recent prescribed fire activity, as noted, however this has been small scale and generally limited to private property. A large landscape surrounding the project area exists in the same condition. These areas, which have missed regular intervals of fire, are described as departed from their historic fire regime. Figure 3-1 further depicts these landscapes as an associated departure from their historic fire-return intervals.

When forests or stands do not undergo burning (either naturally or through prescribed fire), they develop characteristics such as the growth of more fire prone species or the forest fuel just continues to build and build. In determination of fire regime alignment with known historical ranges, areas are categorized by being of a specific condition class (Table 3-1). When an area misses a fire intervals, stands transition from those associated with their historic range (Condition Class 1) to those that are outside of their historic range and represent stands prone to larger fire growth potential (Condition Class 3). This concept is also referred to as the fire-return interval departure (FRID). The FRID analysis is a method for quantifying the difference between current and pre-settlement fire frequencies on a management landscape (Caprio et al. 1997).

The cessation of indigenous burning and the increase of fire suppression activities are thought to have affected the number of beneficial acres burned on the forest in the past 100-plus years, which infers that nearly all land in the project area are associated with Condition Class 3. By performing analyses of FRID conditions on the landscapes, land managers can determine specific areas of need to conduct fuels related activities in order to mitigate associated fire hazards and provide ecological benefits to areas that may be at-risk of losing ecosystems components due to large-scale disturbances.

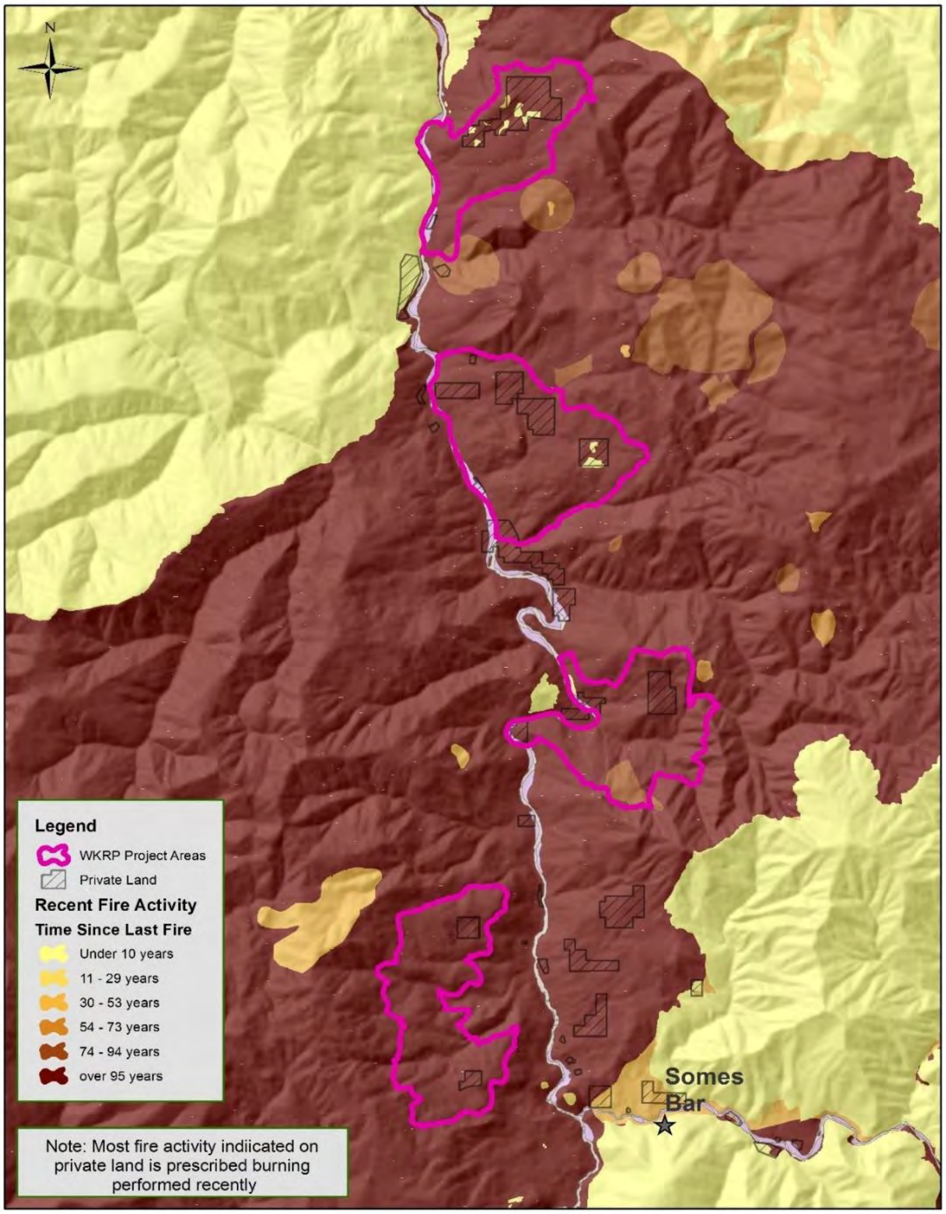

Figure 3-1. Recent fire activity (1909-2016) near the project area showing time since last fire (including prescribed fire).

Another concept commonly used by the Forest Service especially in Northern California where weather precipitation can be more variable is the percent FRID or PFRID. Results utilizing the PFRID concept can help refine understandings of departures from pre-settlement fire regimes across large landscapes in a fire-prone region. PFRID metrics quantify the extent in percent to which contemporary fires (i.e., since 1908) are burning at frequencies similar to the frequencies that occurred prior to Euro-American settlement (Safford and Van de Water 2014). These PFRID metrics are associated with positive and negative condition classes, which show a range of departure based on the fire return interval (Figure

3-2). These percentage-based measures are less sensitive to the incidence of a single fire, and are more suitable to comparisons of fire frequencies over time between the current and pre-Euro-American settlement periods (Safford and Van de Water 2014).

Both FRID and PFRID are determination assessments, which pertain to an areas alignment with their known historical or measured fire regime. Accordingly, a goal of this project is to work to restore landscapes to condition classes, which mirror their historic fire regimes. Fire regime condition classes (FRCC) are described in Table 3-1.

Table 3-1. Descriptions of fire regime condition classes (FRCC).

Condition Class	Fire Regime
1	Fire regime is within historical range and the risk of losing key ecosystem components is low.
2	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals.
3	Fire regimes have been significantly altered from their historical frequencies by multiple return intervals.

Across the SRNF (including Ukonom RD as part of the KNF), the fire regime is historically described as one of frequent fires and mixed severity as recent tree-ring data indicate median fire intervals of generally less than 35 years (Adams and Sawyer 1980). Typical burns have been generally frequent, occasionally large, and generally low or moderate-intensity surface burns (Whitlock et al. 2003). Highest severity fires have historically occurred on the upper slopes and ridges, whereas less intense fires have occurred in the lower to mid ranges. Generally speaking, fire frequency and occurrences in northwestern California increases from west to east and from higher to lower elevation but this is also a factor of causal ignitions as high frequency lightning years like 2008 alter this concept dramatically.

Occasional patches of high severity most likely occurred, but these would have mainly been limited to the upper ridges, where the conditions of fuel loading and arrangement aligned with other favorable conditions such as wind and aspect. Douglas-fir/tanoak stands generally exhibit a moderate-severity fire regime with periods of high-severity fires. This is evident by examining areas of recent wildfire occurrence throughout the Orleans and Ukonom RDs as well as adjacent forests with similar fuel types in the Klamath Mountains. Tanoak have adapted to low-moderate severity fire with epicormic sprouting and basal sprouting following high intensity fire (Jimerson et al. 1996). The frequency of multiple stem tanoaks are high to extremely high throughout the project area and this has led to some widespread continuous fuel ladders. Research indicates that hardwood management is needed to address this by thinning less dominant stems in order to reduce the individual stem competition and promote mature stems for acorn production.

The role fire plays in an ecosystem is characterized by the fire regime attributes that describe the pattern of fire occurrence, behavior, and effects. Desired conditions for these attributes would be further discussed in this document. Variation in fire severity has an important influence on forest heterogeneity because fires may kill all trees in some stands and few in others. Stand development after high-severity fire leads to even-aged or several-aged stands, while forests that experience low- or moderate severity fires have trees in many age classes because few trees are killed in a stand (Agee 1993, Scholl and Taylor 2010).

Figure 3-2 depicts the existing conditions for the project area in regards to their alignment or departure from the associated fire return intervals. When natural ignitions (or ignitions in general) are suppressed and the role of fire is not allowed to interact with the landscape, fuels buildup until some action is taken to decrease their density such as prescribed fire or mechanical treatments. A primary goal in this project's vegetation management strategies is to reintroduce fire on the landscape to allow areas to burn more frequently so that their conditions can resemble those with closer historical regimes.

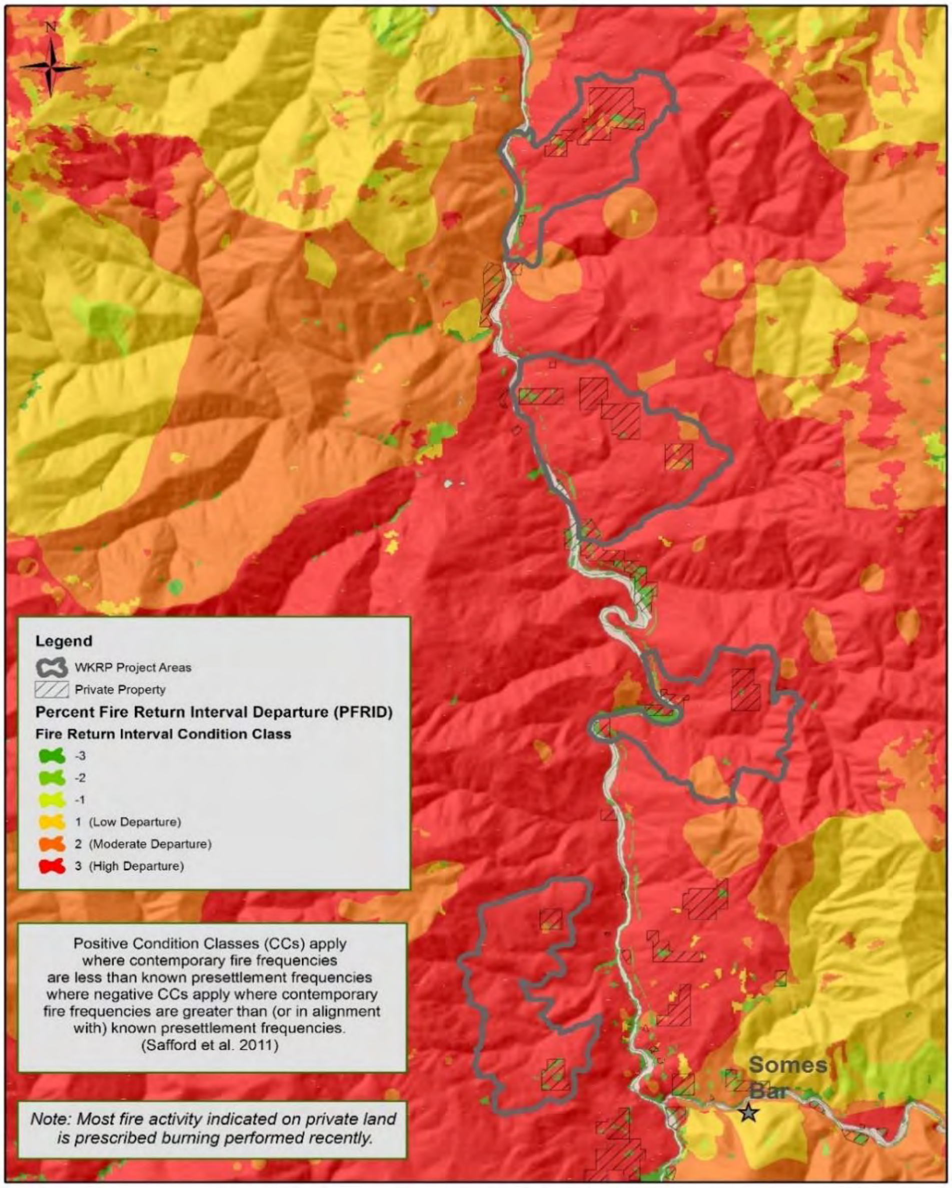

Figure 3-2. Project areas depicting mean pre-settlement fire-return interval departure.

Figure 3-2 displays positive condition classes apply where contemporary fire frequencies are less than pre-settlement frequencies (Hann and Strohm 2003); negative condition classes apply where contemporary fire frequencies are greater than pre-settlement frequencies (Safford et al. 2011). Therefore, areas that have seen recent fire activity can be seen in yellow hues and areas, which are more departed from pre-settlement frequencies, are seen in more of a red hue. One should note that areas indicated in green also depict those that are associated with a high departure from known historic pre-settlement frequencies as there have been frequent overlapping wildfires in the recent past. The mapping base was the Forest Service existing vegetation (EVEG) geodatabase, which uses the CALVEG[13] classification. Most of the data used came from composite dendrochronological fire histories including records from multiple trees in a defined area (Safford and Van de Water 2014).

Comparisons between historical and current fire regimes provide information to managers in prioritizing areas for ecological restoration and other management actions. This type of FRID analysis quantifies the difference between current and pre-settlement fire frequencies (prior to Euro-American settlement), allowing managers to target areas at high risk of threshold-type responses owing to altered fire regimes and interactions with other factors (Safford and Van de Water 2014). This information could also be used to identify places, which may be more prone to vegetation type conversions in areas, which have burned recently at higher fire severities.

As you can see from the figure above, there is a clear illustration that the process of fire has been absent on the landscape for a long time. One can observe this by looking at the area in the southeastern corner of the map where recent wildfires have occurred just outside of the project boundary. These wildfires, some overlapping as can be seen in the green color, have brought the frequency of the fires to align with the historic fire regime of the area according to the associated fire regime condition class.

Methodology

The following subsections discuss the scope of analysis, methodology, and indicators to assess the environmental consequences of the alternative on fire and fuels for the project area.

Modeling for Potential Fire Behavior Risk and Fire Effects

Modeling of potential fire behavior and the resulting intensity/severity of such fire behavior requires several inputs for calculation. These include, but are not limited to, fuel, weather and topographical conditions of the area being analyzed. Fuel and weather conditions can change slowly over time and space or can change rapidly. For this analysis, conditions were held constant and were based on what are considered the 90th-percentile wildfire weather and fuels conditions for the project area. While these conditions represent a high percentile observation, it is important to note that the conditions are defined in this fashion because they are only observed up to 10 percent of the time. For weather, it pertains to hot, dry conditions and for fuels, it pertains to a low level of fuel moisture.

The program Fire Family Plus (version 4.2) was also utilized to examine weather in order to show local wind and weather observations. Ninetieth-percentile fuel moisture variables were derived from Fire Family Plus, which described the conditions represented on a hot summer day. Weather variables such as temperature, relative humidity and wind were derived from a nearby Remote Automated Weather Station

[13] CALVEG classification is a provisional system that meet regional and nation vegetation mapping standards that further categorize existing vegetation (EVEG) boundaries for ecological tile units by incorporating Ecological Units of California into the database layer.

(RAWS) located in Somes Bar, which analyzed hourly weather data from 1993 through 2016 and a single day was chosen to utilize weather observations. For this analysis, a weather and wind file was developed from August 1 to August 31, 2008 with a date of August 31, 2008[14] chosen to depict the outputs.

Fire behavior modeling was done utilizing the program FlamMap 5[15] and ArcMap 10.3 in order to analyze and estimate the current fire hazard condition potential (in relation to predicted fire behavior) if a fire were to occur in certain areas during a specified set of weather conditions. The fire modeling process was performed in order to depict potential burning conditions incorporating existing vegetation data from the program Landfire[16]. The combination of these programs is commonly used to derive a landscape perspective of potential fire conditions.

The following 90th-percentile fuels conditions were used to describe fuel conditions:

- 1-hour fuel moisture: 3
- 10-hour fuel moisture: 4
- 100-hour fuel moisture: 8
- Herbaceous fuel moisture: 30
- Live woody fuel moisture: 70

A variety of other factors (which would be later discussed in detail) would also be considered prior to unit implementation, however by first considering risk on the landscape, we should have a solid starting point to which we can apply other pre-implementation prioritization criteria.

The analysis of weather and fuels inputs generated files, which were integrated into FlamMap to analyze the associated characteristics of wildfire, which were simulated on the landscape. The fire behavior conditions, known as indicators, relate fire behavior aspects as a certain type of fire hazard, which would be present. These indicators assist in planning efforts to appropriately determine the types of suppression resources needed to safely manage an ignition under the given circumstances. In order to assist with planning implementation factors, fire modeling of the project areas was buffered by a half mile distance to identify where treatments could potentially provide better initial effectiveness and also to provide for some unit prioritization by first considering current risks on the landscapes (Figure 3-3).

Fire hazard indicators were modeled (Table 3-2) in terms of rates of spread (ROS) and flame length (FL), which were calculated based on inputs of fire behavior fuel models, canopy characteristics (for wind reduction), topography (elevation, slope and aspect), fuel moisture conditions, and weather. Flame length and rates of spread are known critical factors in determining the effectiveness of suppression resources. These fire behavior outputs are related to suppression effectiveness in terms of whether hand crews, equipment, or aerial attack can successfully suppress the wildfire. Figure 3-3 demonstrates the potential of fire suppression as it relates to the existing condition within the project area in terms of fire behavior potential (or fire hazard rating on the associated maps).

[14] This date coincides with a recent fire run on a local wildfire, the Mill Fire, on the Six Rivers National Forest.
[15] FlamMap 5 simulates thousands of wildfires on the landscape given vegetation and environmental inputs.
[16] Landfire is a program that provides over 20 national geo-spatial layers (e.g., vegetation, fuel, disturbance), databases, and ecological models that are available to the public for the US and insular areas. Available at *www.landfire.gov*.

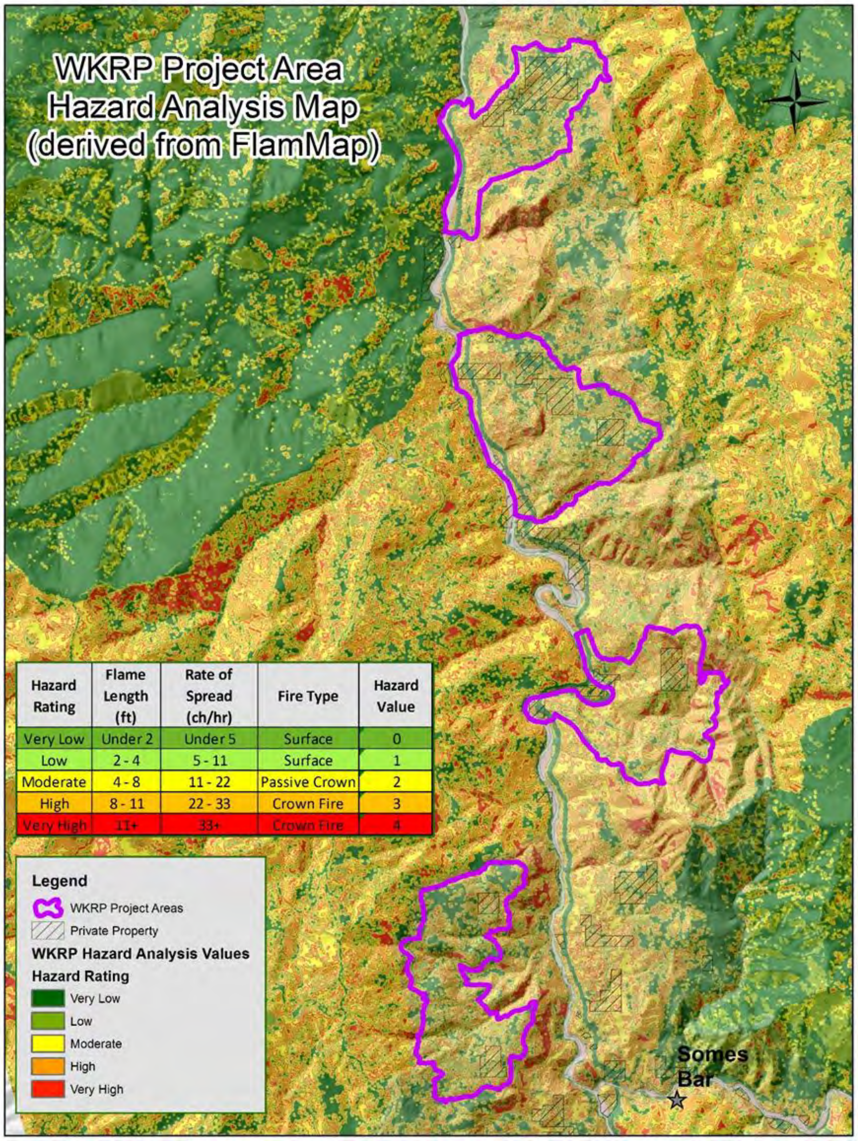

Figure 3-3. Project area associated hazard assessment rating (FlamMap wildfire modeling).

Table 3-2. Relationship of surface fire flame length and fireline intensity to suppression interpretations[17].

Fire Behavior Potential	ROS (ft/min)	ROS (m/min)	FL (ft)	FL (m)	Suppression Effectiveness
Low	0-11	0-3.3528	0-4	0-1.2192	Handcrews (Direct attack)
Moderate	11-22	3.3529-6.7056	4.1-6	1.2093-1.8288	+Engines/Watertenders (Direct with equipment)
High	22-33	6.7056-10.0584	6.1-8	1.8288-2.4284	+Aerial Support/Dozers (Direct/Indirect with equipment including aerial support)
Very High	33+	10.0584+	8.1-11	2.4284	+Aerial Support/Dozers (Indirect only)

[17] Fire characteristics charts such as this are intended to illustrate fire behavior characteristics from values calculated by computer programs such as the BehavePlus fire modeling system.

Predicted fire behavior was variable across the landscape from low to high, however analyzing the graphic depiction of the modeling showed pockets of potential high fire behavior in concentrated areas. Roger's Creek had the highest rate of high fire hazard within the project area, but Donahue depicted the highest amount of high fire hazard potential just outside of the project area boundary. Additionally in the Ti Bar area, a pocket of very high fire hazard is shown just outside of the project area boundary to the south. These assessments of fire hazard areas would be taken into account during project priority area determinations.

Assessment of Fuel and Forest Structure

Stand exam data taken across the project area was uploaded into the model program *FS Veg* where an analysis of forest stand characteristics could be determined by utilizing the Forest Vegetation Simulator (FVS) as well as the Fire and Fuels Extension (FFE). The FVS provides analysis based on stand inputs to determine structure across large areas; however, these outputs homogenize large areas and do not necessarily take into account individual unique characteristics. The outputs tend to be limited by the quantity of gathered data; however, the program also serves as a platform for performing stand growth determinations.

Another aspect FVS provides is a determination of potential stand mortality[18] on a percentage of basal area basis. One note to make here is that a large percentage of basal area can be represented by either one large tree or many smaller trees. The expected change in basal area mortality following the various treatments can be seen in the analysis below.

The environmental variables depicted in Table 3-3 were input into fire modeling programs to determine effects of the Proposed Action (prescribed fire only inputs) and the No Action Alternative (wildfire 90th percentile).

Table 3-3. Environmental inputs used for FVS fire modeling—WKRP fuel modeling parameters (FireFamily Plus Output).[19]

Environmental Factor	Wildfire (All Months) 90th Percentile	Prescribed Fire Only (10/1 to 6/30) 90th Percentile
Temp Max	95	85
RH	19	22
Wind	8	8
1-hour fuel	4	4
10-hour fuel	5	5
100-hour fuel	8	12
1000-hour fuel	10	10
Herb Fuel Moisture	4	30
Woody Fuel Moisture	70	70

[18] Stand basal area mortality is an indicator of forest health.
[19] Model outputs are compiled from 20 years of data from the Somes Bar RAWS.

Environmental Consequences

Current fuel loading conditions and associated (or anticipated) fire behavior within the project area is unacceptably high. This condition is due to multiple factors but the main factor is a lack of fire process on the landscapes for an extended period. The current conditions can lead to high severity wildfires could result in high rates of stand mortality. However, since there has been a lack of fire process for so long, dominant hardwoods have been succumbing to mortality and their numbers would continue to decline. By applying an adaptive management of prescribed burning and thinning actions on landscapes, conditions should change over time as the trajectory of the stand is altered. The adjustment of restoring the ecological balance by utilizing fire on the landscape may have short-term negative visual effects within one to three years but over a long-term basis of perhaps three to seven years, the response in individual stands should be a positive gain.

Restoring the process of fire as an ecological tool is key to the success of landscape treatment for this project and performing this action in combination with strategically placed treatments should provide acceptable levels of effects from the application of prescribed fire. Controlling the intensity and severity of prescribed fire application can be an extremely difficult task but through a detailed plan of action and analysis of fuels and weather conditions, successful results should be attained over time. Applying fire at differing intervals should achieve a variety of beneficial results and developing recurrence intervals should build resiliency to future wildfires while mutually benefiting multiple culturally and ecologically important species.

Alternative 1 – No action

Direct and Indirect Effects

Under the No Action Alternative, no initial or follow up fuel treatments would occur, thereby continuing to defer risk of wildfire into the future. The No Action Alternative would not change the current conditions in the project area and therefore would not support the project’s purpose and need. There would be no direct effects on fire behavior specifically to the fire intensities and potential flame lengths or improvement on the growing conditions of dominant hardwoods. Additionally, there would also be no direct effect to address the existing fuel loading conditions especially those immediately adjacent to private property, as resiliency would not be built on the landscapes.

Forest resiliency to wildfire in the project area would continue to decline and accordingly, through the coming years, mortality of large hardwoods would generally increase in stands, which would in turn increase the fuel loading. No fuels treatments would occur under the No Action Alternative including the extremely valuable strategic fuelbreak construction intended to surround the communities. Most importantly, the process of fire would not be restored back onto landscapes, which have been missing that as an ecological component. Fire return intervals could continue to become more and more departed. As Figure 3-2 shows, a large area is already in Condition Class 3 and these areas are at risk of losing key ecological components as Table 3-1 describes. By not taking action on the project landscapes, continuing a lack of fire process would drive stands further and further from their historic conditions. This in turn would impact their ability to build resiliency function such as encouraging the development of fire prone species, which can shade out native fire adapted species.

Natural fuel accumulations would continue to increase as more trees begin to succumb to overcrowding, drought, insect and pathogens thereby increasing the rate of mortality. These natural processes that would eventually occur instead of the controlled processes of thinning and prescribed fire application, which would lead to an increase in the amount of ground and surface fuels within the area. This additional accumulation in ground and surface fuels would gradually begin to shift the potential fire behavior in the area, to a more severe stature if a wildfire was to start. This increase could promote a more severe surface fire as the type of fuels changed from branches and needles (0- to 1-inch material) to the larger size material (3-plus inches) causing higher residence burning times[20] and increased amounts of smoke production.

Fire Suppression

Due to the continued and potential increased threat to life and property, under Alternative 1, firefighting resources would continue to focus strategies and tactics on reducing the impacts of the communities, protecting infrastructure and private property as the highest priority followed by protection of natural resources. In fact, one could also argue that the threats would increase as fuel loading would continue to build over time as forests continued to grow increasingly dense due to the continual lack of process to change stand dynamics.

As surface fuels continue to accumulate, with no additional management actions, suppression efforts would gradually become more difficult as wildfires could grow to larger unmanageable sizes much quicker. Therefore, direct attack in most cases could no longer be used as an initial tactic in suppressing a fire, but have to be changed to more indirect tactics, whereby more area has the potential to be affected by fire, in some cases high intensity and more severe fire. With the increases in fire behavior generated by these surface fuel changes, fire suppression forces would have higher resistance to control due to fuel loading and by more intensive fire behavior. Aerial retardants would be less effective due to closed continuous canopies. If a fire were to start in or burn into the project area, ground and aerial initial attack operations as well as extended attack would become less effective and firefighter and public safety would be more difficult to ensure.

Fire Behavior and Fire Effects

Without the restoration of fire, forest health would continue on the current trajectory. Fire-adapted species would continue to flourish on the landscapes outcompeting more fire resilient species and native species which are vital to many cultural perspectives. Historically non-native flora species would continue to present higher levels of stand densities and associated fire behavior potential representing higher fire hazards on the landscapes (Taylor and Skinner 2003). If a wildfire ignites in the project areas without action on the landscape, the ecosystem and communities would be subject to potentially stand replacing results as we have seen in recent years in the Klamath Mountains region.

Without frequent fire to clean the understory of stands, excessively dense stands lead to drought stress and bark beetle outbreaks, resulting in wide spread mortality of trees in many areas and the potential for

[20] This term refers to the amount of time fire will burn in an area based on the amount of available fuel loading.

extensive mortality. This leads to a large increase in the amount and continuity of both live and dead forest fuels, resulting in a substantial increase in the probability of large, severe wildfires (Weatherspoon 1996).

Table 3-4 and Table 3-5 from FVS depict the potential flame lengths and associated mortality depending on whether the stand was previously managed (plantation) or non-plantation.

Table 3-4. FVS current condition modeling of potential associated fire behavior in plantations—FVS output depicting potential flame lengths (No Action Alternative).

Year	Average Flame Length (ft.)	Average of BA Mortality (%)
2017	18.3	81
2022	17.8	86
2027	19.6	88
2032	19.3	91
2037	22.9	93
2042	16.5	92
2047	17.5	93
2052	17.7	94
2057	12.1	94
2062	11.5	93
2067	11.2	92

Table 3-5. FVS current condition modeling of potential associated fire behavior in non-plantations—FVS output depicting potential flame lengths (No Action Alternative).

Year	Average Flame Length (ft.)	Average of BA Mortality (%)
2017	7.3	49
2022	6.4	55
2027	7.2	60
2032	8.5	64
2037	9.5	67
2042	10.1	69
2047	10.3	69
2052	10.6	70
2057	10.8	70
2062	10.8	70
2067	9.9	69

As seen in the tables above, under the No Action Alternative, stand health would continue to decline as modeling shows gradual increases in basal area mortality through the next 50 years. The increase in mortality is a valuable indicator in terms of stand resiliency as it can directly pertain to multiple other conditions such as the potential fire behavior or the susceptibility to other disturbances such as insects, pathogens and disease. This course of stand trajectory could eventually lead to widespread stand replacement of most native species.

Additionally under Alternative 1, there would be no alteration/reduction in surface and ladder fuels, raising canopy heights and/or promoting fire resilient species or individuals, which would create more fire resilient stands. The associated fire behavior is already extremely high and over the course of continued no action, high severity stand replacing wildfires would dominate on the landscapes. Vertical continuity of fuels from the forest floor to the crowns of overstory trees would remain and under the right conditions could produce crown fire events. Fire hazard of late summer scenarios would also continue to present situations of high severity fires with potentially high rates of spread leading to high tree mortality rates and threats to rural communities.

Recent Fire History Considerations

In the last 45 years, there have been over 2,900 fires on the forest. A large number of these wildfires occurred within about a mile from communities or next to major roads. Although most fire starts occur near human populations and thoroughfares, this is mainly due to the high rate of ignition occurrence. During this same timeframe, Ukonom RD has had a noticeably higher rate of lightning occurrence when compared to the Orleans RD (Table 3-6). The project area also seems to have a noticeably higher rate of lightning occurrence over the same period and this frequency is almost twice as much as the rest of the forest combined. Although the occurrence of human ignitions is of a higher rate, those ignitions have started wildfires outside of the project area of focus.

Table 3-6. Recent wildfire on the Six Rivers National Forest, lightning ignited compared to other starts.

District	Fire Year	Total # of fires	Lightning Fires	% of total
Orleans RD	1970-2015	558	139	25
Ukonom RD	1970-2015	340	206	61
All Districts	1970-2015	2,925	1,011	35

Lightning ignition occurrence has become more frequent across the forest in recent years. Lightning generally occurs in the "high country" far away from populated areas, however in recent years (2006, 2008, 2009, 2013 and 2015) lightning ignited fires on ridges in some locations close to rural residents. These fires are difficult for land managers to handle since they have the ability to become larger fires due to factors, such as the fuel loading present and low values at risk, and since lightning is usually widespread and starts fires in a variety of locations.

Wilderness fires account for a large percentage of all acres burned on the forest lands over the last 45 years and the amount of acres that have burned on the forest has been increasing dramatically in recent years (Table 3-7). Wilderness fires can pose a risk to the nearby rural communities, as they grow uncharacteristically large due to the large amount of available fuel accumulations from years of fire suppression. These scenarios have presented strategic and tactical hazards for land managers due in part to limitations provided to firefighters by the terrain accessibility.

Table 3-7. Recent wildfire starts compared to total acreage burned.

Fire Years	# of Fires	Total Acreage Burned
2005-2015	693	355,459
1995-2005	800	91,151
1985-2005	826	18,450
1975-1985	691	2,178

In recent years, a high number of acres have been burned by wildfires in the Klamath Mountains and a large percentage of these have burned at uncharacteristically high severity due to a variety of conditions. From 2005 to 2015, over 355,000 acres burned on the forest. That acreage is more than 2½ times the amount of acreage burned during the previous period. This dramatic increase in acreage burned by wildfires can be due to a variety of reasons such as the existing fuels conditions, changes in climate resulting in longer seasons of elevated fire danger, and the increased occurrence of lightning. As Figure 3-4 depicts, large fire footprints exist all around the project area, but lack occurrence within the project area.

Cumulative Effects

The fire danger is considerable and spreads throughout surrounding ridges of the Klamath Mountains. So due to the large scale of the present fire hazard and the potential spread of wildfire from outside the project area, the landscape or watershed scale within the project areas are used as the geographic boundary for cumulative effects analysis. Under the No Action Alternative, cumulative effects of the present and potential fire danger from both within the project area boundary and outside the boundary would continue to put human lives and property at a high risk of loss or damage from wildfire.

Tree densities range across the project area from those representative of historic frequencies to areas showing extremely dense conditions as seen in the Light Detection and Ranging (LiDAR map) products. These conditions are a vast departure from stand conditions of the past and can succumb quickly to large-scale disturbances such as fire, insects, or disease. Forest debris accumulates more rapidly and species compositions have departed from historic conditions. As these landscapes have changed over time due to the absence of fire, the behavior of fire would also change accordingly hence the increased fire hazard. Smoke production from wildfires can emit extremely large concentrations of carbon into the atmosphere especially in areas with high fuel loading which have missed several fire return intervals.

During recent years, smoke from large wildfires became trapped in river valleys and remained for long periods. Smoke can impact different resources in various ways. For the effects of smoke on different resources see the following sections: *Wildlife Resources* (effects of smoke on NSO); *Watershed Values* (effects of smoke on fisheries); *Botany* (effects of smoke on sensitive plants); and *Social Environment* (effects of smoke on communities). Many environmental factors can contribute to the conditions when smoke inundates and subsists for long periods in drainages; however, there is a direct correlation between high levels of smoke production and high concentrations of fuel loading. This condition is observed during any year when wildfires burn for extended periods. In fact, smoke production can be so excessive that it lingers for months on end, which has been observed in many recent years.

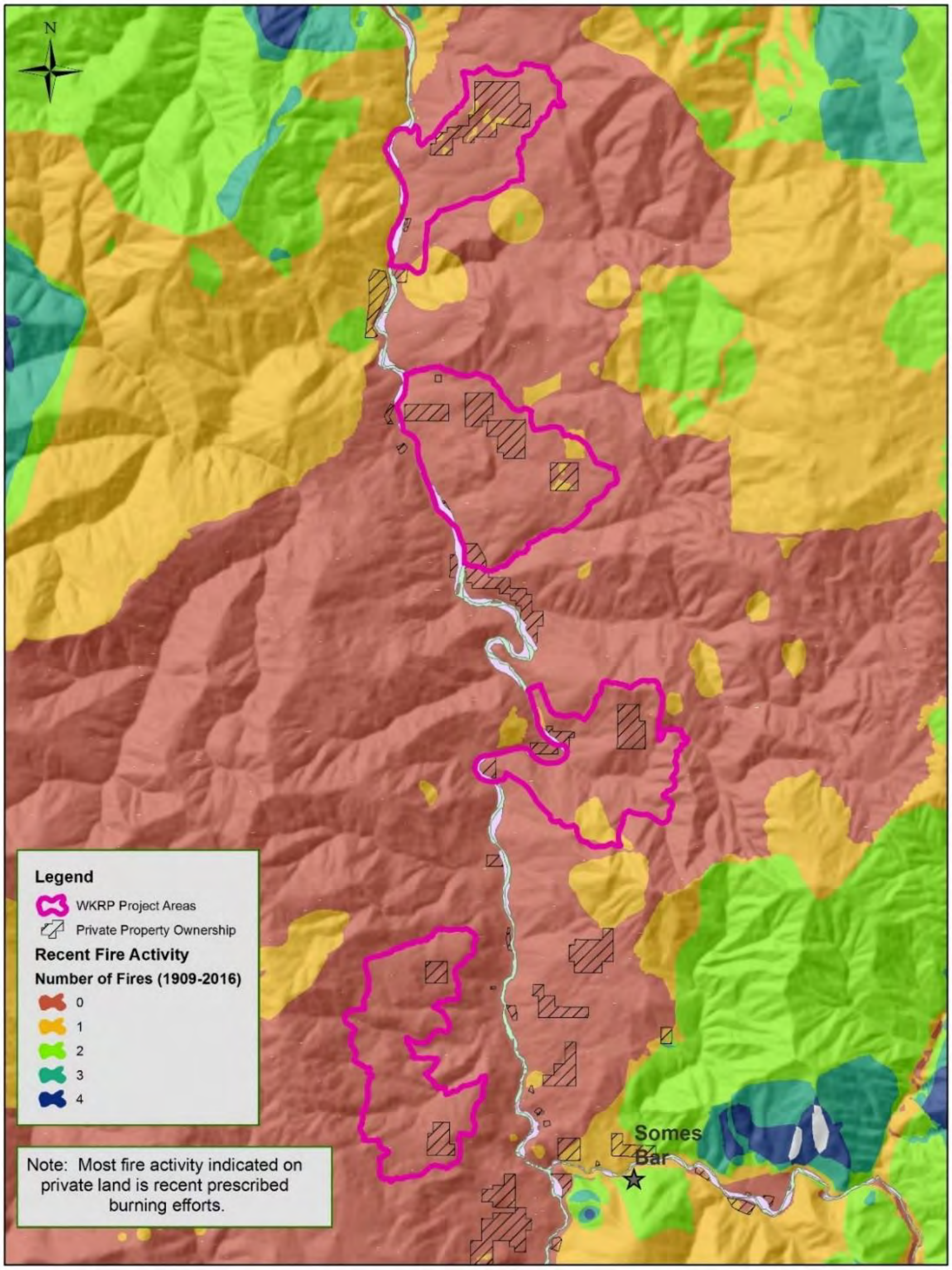

Figure 3-4. Recent fire history map of the project areas and surrounding landscapes.

Particulate matter produced from wildland fires limits visibility and absorbs harmful gases. Over 90 percent of the mass of particulate matter[21] produced by wildland fires is less than 10 microns in diameter and over 80 to 90 percent is less than 2.5 microns in diameter (Figure 3-5). Under the No Action Alternative, smoke production from wildfire events would also continue to be excessive and river valleys would continue to become inundated with wildfire smoke. Local wind inversions can cause this dense smoke to become trapped for extended periods. This smoke can also heavily impact coastal communities when winds develop out of the east in an off shore pattern development.

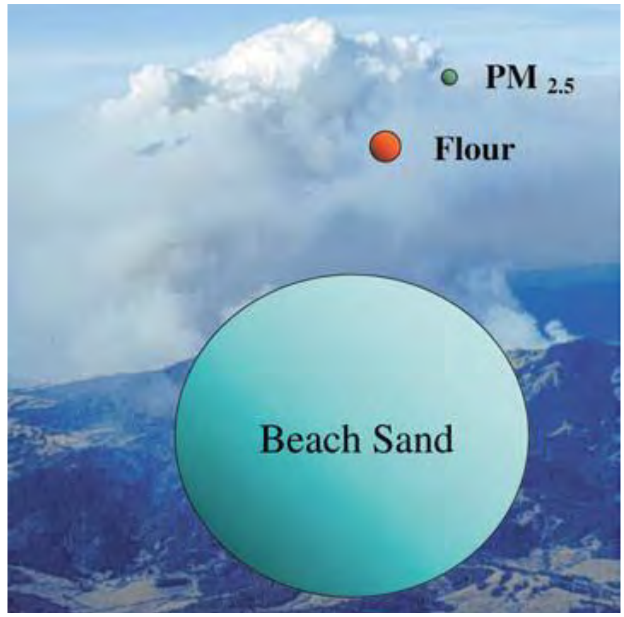

Figure 3-5. Relative sizes of beach sand, flour and a PM 2.5 particle in smoke.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Under this alternative, preparing landscapes to allow for the return of fire back onto the landscapes for recurring intervals and restoring fire back on the landscapes should revive aspects of health and diversity that have been missing for decades. Through the careful, methodical application of combinations of thinning and prescribed burning, the health and function of forest ecosystems across the landscapes should be improved both directly and indirectly. Modeling shows that treatments would reduce overall basal area mortality (see Table 3-8 and Table 3-9) within stands. Creating species preference lists pertaining to increasing diversity on landscapes would also ensure a successful outcome pertaining to the implementation of thinning prescriptions.

Restoration efforts to reintroduce fire back on the landscape should increase the abundance of understory forbs, which in turn would have a positive reproductive effect response of many of the identified TEK fauna species. By focusing treatments on improving conditions of culturally significant flora species (hardwood restoration elements) and retaining larger trees, we should simultaneously see improved conditions for the identified focal species as well as reduced risks on the landscapes close to communities. A management strategy that includes methods for increasing forest heterogeneity at multiple scales would improve habitat quality and landscape connectivity (North et al. 2009).

In addition to promoting more fire resilient trees, prescriptive treatments would be accomplished to treat activity fuels from thinning by either hand pile burning, understory burning or a combination of both. Understory burning treatments would also occur in areas identified as culturally important for

[21] Particulate matter refers to any liquid or solid particle. They generally range in size from 0.1 to 100 microns. PM 2.5 is a measure of fine particles of particulate matter that come from fuel combustion. Often called respirable particles, as they are more efficient at penetrating lungs and causing damage.

collection of other forest products such as for traditional foods or medicines. By applying recurrent fire back into the ecosystem, creating greater ecosystem and community resiliency to wildfire, hopefully in the years following treatment, incident commanders of future wildfire occurrences both in and adjacent to the project area may allow naturally ignited fires to play more of an ecological role and burn to established strategic fire control features[22] for the project.

Fire Behavior and Effects (Forest Vegetation Simulator and Behave Models)

Under the Proposed Action Alternative, fire effects both prescribed fire as well as wildfire would change through the years following thinning and burning treatments. In the short term of 1 to 3 years, we should see an immediate reduction in hazard risk. Over the course of the longer term (5 to 10 years), we would potentially see a decrease in fire behavior, especially pertaining to any wildfire ignition. Depending on time of year during ignition (weather and fuels conditions), prescribed fire effects would be variable on the landscapes and would ultimately align with objectives associated with the identified TEK focal species.

Allowable ranges for associated fire effects would have to be developed during the life of the project and should be adaptable to change based on the refinement of monitoring criteria to be developed in the years following initial treatments. An example of “acceptable fire effects” to be determined may be the effective percentage of consumption pertaining to a specific vegetation component or an acceptable/desired range of severity from low to moderate. Following initial treatment monitoring, it may be indicated that an alteration to a firing pattern or seasonal component may achieve a higher level of desired effect in order to reach better outcomes. There may be a need to adaptively manage the usage of fire in future instances and this should be recognized as needed change to achieve the desired effect for the associated TEK species habitat elements.

The Forest Vegetation Simulator (FVS) program was utilized to perform modeling of stand effects from the project thinning and burning actions. This program uses environmental inputs as well as thinning parameters to apply a prescription to a homogenous stand and simulates the resulting change over time. The environmental inputs utilized for modeling fire effects are listed in the *Methodology* section. Thinning of trees under 6 inches in diameter was assumed to occur in 2018 with pile burning to occur in 2019. Understory prescribed fire was also factored into the model in years 2020 and 2027.

The FVS modeling (using the FFE) of the Proposed Action demonstrated dramatic changes in potential fire behavior over time in terms of flame lengths and anticipated basal mortality. The outputs in Table 3-8 and Table 3-9 should be compared with the outputs in the No Action Alternative. While the model tends to depict values higher than actual circumstances, the trends of a reduction in fire behavior and associated mortality are noticeable. The following tables depict the associated changes according to thinning and burning at various intervals.

[22]Strategic fire control features are defined as areas, which can be utilized for control line purposes. Specifically: handlines built adjacent to private property or those that are designated to be a unit boundary, handlines built on ridge systems that may have a shaded fuelbreak component, handlines on previously disturbed ground (such as old skid trails or game trail), road systems that may or may not have associated fuels reduction and wet riparian areas that could halt the progression of fire.

Table 3-8. FVS output showing impact of the Proposed Action on fire behavior in plantations—FVS output depicting potential flame lengths (within plantations, thin, pile, and burn in 2019).

Year	Average Flame Length (feet)	Average of BA Mortality (%)
2017	18.3	81
2018	8.3	68.8
2019	**6.2**	**46.2**
2020	6.3	50
2022	7.4	58.2
2027	4.2	48.7
2032	4.7	49.9
2037	5.3	56.2
2042	5.5	55.6
2047	5.7	54.7
2052	5.9	53.4
2057	6.3	53.6
2062	6.7	56.7
2067	7.2	60.8

Table 3-9. FVS output showing impact of the Proposed Action on fire behavior in non-plantations—FVS output depicting potential flame lengths (within non-plantations, thin, pile, and burn in 2019).

Year	Average Flame Height (feet)	Average of BA Mortality (%)
2017	7.3	49
2018	6.5	39.1
2019	**3.7**	**29.9**
2020	3.9	29.9
2022	4.4	35.2
2027	5.0	39.0
2032	5.4	41.5
2037	6.1	47.5
2042	6.4	49.2
2047	6.6	49.3
2052	6.6	48.9
2057	6.7	48.7
2062	6.8	48.6
2067	6.9	48.9

The effects within burn units should achieve patch-style dynamics according to burn plan prescription constraints. As mentioned previously, some mortality is anticipated to occur in regards to prescribed fire application but through preemptive actions such as thinning and pile burning, fuels pullback or other burn plan prescriptive elements, prescribed fire mortality levels should not reach unacceptable levels. By comparing the tables above with those included in the previous section under the No Action Alternative, you can see a clear improvement (reduction) in stand mortality as a result of the proposed actions. This reduction in mortality is a direct result of the change in growing conditions. Improving the growing condition for dominant and codominant hardwoods, as well as increasing spacing between residual trees, is the overall goal for fuels reduction and fire effects.

Following initial thinning treatments of strategic features and priority treatment areas, an improved, reduced fuel load dynamic should allow for a reduction in potential negative fire effects. Lower flame lengths, lower fire intensities and shorter residence burning time should lead to a reduction in dominant tree mortality. Although a main objective is to create a patch-style landscape in order to increase heterogeneity, this condition would be dictated by site-specific conditions as well as associated harvest actions.

Various research supports this restorative type treatment by summarizing: a reasonable start is to put forest and woodland landscapes on a path to successional patterns and disturbance dynamics that reflect the natural disturbance regimes of regional and local landscapes (Swetnam et al. 1999, Keane et al. 2009, Wiens et al. 2012), and allow the future climate to adapt them. To place landscapes on this path, pattern modifications across scales would be needed in areas where past management alterations are greatest (Hessburg et al. 2015).

Treatment units in this project can be generally described as a timber-understory fuel type model (TU) or a timber litter fuel type model (TL) with mixtures of a timber shrub (SH) component. These are fuel type model descriptions used in the Behave fire-modeling program. The primary carrier of fire in the TU fuel models is forest litter in combination with herbaceous or shrub fuels. The primary carrier of fire in the TL fuel models is dead and down woody fuel. Live fuel, if present, has little effect on fire behavior. The effect of live herbaceous moisture content on spread rate and intensity is strong and depends on the relative amount of grass and shrub load in the fuel model (Scott and Burgan 2005).

The following fuel models were chosen to represent the project areas:

- TU5 (165) – Very high Load, Dry Climate Timber-Shrub
- TL3 (183) – Moderate Load Conifer Litter

Fuel model TU5 is probably most common currently on the project area landscapes; however, some stands represent fuel models TL3 as they have larger trees on the landscape. A note should be made however, in that a percentage of stands depicting TL fuel models also have a percentage of TU fuel model since they have not been maintained in quite a long time. This assumption would go into the fire behavior modeling and would change in time with pre and post treatments.

In general, a fuel model of TU3 has less fuel than fuel model TU5. This numerical relationship of fuel loading exists throughout the different fuel model classes. For the project area, TU5 was chosen for its representation of understory fuels while TL3 was chosen for its representation of timber characteristics. As treatments occur over time, these fuel models are anticipated to transition to lower fuel model representations but for initial treatment modeling, a reduction in understory fuels was the only depicted change.

The following tables (Table 3-10 and Table 3-11) demonstrate the potential changes in fire behavior potential in stands as compared to current fire behavior shown in Table 3-4 and Table 3-5. Stands in the project area were shown to have a combination of fuel models (both TU and TL). For the initial pre-treatment model, it was estimated that 60 percent of the stand represented TU5 and 40 percent of the stand represented TL3. This assumption remained for the post treatment model but the shrub fuel model was changed from TU5 to TU2 as it is expected that there would be a reduction in fuel loading following initial treatment. The fuel model changes in composition predicted to occur through thinning and burning treatments (pre- and post-treatments are shown) were developed utilizing the program BehavePlus 5.0.4.

Table 3-10. Current fuel conditions in a representative previously managed stand (pre-treatment).

TU5 (60% of unit) and TL3 Fuel Model – Modeled Under 90th Percentile Conditions	
Model Criteria	**Model Output**
Surface Rate of Spread (chains/hour)	6.7
Flame Length (ft.)	7.6
Surface Intensity (Btu/ft./sec)	84
Transition to Crown Fire?	Yes
Fire Type	Torching

Table 3-11. Future stand condition following thinning and burning treatments (post-treatment).

TU2 (60% of unit) and TL3 Fuel Model – Modeled Under 90th Percentile Conditions	
Model Criteria	**Model Output**
Surface Rate of Spread (chains/hour)	7.3
Flame Length (ft.)	3.4
Surface Intensity (Btu/ft./sec)	84
Transition to Crown Fire?	No
Fire Type	Surface

As described previously, the fuel models are anticipated to transition from higher fuel loading (TU5) to lower fuel loading (TU2) and a reduction in potential fire behavior can be seen in the associated tables. The model predicted that flame lengths would be reduced by half and that the associated fire type would change “torching with a potential transition to crown fire” to “surface fire with no crown fire transition”. The potential surface rate of spread is depicted to be slightly higher than the current fuel model depiction (possibly due to a small shift in ground fuels) but the overall point to capture is the predicted reduction in associated potential flame lengths.

Treatment units adjacent to private property would be assessed for needs on the landscape and would receive acceptable levels of fuel reduction through either hand piling and burning of fuels, understory burning or both. These communities would become more fire resilient through years of thinning and prescribed burning treatments. Additionally, the roadside access/egress conditions would improve site visibility allowing safer passage as well as minimizing the potential for accidental roadside ignitions. Ridgetop connected treatments should also reduce the risk of wildfire crossing readily over those features and modify fire behavior over the broader landscape.

Overall, large areas would be treated to provide “modified” shaded fuelbreaks[23] and defensible fuels profiles near key transportation corridors and within the zones of the WUI/intermix. By decreasing fuel ladders and reducing surface fuels, forest floors would be converted from ones that produce moderate-high fire behavior to ones that produce moderate-low fire behavior.

[23] .A modified shaded fuelbreak is defined as a defensible location, where ground and ladder fuels have been modified, that can be used by fire suppression resources to suppress oncoming wildfires.

Fire Suppression

The Proposed Action aims to reduce ladder fuels, which in turn increases canopy base heights. Canopy densities would be decreased through thinning activities and to a potentially noticeable extent, a reduction in fuel ladders would also occur through the same activities. These, in combination, would help to reduce rates of spread, flame length, fireline intensity, resistance to control and the potential for a ground fire to transition into a crown fire. The reduction in fire behavior indicators would occur over time and through multiple entries as the fuel models transition following thinning and burning by improving the resiliency of stands to large-scale crown fires (North et al. 2012).

If full fire suppression continues as the management strategy for unplanned ignitions within the project area, fire suppression resources would have an increased ability to control fires at initial attack with minimal risk to their safety and the public. Through the assignment of treatment activities, reduced fire severities should occur in the project areas increasing abilities to keep fires small with the use of direct attack or fire managers should be able to allow the fires to burn under appropriate conditions to strategic control areas. Decisions on how to manage a wildfire scenario are always made by determining the associated values at risk. The values at risk in an area associated with the protection of life, property and natural resources. A component that this project integrates is the assignment of thinning actions in order to develop strategic control features associated with values at risk.

By developing strategic control features, an additional level of consideration should be given to incident commanders when it comes to their decision process regarding suppression. Although there is widespread recognition to restore fire process on the landscapes, this concept is always a condition of associated values at risk such as private property infrastructure or other sensitive features that may dictate some form of suppression. Depending on the local values at risk, full suppression may always be the needed tactic when it comes to wildfire adjacent to private property.

Under this alternative, treatments are targeted to break up the horizontal and vertical continuity of live fuels to reduce the abundance of ladder fuels. By altering fuel continuity, elements intended to build resiliency to large-scale uncharacteristic wildfires can become restored on the landscapes. Through time as stands are manipulated to represent different characteristics, concepts of modified suppression tactics could more safely be employed by fire managers. These tactics could include utilizing a wildfire confinement strategy more often in times of unplanned ignitions. This strategy is widely utilized as a management option in certain areas (sometimes including the KNF and SRNF), however following treatments included in the Proposed Action, landscapes would be better prepared to show lower amounts of uncharacteristically high intensity fire effects during unplanned ignitions. In effect, treating stands on the landscape would more readily allow wildfire to burn to control features with minimal suppression activities utilizing more of a confinement strategy and allowing wildfire to act as an ecological process should not defer risk in the future, which often occurs under full fire suppression management.

Cumulative Effects

When considering the potential cumulative effects of the project, it would be most beneficial to think in terms of net value change. Actions associated with proposed treatments may pose a few temporary risks in the short term, however these short term risks are far offset by the anticipated long-term gains following implementation. While the main anticipated direct effect is a positive in terms of aiming to reduce fire hazard risk by performing strategic fuel reduction activities and lowering fire behavior characteristics, some of the potential short-term indirect effects could be seen as negative effects. However, by conducting multiple treatments on landscapes and providing for a recurrence of prescribed fire, indications are that there would be a positive net value change over time. Another measure of success for recognizing positive change in the reduction of basal area mortality would be the observation of increased growth for dominant hardwoods or developing hardwoods as well as the increase in habitat elements for multiple species.

Small diameter basal mortality is the main negative cumulative effect pertaining to prescribed burning. This may be most evident along roadways and near private property. Although through conducting thinning actions prior to understory burning, we should be able to limit the frequency of these and create a better visual product. Thinning actions after prescribed fire entries may also be able to mitigate this visual effect. Fire-killed leaves and needles are a short-term visual indicator of mortality; however, in a one-year period following the entry, these fall to the ground lessening the visual effect.

Thinning action prescriptions that were developed focused on the improvement of living and breeding conditions for multiple species. The main goal is to reduce the fire hazard threat that currently exists while recognizing multiple habitats of species to improve. Limited operating periods for several endangered, threatened, or sensitive species should ensure that thinning and prescribed burning operations do not negatively impact reproductive seasons. Additionally, burn plan language would give clear resource and prescribed fire objectives to ensure that implementation actions would minimize resource concern elements.

Although smoke production from prescribed fires is very temporary in nature and light in duration compared to wildfire smoke (lasting a period of hours or days), it still can be a nuisance to those in close proximity. Prior to and during the implementation of burning, it is anticipated that smoke management techniques would be utilized in order to minimize emissions as much as possible. These techniques may include only burning concentrations of fuels in an area as an initial action, isolating fuels that may smolder for long periods, mosaic burning in areas of non-continuous fuels and/or mechanical removal of fuels (USDA Forest Service 2001).

Smoke production can become a limiting factor to achieve project accomplishment as air quality regulations exist which limit the amount of smoke that can be produced daily, however this may be more of a factor when multiple projects are going on simultaneously throughout the air basin. Long-term success for this project may lie in our ability to scale up during times of implementation and following initial entries, we should be able to achieve larger scale burning according to our strategic feature location designations. Additionally, burn plan development would also include language on how to reduce smoke emissions, identify sensitive smoke receptors for notification purposes or indicate favorable wind directions for smoke transport. While this effect can be a localized impact, it would be very important to consider its cumulative nature and address all potential impacts accordingly. Prior to the implementation of thinning activities, adjacent landowners should also be notified prior to activity and an implementation plan would be developed to address this process.

In consideration of additional projects within the project area boundaries, as well as those just outside of the project boundaries, this project is a direct compliment to other efforts. There is a recognition that fire danger exists well beyond the project boundaries (as well as on private inholdings) and providing for a connectivity of fuels reduction treatments aims to address that issue. Working across jurisdictional boundaries achieves the greater goal of the WKRP as well as aiming to achieve goals within the Cohesive Strategy.

By initially developing strategic fire control features of private property thinning, ridgeline fuelbreak construction and careful assessment of high fuel loading condition, we should be able to return fire successfully to the project areas. Once first-entry treatments of fire have occurred, second and third entry treatments may occur at larger scales due to previous reductions in fuel loading and decreased tree densities as well as the multiple established control line placement.

A key component to the success of this project would be monitoring effectiveness of actions following treatments. There can be a fine balance between too much action on the land and too little. Adapting our actions and learning to control the intensities of our actions should lead us to be able to better interpret long-range effects and outcomes. Through recognizing our need to have adaptive management on certain landscapes, we should be successful in finding an appropriate balance of cumulative effects for the project.

Lastly, one potential hurdle for this project may be the ability to accomplish large acreages of burning and the amount of smoke production, which may ensue. Landscapes in the project areas have not burned in roughly 100 years and returning the fire process must be well planned and thought out to ensure desired effects are achieved. Project treatment areas were developed to be of the smaller scale (averaging around 40 acres in size) but the scale of the project may make it difficult to accomplish in a reasonable timeframe unless some larger acreage is accomplished annually.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Project related fuels activities would adhere to all applicable relevant state and federal laws and associated provisions such as the Clean Air Act[24] and Clean Water Act[25].

All project related fuels activities would adhere to management direction standards and guidelines (S&Gs) provided within the KNF LRMP[26] including actions associated within specific management areas.

All prescribed fire activities would be conducted in accordance under federal policy direction provided within the Forest Service Manual (FSM)[27].

Vegetation

Introduction

The Proposed Action plans to increase landscape heterogeneity by management of topographically-driven treatment units and stand-level heterogeneity by integrating openings and retention patches into

[24] Including provisions of the Clean Air Act, California's Title 17.
[25] In accordance with requirements of the Regional Water Quality Control Board, North Coast Region.
[26] Klamath LRMP Forestwide Management Direction Chapter 4 (22-10 through 22-24).
[27] FSM 5100, Chapter 5140.

commercial thinning operations, in a way that would mimic patterns created by wildland fires (Hessburg et al. 2016; North and Sherlock 2012; Sherlock 2007). In addition, the Proposed Action calls for thinning from below (thinning smallest trees in a stand), both manually and mechanically; thinning throughout the diameter classes (with the exception of predominant and dominant trees), mainly mechanically, but also using mastication in young plantations; pile burning and the use of prescribed fire.

Thinning from below increases the residual size of trees left in a stand (Agee and Skinner 2005; Smith et al. 1997). In general, larger trees have thicker bark, and are therefore more fire resilient than smaller trees. Thinning, whether from below or throughout the diameter classes (with the exception of predominant and dominant trees), increases spacing and reduces stand densities, resulting in less inter-tree competition, which increases individual tree vigor, resulting in stands that are more resilient to insects, disease, wildland fire, and drought (Agee and Skinner 2005; Fettig et al. 2007; Hessburg et al. 2016; van Mantgem et al. 2009; Vernon 2017).

From a silvicultural standpoint, the Proposed Action would have many benefits to project area and human environment. These include: 1) reducing stand densities and increasing the average tree size of residual trees, which, 2) increases tree health and vigor as well as insect, disease, drought and wildland fire resiliency; 3) maintaining and enhancing existing structural and compositional diversity; 4) increasing heterogeneity at the stand scale as well as at the landscape scale; and 5) increasing availability of a wide-variety of forest resources for humans, plants, and wildlife.

The No Action Alternative would leave the project area in a continued state of overstocking and generally stagnant stand conditions in which the landscape is highly vulnerable to disturbance agents such as insects, disease, wildland fire, and drought. Fire suppression has resulted in uncharacteristically dense stands of continuous of conifer dominated forests across the landscape that are not commonly talked about in the oral histories of the area. Therefore, the No Action Alternative is not within the guidance and direction of the KNF LRMP or the Katimiin MOU.

Affected Environment

Approximately 26 percent (1,467 acres) of the project area consists of stands that were established after a previous regeneration harvest (clearcut) (Table 3-12). The Proposed Action proposal calls for commercial thinning of just under half (652 acres) of these stands, otherwise known as plantations (Table 3-13).

Table 3-12. Acres of managed stands by date of plantation establishment within each focal area.

Focal Area	1960-1969	1970-1979	1980-1989	1990-1999	Total Acres
Rogers	36	135	104	–	274
Ti Bar	81	35	14	8	137
Patterson	154	71	143	31	399
Donahue	345	44	267	–	656
Totals	***616***	***284***	***528***	***39***	***1,467***

Table 3-13. Acres of managed stands by date of plantation establishment by Proposed Action treatment type.

Treatment	1960-1969	1970-1979	1980-1989	1990-1999	Total Acres
Mechanical, Manual, Rx Burn	380	113	158	1	652
Mastication, Manual, Rx Burn	30	–	126	31	187
Manual, Rx Burn	162	126	199	6	495
Rx Burn	44	45	44	–	133
Totals	***616***	***284***	***528***	***39***	***1,467***

An additional 797 acres (14 percent) of the project area has had some previous silviculture activity (usually commercial or pre-commercial thinning). Approximately half (416 acres) of this area is proposed for commercial thinning (followed by manual fuels reduction and prescribed burning), and the remaining would be treated by manual fuels reduction followed by prescribed fire (379 acres) or prescribed fire only (2 acres). The remaining project area (59 percent) has no previous silvicultural activity, of which 157 acres are considered for commercial thinning (followed by manual fuels reduction and prescribed burning) under the Proposed Action. The majority (1,778 acres) would be treated with manual fuels reduction followed by prescribed fire, or prescribed fire only (1,356 acres).

Certain species of trees are of particular interest to the WKRP collaborative and the Karuk Tribe, including deciduous hardwoods such as Oregon white oak, California black oak, certain evergreen hardwoods such as large acorn-producing tanoaks, large nut-producing giant golden chinquapin, large madrones, sugar pines, and the few scattered ponderosa pine. The majority of these tree species are considered early seral trees that are either fire-dependent or enhanced by fire. This is also reflected in their lower tolerance for dense stand conditions compared to Douglas-fir and white fir, which quickly crowd, overtop, and eventually kill many of these tree species in the absence of disturbance (Hunter and Barbour 2001). There is extensive cultural, archeological, and scientific evidence that healthy, mature individuals of these tree species were present in much higher numbers within the project area than they are today prior to the occupation of these lands by Europeans and the subsequent establishment of the National Forest System (NFS) and fire suppression policy (Taylor and Skinner 2003; North et al. 2007; Crawford et al. 2015).

The collaborators in WKRP are committed at a basic level towards moving this landscape towards a condition where fire can be reintroduced as a management tool and a process, and restoring ecosystem function, among other goals. In order to accomplish these goals, stand densities need to be reduced to allow prescribed fire to move through plantations under desired conditions; the size of residual trees need to be enhanced to increase resilience in the case of moderate to high intensity wildfire; and the proportion of ecologically functional hardwoods need to be enhanced because of their unique adaptations to fire, including ability to re-sprout following severe wildfire (Cocking et al. 2012). To support total ecosystem function, a variety of stand conditions are needed, including patches of early-seral-like/open conditions as well as dense patches of conifers, conditions that support a wide-array of conifer and hardwood species. Given current conditions, silvicultural tools are critical to achieving collaborator goals of stand-level and landscape level heterogeneity and fire resilience, especially considering the length of time since the establishment of fire suppression (shade-tolerant encroaching conifers have now reached sizes that are not possible to thin using manual fuels reduction and/or prescribed fire) and level of surface and ladder fuels that has accumulated over this time period.

Stand density index (SDI) is an established (Reineke 1933) measure of stand-level inner tree competition. Designed to measure competition in even-aged, single-species conditions, it is used widely by forest growth models to describe how stand density affects stand development and growth even in uneven aged and mixed stand conditions. The average size of trees in a stand can be looked at and assessed in terms of quadratic mean diameter (QMD) and how it changes through time. Looking at the percentage of basal area (BA) that is predicted to die as a result of a wildland fire under severe conditions, is a good direct indicator of forest resiliency. Therefore, reducing SDI, increasing the QMD, and decreasing the proportion of BA that is predicted to die in a severe wildland fire scenario in and across stands, are cause and effect indicators necessary to inform the decision.

Environmental Consequences

Methodology

Stand level data was collected during the summers of 2015 and 2016, in partnership with the Mid Klamath Watershed Council (MKWC) and the Karuk Tribe. Because of the large scale of the project, it was not feasible to collect stand level data for every stand in the project. The project area was stratified into 10 stand types based on management history, age/size class, and solar insulation. Representative stands from each strata were sampled. The larger the proportion of the area in a strata, the more plots were measured, with more preference given to those strata which contained stands that were most likely to receive mechanical treatment. No one strata had less than four (4) stands or more than ten stands sampled. In total, 71 stands were selected for individual examinations, approximately 25 percent of the total stands identified.

All stand exams were conducted using the Common Stand Exam protocol. Both the Proposed Action and the No Action alternatives were analyzed using the Forest Vegetation Simulator (FVS), with the “Klamath Mountain Variant,” were used to evaluate the effects of time and treatments on vegetation over the next 50 years, starting in 2017. The Fire and Fuels Extension (FFE) of this model was used to predict potential fire behavior and fire effects to vegetation over the next 50 years, starting in 2017.

As with any model, FVS/FFE needs to be used with caution and an understanding of its limitations and modeling assumptions. This model is not intended to provide absolute values for a particular set of circumstances, but is intended to provide valuable information for meaningful comparisons of alternatives. To simplify the display of analysis outputs, proposed treatment units have been broadly grouped according to their management history, proposed treatment type and whether or not they involve commercial thinning. There are eight general groupings presented and the corresponding initial entry identification as shown on the Proposed Action maps:

1. Managed stands with commercial timber and no significant pine component (1a)
2. Managed stands with commercial timber and a significant pine component (1b)
3. Natural stands with commercial timber (2)

4. Managed stands with manual treatment (4a)
5. Natural stands with manual treatment (4b)
6. Managed stands with mastication (3)
7. Managed stands with prescribed fire only (5a)
8. Natural stands with prescribed fire only (5a)

It is important to point out that there is considerable variation between the individual stands/units in each grouping specified above. Stands that were regenerated (clear-cut) are called *managed stands*, and even those natural stands that have had previous thinning, are called *natural stands*. A previously thinned natural stand has more in common with the structural characteristics of a natural stand with no management, than with a managed stand, sometimes also called a *plantation*. Therefore, when reviewing the analysis outputs for any of these groupings one should realize that the numbers are averages for the entire grouping.

For the No Action Alternative, stand development and changes through time were modeled with no vegetative manipulations during the entire modeling period (2017-2067). For the Proposed Action, stand development and changes through time were modeled with the called for vegetative manipulations during the modeling period (2017-2067). For all groupings of stands, two prescribed fires were simulated, in 2027 and 2037; 2020 and 2027; or 2022 and 2030, depending on the prescription category (Table 3-14). Prescribed fires were modeled using 50th-percentile conditions (fuel moisture values, temperature, and wind speed) from nearby weather stations. Basal area mortality was also modeled from a severe wildfire event that could occur in any year. The basal area mortality graphs shown below display the result if a severe wildfire were to occur in any of the years displayed. Ninety-seventh (97th) percentile conditions (fuel moisture values, temperature, and wind speed) from nearby weather stations were used in the wildfire simulations. See Table 3-14 for the complete set of dates of simulated treatments used in the FVS runs.

Table 3-14. Year of activities modeled by FVS within each stand group.

Stand Grouping	Commercial Thinning	Mastication	Manual Fuels Reduction	Pile Burning	Understory Burning
Managed stands with commercial timber, no significant pine	2020	NA	NA	NA	2027 & 2037
Managed stands with commercial timber, with significant pine	2020	NA	NA	NA	2027 & 2037
Managed stands with mastication	NA	2018	2019	2023	2027 & 2037
Managed stands with manual treatment	NA	NA	2018	2019	2020 & 2027
Managed stands with prescribed fire only	NA	NA	NA	NA	2022 & 2030
Natural stands with commercial timber	2020	NA	NA	NA	2022 & 2030
Natural stands with manual treatment	NA	NA	2018	2019	2022 & 2030
Natural stands with prescribed fire only	NA	NA	NA	NA	2022 & 2030

Alternative 1 – No Action

Direct and Indirect Effects

No direct effects would occur in choosing the No Action Alternative. All of the treatment groups presented start in 2017 with an SDI around 80 percent of the maximum for the site species, which is most commonly dominated by Douglas-fir, and do not change much through the 50-year modeling period (Figure 3-6 through Figure 3-13). Once a stand reaches 55 percent of the maximum SDI, the stand enters the ‘zone of self-thinning’ (Reineke 1933, Smith et al. 1997). At this level of inter-tree competition, trees in the stand compete heavily for light and resources, resulting in stressed trees and increased rates of mortality, which also results in increased surface fuel loading. This stage of stand development often lasts a century or longer (Oliver and Larson 1996). In mixed-severity fire regime ecosystems such as the Klamath Mountains, regular fire occurrence plays a role in maintaining appropriate forest densities and patch sizes during this period (Hessburg et al. 2016). However, little to no fire has occurred within our project area in the last century or longer, leading to the uniformly dense conditions present in these stands today.

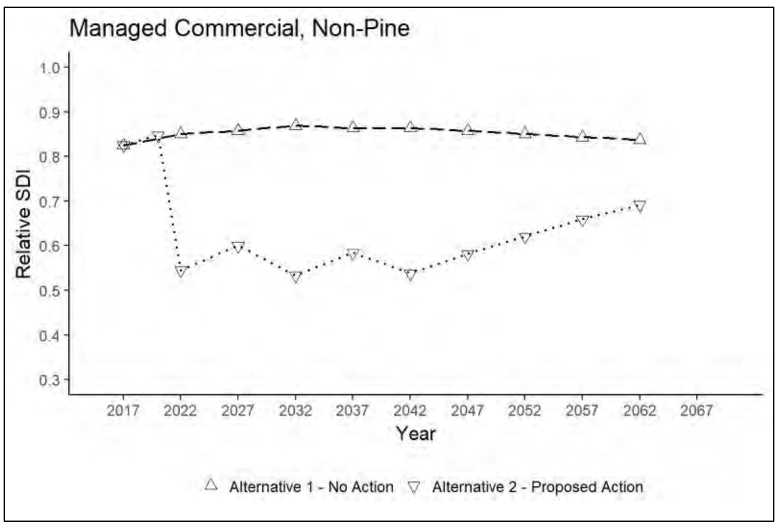

Figure 3-6. Current and predicted percent SDI in plantations.

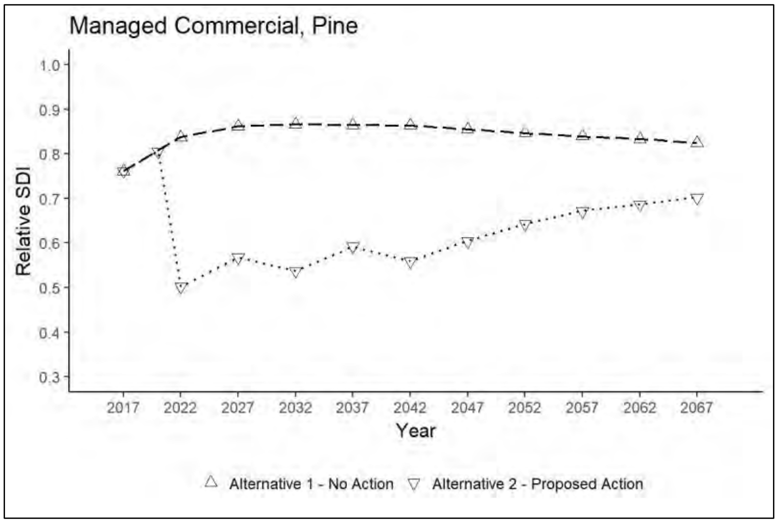

Figure 3-7. Current and predicted percent SDI in natural stands.

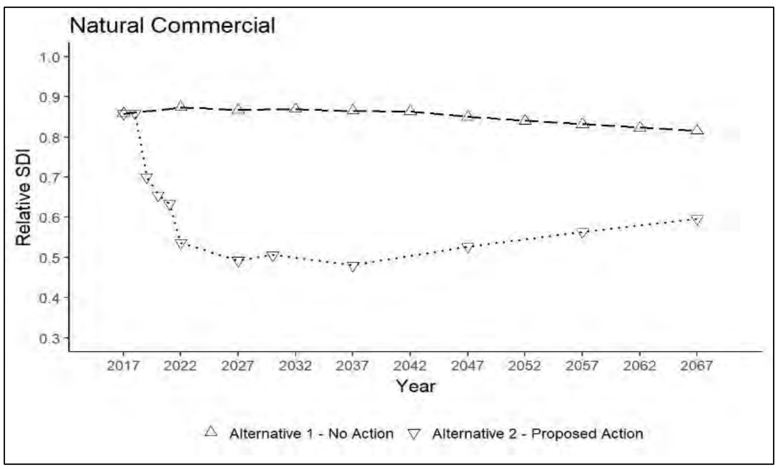

Figure 3-8. Current and predicted percent SDI in natural stands.

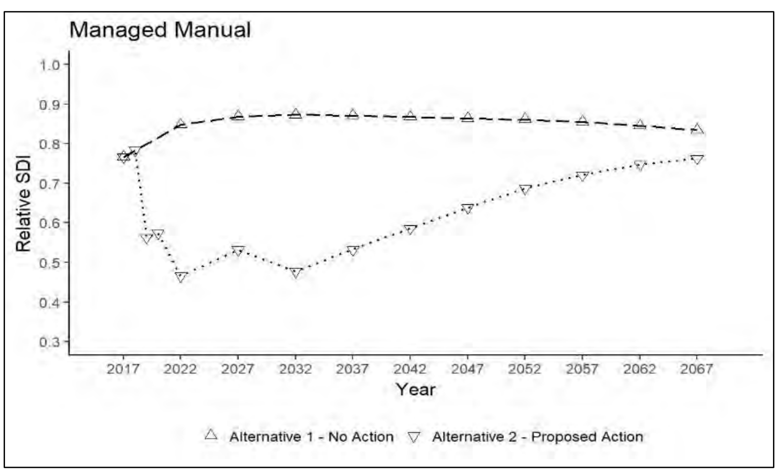

Figure 3-9. Current and predicted percent SDI in plantations.

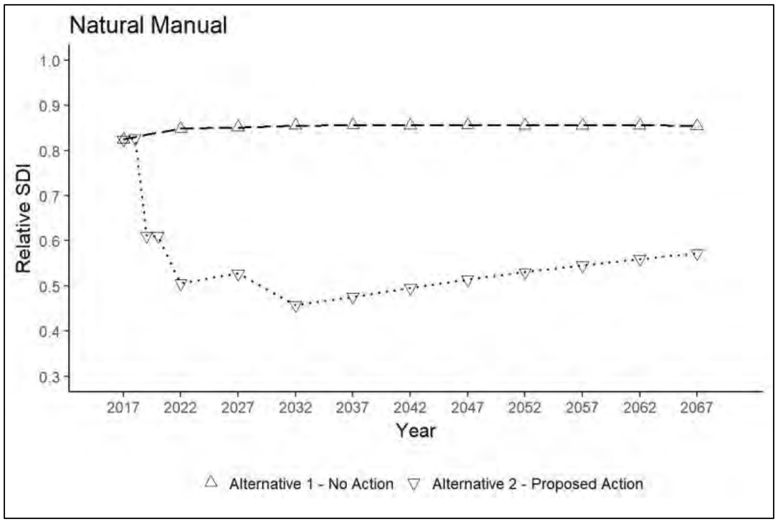

Figure 3-10. Current and predicted percent SDI in natural stands.

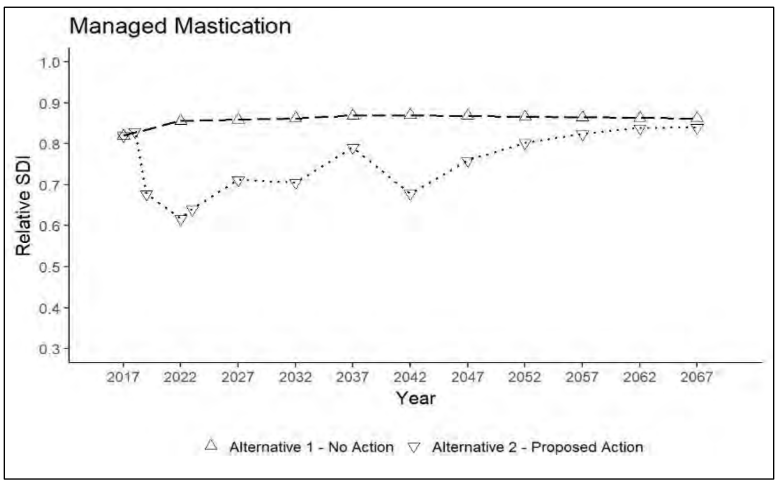

Figure 3-11. Current and predicted percent SDI in plantations.

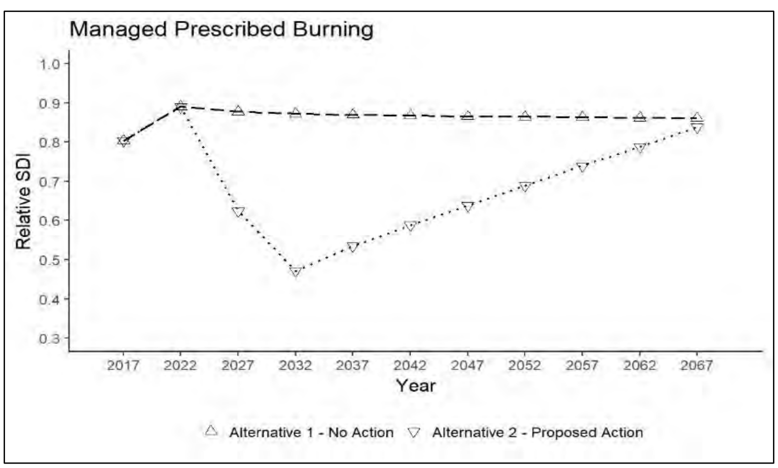

Figure 3-12. Current and predicted percent SDI in plantations.

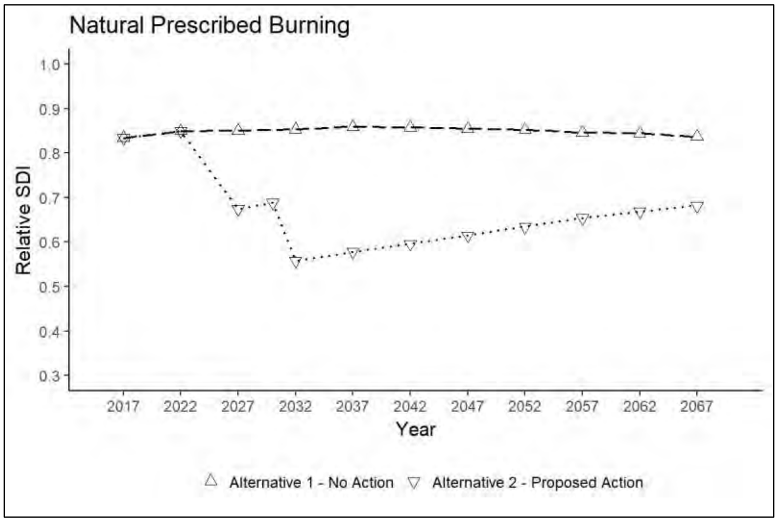

Figure 3-13. Current and predicted percent SDI in natural stands.

With currently high stand densities throughout the project area comes increased susceptibility to damage and mortality resulting from such stressors as insects, disease, fire, and drought (Agee and Skinner 2005, Condeso and Meentemeyer 2007, Fettig et al. 2007, Vernon 2017). Many trees are currently experiencing high levels of competition for soil moisture, nutrients, and available light. Natural self-thinning is occurring to some degree in almost every stand of the proposed project, and additional stressors can trigger pulses of significantly increased mortality. The SDI graphs illustrate the high levels of stand density and inter tree competition that is present in all of the treatment groups. Note these graphs show the maximum SDI in relation to species present, which is most often dominated by Douglas-fir. Species such as Ponderosa pine, sugar pine, and especially black oak and white oak, have even lower tolerance for stand density than Douglas-fir.

The No Action Alternative keeps stands along their current trajectory of being vulnerable to significant mortality during a wildland fire under severe conditions (Figure 3-14 through Figure 3-21). The fact that few of the graphs show a complete loss of basal area if wildfire occurs at any of the shown dates is because the model runs are based on averages across groups of stands, as opposed to individual stands themselves. Some stands would suffer stand replacing wildland fire under severe conditions; however, when taken into consideration and averaged across the proposed project area, these figures show that we do not expect uniform high severity fire effects across the landscape after a wildland event under severe, 97th-percentile conditions. Perhaps unsurprisingly, the brushiest managed stands are currently at the highest risk of significant mortality in these conditions (Figure 3-19). When evaluating the results of these fire simulations, it is also important to note that the project takes place on some of the more gentle slopes in the Klamath Mountains, as the project is centered on communities along the lower middle Klamath. More severe fire effects would be expected on steeper slopes typical of the Klamath Mountains, including in areas adjacent to the project area.

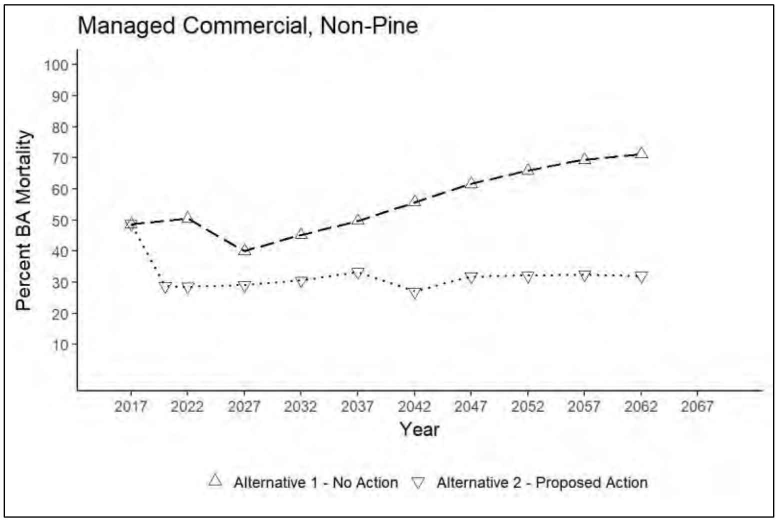

Figure 3-14. Current and predicted BA mortality in plantations.

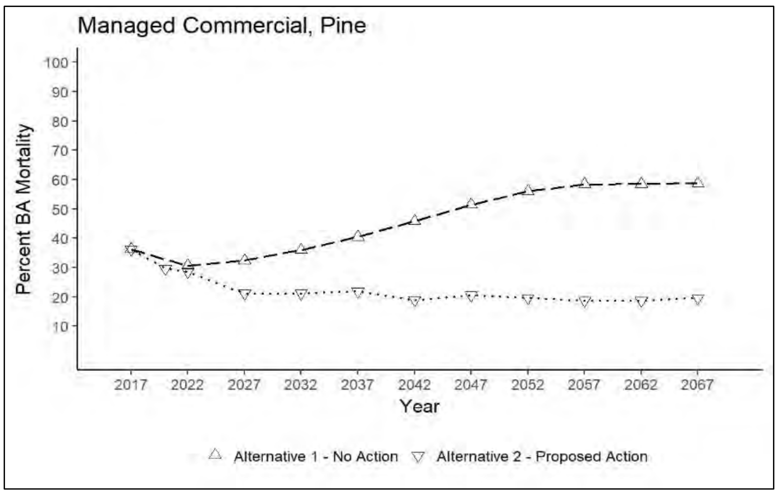

Figure 3-15. Current and predicted BA mortality in plantations.

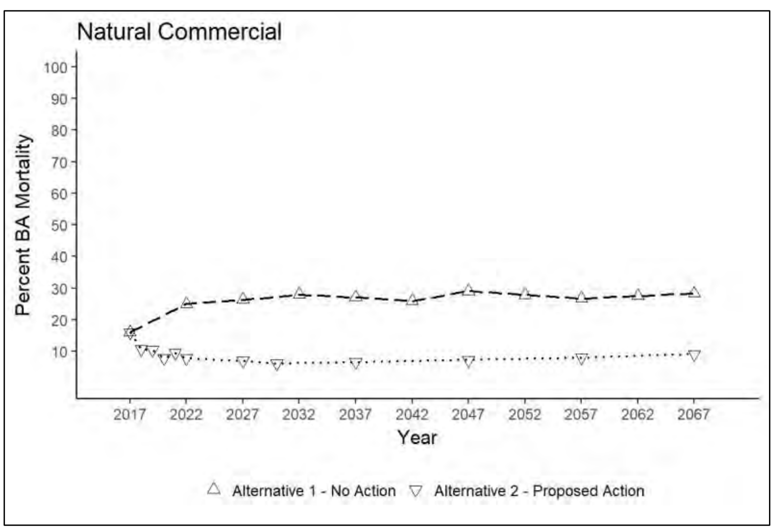

Figure 3-16. Current and predicted BA mortality in natural stands.

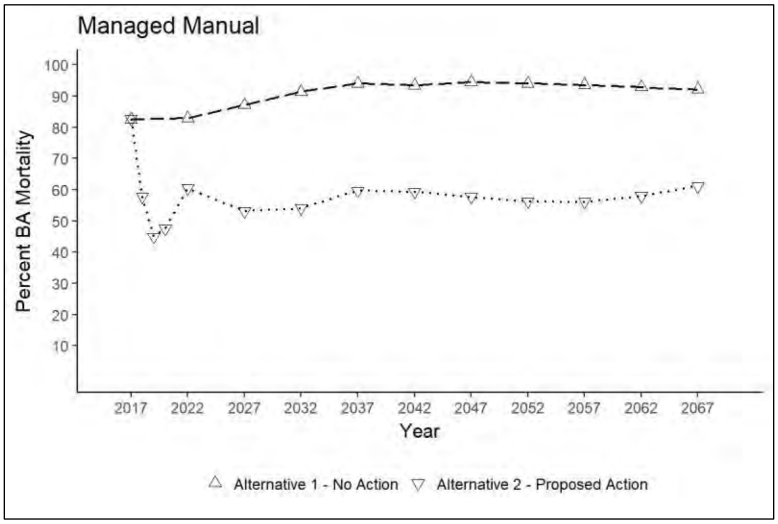

Figure 3-17. Current and predicted BA mortality in plantations.

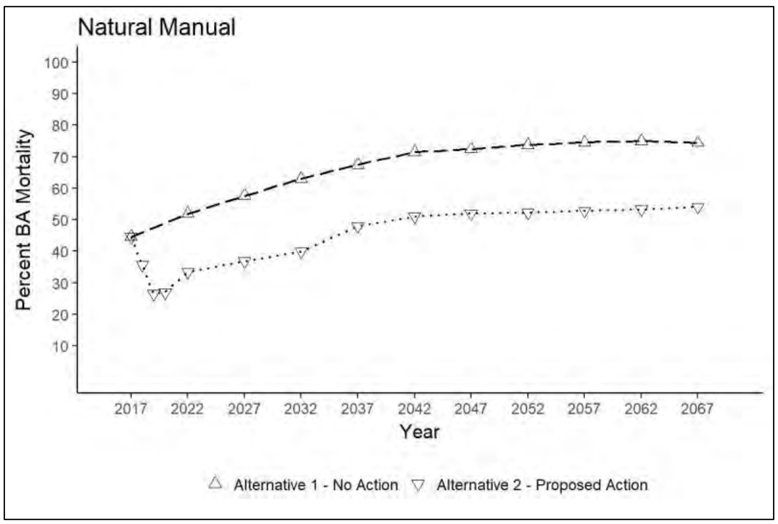

Figure 3-18. Current and predicted BA mortality in natural stands.

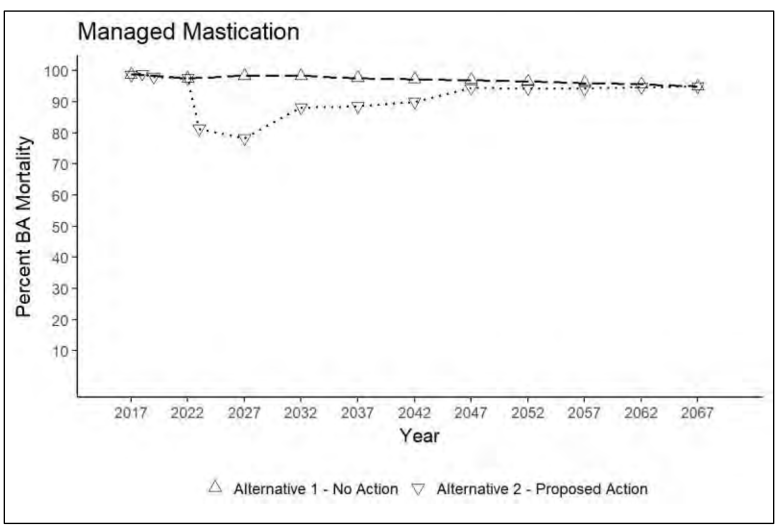

Figure 3-19. Current and predicted BA mortality in plantations.

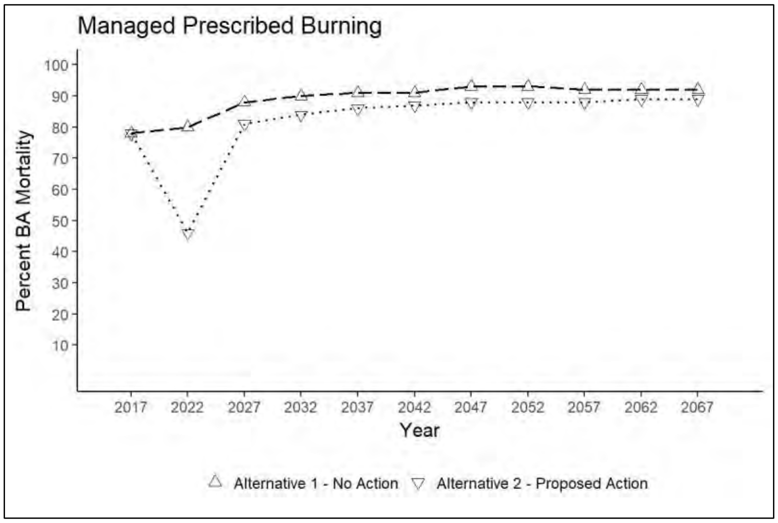

Figure 3-20. Current and predicted BA mortality in plantations.

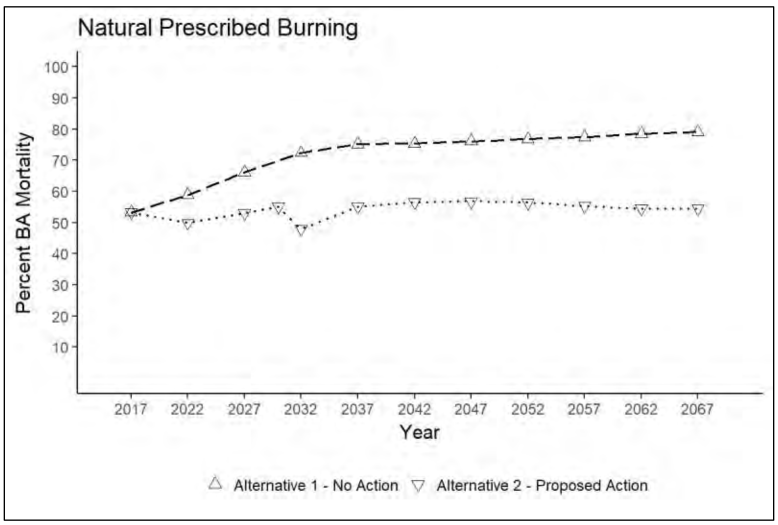

Figure 3-21. Current and predicted BA mortality in natural stands.

It is noteworthy to point out that natural stands planned for commercial treatment show the lowest potential basal area loss under severe conditions (Figure 3-16). Those stands that are proposed for commercial thinning under the action alternative, have almost all been previously thinned from below, and therefore have a dense overstory canopy and very high canopy base height. The dense overstory has kept the ingrowth of brush to a minimum. However, these units are planned for site-specific treatment aimed at maintaining and enhancing trees of interest that are critical TEK resources and require less shade and more growing space. To no one's surprise, young plantations are highly vulnerable to significant basal area loss in a wildland fire under severe conditions, and continue along that trajectory through time until stand densities are altered through some sort of disturbance (Figure 3-17, Figure 3-19 and Figure 3-20).

Cumulative Effects

Under the No Action Alternative, the only way that stand density would be affected is though disturbance such as insects, disease, wildland fire, snow down events, or drought. These disturbance events are inevitable, though management actions can lower the probability of widespread severe impacts from these events. Fire is a natural part of the ecosystem in the Klamath Mountains, and one look at the fire history of the area shows that it is just a matter of when a wildland fire would occur, not if. Under the no action alternative, a wildland fire under severe conditions could significantly alter the project area in terms of structure and composition, with stand replacing fire in many stands being a real possibility, as has occurred in recent years during wildfires in August.

Within the project area, there is already evidence of bark beetle activity. Western pine beetles (*Dendroctonus brevicomis*) were observed in plantations with a significant pine component in both the Ti Bar area and in Donahue. Given current and future SDI predictions under the no action alternative (see Figure 3-7) it is highly likely, if not inevitable, that we would see significant mortality associated with a bark beetle outbreak similar to what recently occurred in the Sierra Nevada Mountains.

Due to the high stand densities within managed stands and several recent years of lower than normal spring precipitation, conditions have been ideal for the spread and intensification of black stain root disease (*Leptographium wageneri*) by stressing the Douglas-fir trees and increasing insect vector abundance and activity (Angwin 2003). Increasing levels of black stain activity have been observed in plantations over the last 10 years. Under the No Action Alternative, the levels of moisture stress in Douglas-fir trees would continue to be high and this disease would continue to kill Douglas-fir trees on the edges of existing and newly established root disease centers. Because the local variety of this disease only affects Douglas-fir trees, and because there are many hardwood trees and occasionally other conifer species present, the cumulative effects from this disease in terms of future canopy cover, relative stand density, opening sizes, etc., would be insignificant.

Alternative 2 – Proposed Action

Direct Effects

The Proposed Action would directly affect the size and density of stands throughout the project area by lowering the SDI (Figure 3-6 through Figure 3-13) and increasing the QMD (Figure 3-22 through Figure 3-29). The only treatment groups with a lower QMD overtime under the Proposed Action compared with No Action are managed stands that are to only be treated with prescribed fire and managed stands that are to be treated with mastication (Figure 3-27 and Figure 3-28). This is due to fact that in such small, dense stands, prescribed fire would kill trees in all diameter classes. If manual treatments were to be applied before the prescribed burning, those numbers would more closely resemble those seen in the managed manual stand group (Figure 3-25). Mastication also eliminates some larger trees; though none of the existing trees in these stands are very large (these are very young, brushy plantations). Although only the initial sequence of treatments proposed under this project were modeled, these figures illustrate the need for future management activities to maintain healthy stand densities and to continue to increase the residual size of trees through time, especially in managed stands.

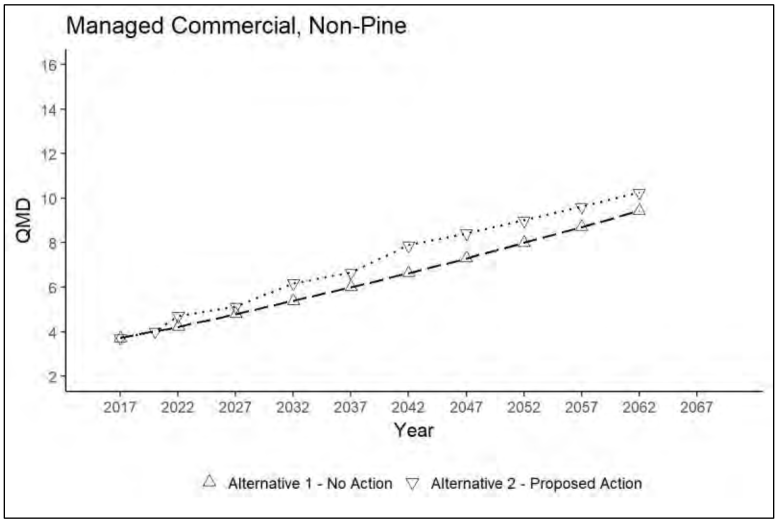

Figure 3-22. Current and predicted QMD (inches) in plantations.

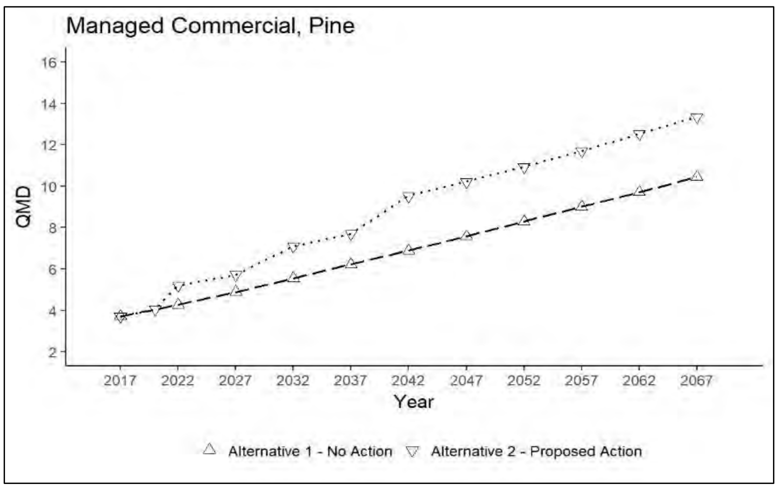

Figure 3-23. Current and predicted QMD (inches) in plantations.

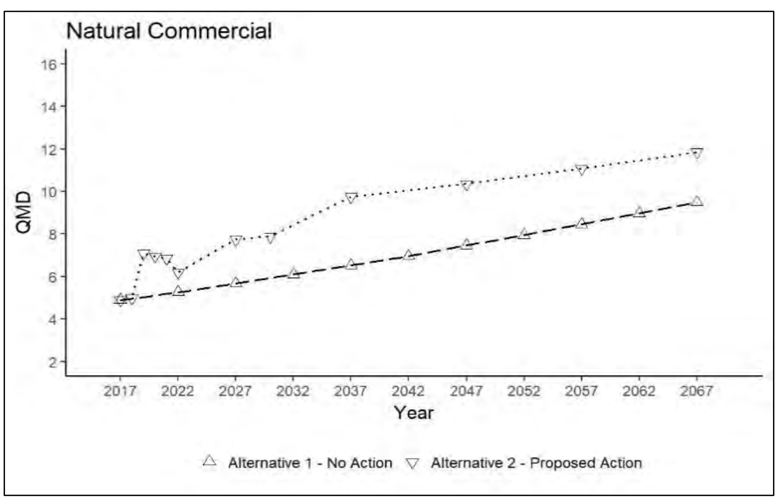

Figure 3-24. Current and predicted QMD (inches) in natural stands.

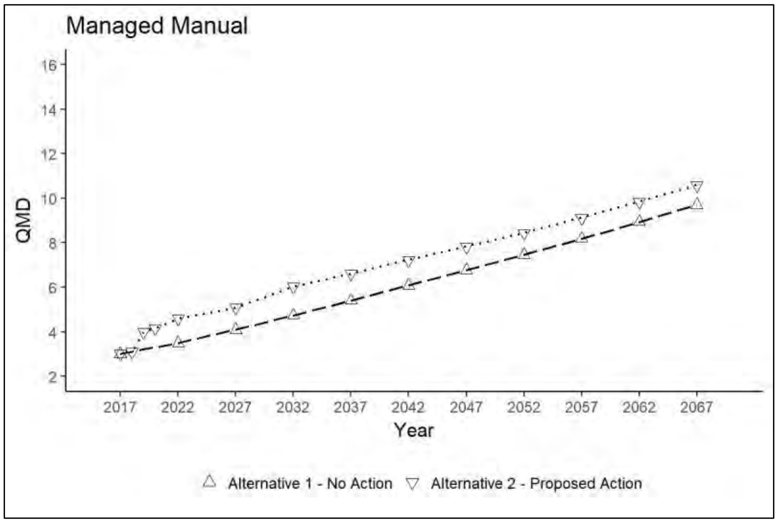

Figure 3-25. Current and predicted QMD (inches) plantations.

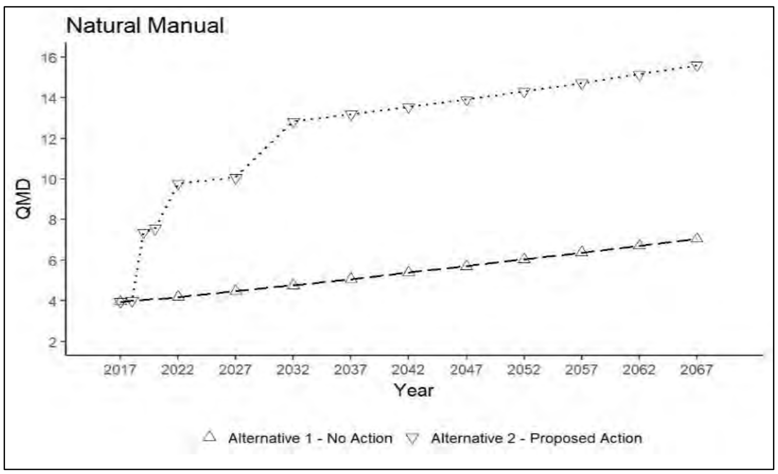

Figure 3-26. Current and predicted QMD (inches) natural stands.

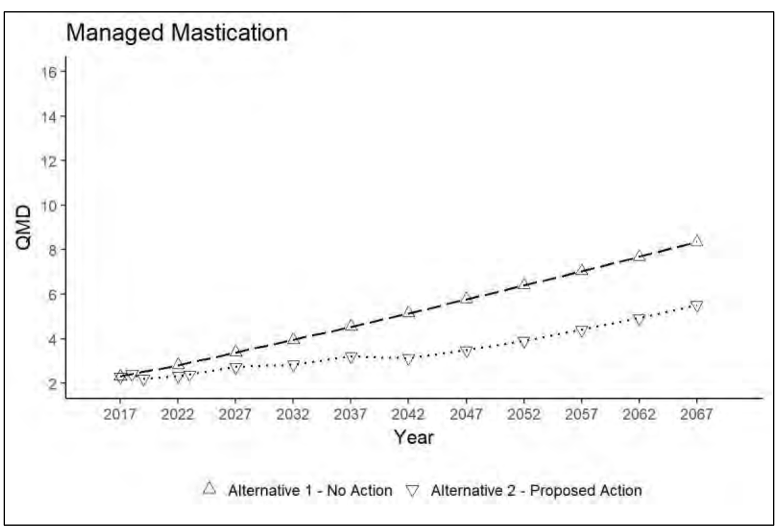

Figure 3-27. Current and predicted QMD (inches) plantations.

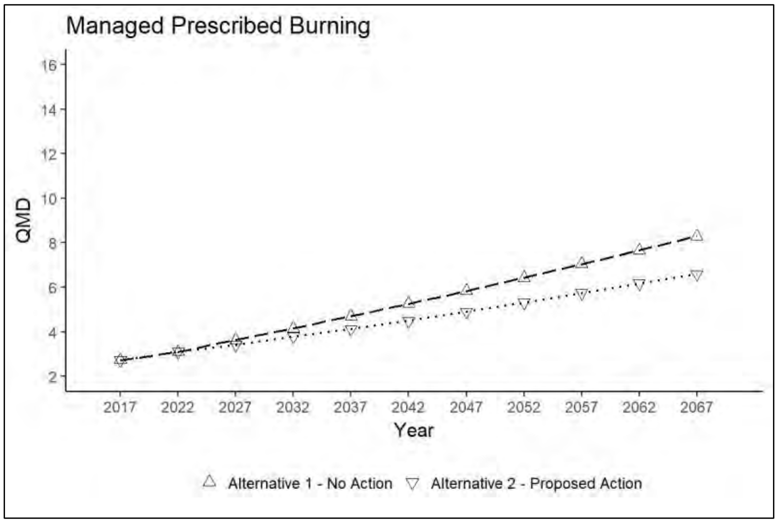

Figure 3-28. Current and predicted QMD (inches) plantations.

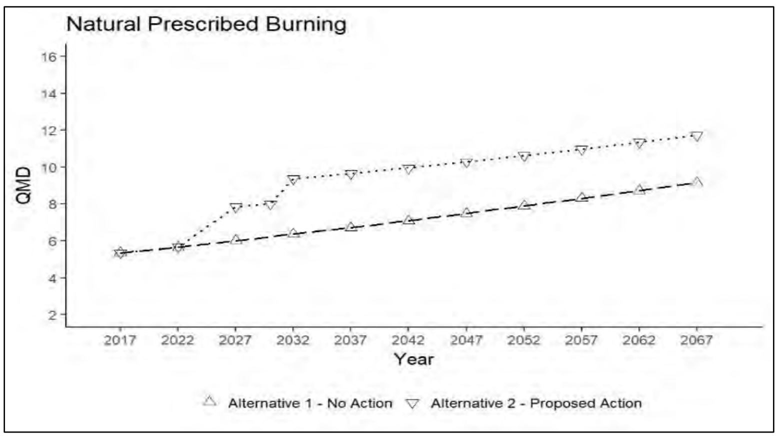

Figure 3-29. Current and predicted QMD (inches) in natural stands.

The Proposed Action would also directly benefit the trees of interest to the collaborative (California black oak, Oregon white oak, golden chinquapin, large tanoaks, etc.). In plantations, larger hardwoods, both single-stemmed and larger stems in clumps, would be favored for retention and conifers thinned out around them to enhance hardwood growth while reducing stand densities. In natural stands, hardwoods over 24 inches in diameter at breast height (dbh) are usually the oldest trees in the stand. These trees were once the dominant or co-dominant trees in the stands before fire exclusion, but are now being outcompeted by conifers. Thinning around these remnant trees, many of which are being over-topped and shaded-out by faster growing Douglas-fir, would enable them to receive more light and grow fuller crowns, which would allow them to continue to persist in these stands (and thus continue to provide valuable structural habitat and diversity and maintain and support a healthy mixed-severity fire regime), increase their health and resistance to disturbance, as well as increase acorn production in true oaks, tanoak, and chinquapin (Devine and Harrington 2006, Engber et al. 2011).

Indirect Effects

There are several beneficial indirect effects of implementing the Proposed Action. Decreasing stand densities would result in increased health and resilience as there would be less inter-tree competition for water, and light, and other resources (Smith et al. 1997). The resultant increase in tree vigor would allow for trees and stands to be more resistant to disturbance agents such as insects, disease, and drought (Fettig et al. 2007, Vernon 2017). Western pine beetles already present in the project area , they would continue to attack potential host trees, but healthier more vigorous trees have a far better chance of surviving an attack than those that are stressed (Fettig et al. 2010, 2007).

Similarly, decreased stand densities would allow for more airflow through stands, potentially leading to lower relative humidity and faster drying, which could help to limit the spread of sudden oak death (*Phytophthora ramorum*), should it make its way into the project area. Increasing heterogeneity may also decrease disease severity in the case of infection (Condeso and Meentemeyer 2007). In addition, it's possible that prescribed fire treatments help to prevent the spread of sudden oak disease (Moritz and Odion, 2005). Regardless of the treatment method, a reduction in host density, especially young tanoak, would likely reduce spread of the disease in the case of infection.

With an increase in QMD after treatments (Figure 3-22 through Figure 3-26 and Figure 3-29), stands throughout the project area would, on average, have thicker bark than if left untreated. Thicker bark coupled with reduced ladder fuels, and reduced surface fuels, would result in more fire resilient stands as illustrated by reductions in predicted basal area mortality under severe wildfire conditions (Figure 3-14 through Figure 3-21; Agee and Skinner 2005).

Thinning the stands throughout the project area, both from below and throughout the diameter classes around trees of interest (with the exception of predominant and dominant trees), while also creating gaps and leaving small portions of the stands untreated, would increase heterogeneity both within stands and throughout the project area at the landscape level and also advance stand structures towards those found in active mixed-conifer fire regimes (Churchill et al. 2013, Hessburg et al. 2016, North et al. 2007). Field crews combed the project area looking through the TEK lens for species of cultural significance so that through the Proposed Action we could culture and enhance species such as hazel, huckleberry, iris and various trees. The varying intensity of our thinning prescriptions allow us to mimic patterns created by fire, which support and enhance the unique ecology of this area, including rich conifer and hardwood diversity and diverse and abundant TEK resources. In addition, these varying stand density patterns may be effective at reducing the spread of crown fire in the event of wildfire (Sherlock 2007).

By implementing the Proposed Action, the trees of interest, particularity the true oaks, tanoaks and chinquapins, would in time have the necessary resources to increase the size of their crowns, allowing them to produce more carbohydrates, which would lead to increased growth and production of acorns and nuts (Devine and Harrington 2006). Increased acorn and nut production would have many benefits, both ecologically and on the human environment. The Karuk and other local tribes rely heavily on these oaks for acorns as a significant portion of their diets. As availability and quality increase, younger generations are more likely to continue to utilize these important resources. Having places that are easy to access for acorn gathering would be very positive on a physiological, cultural, and spiritual level. Acorns and chinquapin nuts are also an important food source for local wildlife.

Other understory vegetation would also be enhanced through time with thinning and the creation of gaps in the canopy. Willow (*Salix* spp.) and hazel (*Corylus cornuta*), would have reduced competition for water and light; and understory burning would enhance these species for local cultural use. In many places, hazel exists in the understory where it is not receiving much light, and therefore is not producing hazel nuts. Currently hazel nuts can be found alongside roads where plants receive more light. These highly prized hazel nuts should be more abundant throughout the project area after canopy level treatments have been implemented and the plants have had time to respond to more favorable conditions. Here again, this increases production of nuts would benefit wildlife as well as local indigenous peoples who wish to gather traditional resources.

Cumulative Effects

For silviculture, the indirect effects and the cumulative effects are much the same. Of particular importance is that if the Proposed Action is implemented, we would be shifting the landscape towards an ecological condition where wildland fire, both planned and unplanned, would not pose as high of a risk to existing resources, infrastructure, and the ecocultural balance of these forests as it does today. Fire is a vital, natural, ecological disturbance agent that is critical to the ecosystem dynamics of the Klamath Mountains. The flora and fauna of the bioregion have lived with and evolved with fire for millennia, as well as the inhabitants and their culture.

The Proposed Action would help the local communities to be more resilient, and would constitute a huge step towards restoring and maintaining a resilient landscape along the Klamath River. Beginning around the communities is a logical place to start. By virtue of implementing the Proposed Action, there would be many jobs created at the local level that would have effects on the surrounding rural and urban communities. All of the thinning, whether manual or mechanical, would require many people to implement over a long period, such is the case with prescribed fire as well.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The project would meet all timber and vegetation standards and guidelines described in the KNF and SRNF forest plans (or LRMPs). The forest plans incorporate all applicable provisions of the Northwest Forest Plan of 1994 (NWFP). In addition, the forest plans incorporate provisions of the National Forest Management Act of 1976 (NFMA), its implementing regulations, and other guidance documents.

Wildlife

Introduction

The objective of the proposal is both short- and long-term in its aim for wildlife species and the habitats on which they rely. The short-term aspect is to manage for protection from stand-replacing fire, this would help prevent further habitat fragmentation and loss of habitat connectivity. The long-term aspect is to restore and improve the function of habitat for late-successional and old growth associated species such as the fisher, and NSO. In addition by reintroducing wildfire and creating a landscape mosiac this would improve conditions for the Karuk Tribe traditonal ecological knowledge (TEK) focal species.

Traditional Ecological Knowledge Focal Species

Chapter 2 describes the rationale for the following five focal species selected according to the guidelines for the initiation of the *Somes Bar Project* and inform the planning efforts of the greater WKRP collaborative. Each TEK focal species (Table 3-15) comes with a set of habitats, which serve as indicators of the health of a habitat segment for the applicable focal species:

- Pacific fisher is a Forest Service Sensitive species, important for cultural use and an indicator for forests and oak woodlands.
- Northern spotted owl is listed as threatened and is an indicator for old growth forest.
- Roosevelt elk is an indicator for open areas and high elevation grasslands with associated cultural use vegetation.
- Pacific giant salamander are found in low-gradient riparian areas, and are indicators for the health of the environment and revered as the water purifier.
- Willow is important for cultural use and an indicator for riverine areas.

Awareness of the interconnectivity between the focal species and cultural use species lies at the heart of TEK. It is also crucial for the revitalization of traditional knowledge, practice, and belief pathways through the adaptive management framework adopted by the WKRP. In this section, Pacific fisher, northern spotted owl, Roosevelt elk, Pacific giant salamander and willow are discussed in context of both the No Action Alternative, with associated risks with doing nothing, and the Proposed Action of reestablishing fire on the landscape for both the potential for short term impacts to the species as well as long-term benefits to their individual habitat conditions. In addition, the direct and indirect effects of the no action and the Proposed Action also analyzed for NSO and Pacific fisher in the context of legal requirements of the Endangered Species Act (ESA) and FSM direction (FSM 2670).

Legal Compliance and Mandatory Disclosure

Using the following three lists, a determination is made of whether the species range overlaps the project area and whether habitat is likely to exist in the project area (if both are true, then the species is analyzed for the project): 1) Threatened, Endangered, Proposed and Candidate terrestrial species in the project area are identified using the USDI Fish and Wildlife Service (USFWS) list of Threatened, Endangered, Proposed or Candidate Species list website (IPaC) dated November 01, 2017 (Consultation Code: 08EACT00-2018-SLI-0028 – AFWO; see BA in the project record, Yost and Bettaso 2018); 2) the Forest Service (Pacific Southwest Region (Region 5)) Sensitive Species list (revised July 3, 2013) identifies the species to consider for this analysis; and 3) Survey and Manage (S&M) species list as identified in Record of Decision (ROD; 2001) as adjusted in 2014 and interpreted by Forest Service, Region 5 guidance (2014).

The project record contains the following reports: BA for ESA-listed wildlife species (Yost and Bettaso 2018), BE for Forest Service Sensitive wildlife species (Yost and Bettaso 2017a) management indicator species (Yost and Bettaso 2017b), survey and manage species (Bettaso, Yost and Hoover 2017), and migratory bird species (Bettaso 2017) that document these conclusions. These reports contain additional details of the project including site history, Recovery Plan guidance, and unit by unit treatments, etc.

Forest Plan Guidance

One of the primary purposes of a forest plan is to guide land management through the adherence to the Forest-wide and management area S&Gs. The desired condition represents the general goal for which the project would strive. Forest plan S&Gs (both forest-wide and specific to management areas) were developed to assure compliance with law, regulation and policy and to minimize impacts during forest plan implementation.

Information from both forests plans pertinent to Forest Sensitive species occurring in the *Somes Bar Project* is displayed below; this information was used in developing analysis indicators. The Proposed Action and the *Somes Bar Project* is in accordance with guidance and direction from the KNF and SRNF LRMPs, and the Katimiin MOU between the Karuk Tribe and the KNF for the management of the Katimiin CMA.

Special Habitat KNF Management Area 5

This management area consists of special provisions for peregrine falcon, bald eagle and Late Successional Reserves. The KNF LRMP includes a provision for the Special Habitat Management Area around peregrine falcon eyries. The project proposes fuels reduction treatment that occurs within the Special Habitat area. However, no known peregrine falcon eyries are located within 0.5 miles of the focal areas. Therefore, the proposed treatment is consistent with the management of this area and would not be analyzed further for this project.

Bald eagles were also delisted under ESA but the eagle is included in the Forest Service Sensitive species list. Forest plan provisions for the Special Habitat Management Area around bald eagle nests would be followed. Effects of the project on bald eagles are disclosed under discussions of Forest Service Sensitive species.

Table 3-15. Karuk Tribe focal species short-and long-term response to treatments.

Focal Species Habitat Components	No Action	Short-Term Habitat (0 to 5 years)	Long-Term Habitat (5 to 15 years)
Pacific Fisher: conifer forests, upland oak stands	The Klamath National Forest Forest-Wide LSR Assessment (LSRA 1999) and the Ishi-Pishi Ecosystem Analysis determined that the project area and the Ten-Bear LSR was deficient in late-successional habitat. Fire modeling predicts increased losses or degradation of late successional habitats. Stands would remain in overstocked conditions with a lack of structural diversity and decreased heterogeneity. The lack of treatment would result in increased fragmentation of habitat, lack of connectivity between suitable habitat patches, increased stand densities, increased fire severity, overstocking and potential loss of hardwoods due to competition with conifer.	In the short-term, canopy cover would be reduced. A small amount of denning, and resting (18 acres), and movement (57 acres) habitat would be lost due to small isolated landing and temporary road construction. Treatment design features would enhance hardwood stands within and adjacent to suitable habitat for fisher.	In the long-term, late successional habitat would be more resistant to large-scale disturbance. This would increase the probability of maintaining connectivity for late-successional species and reducing potential fragmentation of habitat. Important structural elements would be maintained within the stand (large snags, trees and hardwoods) post-treatment. This would enhance resiliency of oak woodlands, and establish resilient heterogeneous forests at multiple scales.
NSO: late-successional habitat and old growth	The Klamath National Forest Forest-Wide LSR Assessment (LSRA 1999) and the Ishi-Pishi Ecosystem Analysis determined that the project area and the Ten-Bear LSR was deficient in late-successional habitat. Fire modeling predicts increased losses or degradation of late successional habitats. Stands would remain in overstocked conditions with a lack of structural diversity and decreased prey base for NSO foraging. The lack of treatment would result in increased stand densities, increased fire severity, overstocking and potential loss of hardwoods due to competition with conifer.	A small amount of nesting, roosting and foraging habitat (18 acres) and dispersal (57 acres) would be lost due to small isolated landing and temporary road construction. Treatment design features protect woodrat habitat, a prey species for NSO where wood-rat habitat is found, choose 0.25 acres adjacent to retention patch to treat small diameter vegetation (4 inches or less) to encourage re-sprouting and create future woodrat habitat.	In the long-term, late-successional habitat would be more resistant to large-scale disturbance. This would increase the probability of maintaining connectivity for late-successional species and reducing potential fragmentation of habitat. Important structural elements would be maintained within the stand (large snags, trees and hardwoods) post-treatment. This would enhance resiliency of oak woodlands, and establish resilient heterogeneous forests at multiple scales. In addition, the Proposed Action provides mosaics of interior habitats and edges to provide for the diversity of prey for NSO.
Roosevelt Elk: open space, transition between wide open to more dense habitat	As the local elk population continues to increase, fire suppression and lack of management has created conditions with limited early seral habitats. This leads to continued simplification of critical winter foraging habitats and may ultimately limit population size and distribution.	Hiding cover maybe reduced in the short-term, but this is not a limiting factor for this population. Provisions to improve quality winter foraging habitat that would support a stable elk herd population as described in the KNF Elk Management Plan.	Promote a mosaic of habitat types across the landscape; re-introduction of wildfire back on the landscape would reduce conifer encroachment in hardwoods, increase perennial grass diversity and increase structural diversity providing cover for calving and calves.

Focal Species Habitat Components	No Action	Short-Term Habitat (0 to 5 years)	Long-Term Habitat (5 to 15 years)
Pacific Giant Salamander: riparian, clean water	No action would set riparian zones up for high severity fire and reduce the variable stages of decay in large logs throughout the range of Pacific giant salamanders. More trees fall after fire, but it takes a long time to get the variability back in the stages of decay.	Burning in favorable conditions would scorch these large logs but would not totally consume them all. Having backing fire into riparian areas and not using drip torch fuel in them would reduce the potential for impact to this species. This species as a focal species also gets to the human responsibility. If a person sees one and it would be harmed we are supposed to move it to a safe place. Smoke shading in restored fire regimes can help benefit this species by reducing insolation factors and river temperatures.	Riparian areas are part of the landscape and may need fuel treatments based on fuel loading within and in surrounding uplands. Reducing the risk of uncharacteristically high severity fire in riparian areas can limit the effects to riparian dependent species such as TEK focal species willow and Pacific giant salamander as well as limit the spread of invasive species. Post implementation of all planned entries, the riparian areas that support Pacific giant salamanders and willows would be more resilient to the risk of uncharacteristic high intensity fires. Willows treated over time would provide material for weaving baskets.
Willow: Klamath River and lower parts of tributaries	Sand bar willow is infested with bugs, which would continue with no treatment. Weavers cannot use willow infested with bugs.	Cutting and burning would improve willow stands in four units along Klamath River. More light to mountain willow is also important. Many bird species are also associated with different willow species. Avoiding use of prescribed fire during nesting season is intrinsically linked to this focal species. Use of monitoring and adapting based on implementation would reduce impacts. If for example the willow flycatcher comes to nest earlier that when Pleiades is no longer visible (April) then early season burns would need to stop sooner.	

Late-Successional Reserve (LSR) treatment would include approximately 49.4 acres specifically in LSR Ten Bear RC349 and a 100 acre LSR KL0058. Treatment within Ten Bear LSR 349 inlcudes 24 acres of manual rx fuels, and 11.9 acres of mechanical treatment in the Patterson Focal Area. Treatment in the Donahue Focal Area would include 13.5 acres of manual rx fuels in LSR100-KL0058. The KNF Forest-Wide LSR Assessment (LSRA 1999) determined that this area of the LSR was deficient in late-successional habitat. Portions of the LSR prior to its designation were harvested, therefore, extensive stands of dense plantations exist that not only create a fuels hazard, they also do not provide suitable habitat for late-successional species such as the NSO. Plantations and young natural stands are even-aged and lack the horizontal and vertical diversity components associated with late-mature stands. Young stands have the potential to achieve rapid diameter and height growth with thinning treatments. Silvicultural prescriptions can be applied to younger stands in order to accelerate their development toward late seral conditions. These treatments could increase the amount of late seral vegetation sooner than would occur naturally. The LSRA indicated the proposed area needs extensive fuels treatments to protect the LSR as well as extensive habitat restoration. Planned treatments outside but adjacent to the Ten Bear LSR and KL0058 would reduce fuel loading risk and provide additonal protection to late-seral stands.

Methodology

The analyses are based on the best scientific[28] and commercial data available at the time this document was written. Information such as data collected from Forest databases, remote sensing vegetation analysis, the Forest existing vegetation (EVEG), direct field assessments, California Natural Diversity Database, and the most recent and appropriate scientific research and species information, was all used for the consideration of direct, indirect and cumulative effects.

Spatial and Temporal Bounds

The *treatment area* (focal areas) boundaries reflect the physical footprint, where proposed vegeatation and prescribed fire, and therefore potential direct effects would occur. The *analysis area* varies by species and reflects the area within which the species could be directly and indirectly affected by the Proposed Action.

Temporal bounding for the analysis is both short term and long term. Short term consists of the project implementation and the time in which vegetation begins to respond to treatments. These are normally the commercial treatments that occur within five to ten years. Long-term boundaries to habitat changes are limited to vegetation and fuels modeling, which extends to approximately five to fifteen years following project implementation of fuels treatments.

Analysis Indicators

Table 3-16 lists species, analysis areas and indicators that were developed using the forest plan S&Gs and the best available science to estimate direct, indirect, and cumulative effects for Forest Sensitive species.

[28] Best available science is defined as scientific literature that is relevant to the project and available to the reader and decision-maker.

Table 3-16. List of wildlife species analyzed with associated indicators.

Species	Analysis Area	Analysis Indicator
Northern spotted owl	1.3 miles out from a proposed treatment unit and the homerange of any NSO ACs that intersects a focal area.	Risk to reproduction. Change in critical habitat.
Bald eagle	The project area and the analysis area include the Klamath and Salmon Rivers and within these areas of the river, two eagle nest sites are known to occur.	Level of disturbance to nest sites.
Northern goshawk	The project area was surveyed for goshawk. One goshawk nest was detected near the Rogers focal area and the site produced offspring in 2015. No other sites are known to occur within the project area.	Level of disturbance to nest sites. Risk to reproduction.
Fisher, marten, and wolverine (Fisher is a TEK Focal species)	Ten 7th-field watersheds that contain focal areas. Fisher and marten have been detected within the focal areas. No detections of wolverine. Since the fisher, marten, and wolverine have an overlap in general habitat use, one habitat layer would be used for this analysis. The desired condition maintains all potential suitable habitat for these species within a 7th-field watershed.	Level of habitat alteration (NSO habitat is used as a proxy for suitable fisher, marten, and wolverine habitat). Change in fisher home range
Pallid bat, Townsend's big eared bat, and fringed myotis	The project area has no known bat hibernaculum or maternity sites.	Risk of disturbance of potential hibernaculum or maternity sites
Willow flycatcher	Surveys have not been conducted within the project area. No nest-site locations are known within or adjacent to the project area however were found on the Klamath National Forest. Reproduction is most likely to occur in riparian areas primarily in the low gradient and larger waterways. The remaining waterways within the project area would be high gradient and less suitable	Level of habitat alteration in the inner riparian reserves.
Western bumblebee	Ten 7th-field watersheds that contain focal areas. The actual location and distribution of bumblebee colonies is not known. This analysis is assuming that each meadow could contain a colony.	Level of habitat disturbance in meadows.
Foothill yellow-legged frog	The project area has not been thoroughly surveyed for foothill yellow-legged frogs since measures to protect riparian reserves should not directly affect habitat.	Risk of disturbance in inner riparian reserves.
Southern torrent salamander	Ten 7th-field watersheds that contain focal areas. The project has not been surveyed although one salamander was found in the Ti Bar Focal Area.	Risk of disturbance of seep/spring/riparian habitat disturbed per 7th-field watershed.
Western pond turtle	Ten 7th-field watersheds that contain activities within 100 to 500 meters of the Klamath River.	Risk of disturbance of nesting bench/hibernation habitat disturbed.

Federally Listed Terrestrial Species

Based on the BA prepared (Yost and Bettaso 2018), NSO, with associated designated critical habitat, is the only federally listed terrestrial species known to occur within the project area.

Northern Spotted Owl (Strix occidentalis caurina)

NSO Recovery Plan

On June 28, 2011, the USFWS released the Revised Recovery Plan for the NSO. The purpose of recovery plans is to describe reasonable actions and criteria that are considered necessary to recover a listed species. The 2011 Revised Recovery Plan (Recovery Plan) for NSO represents the "best available science." The Recovery Plan recognizes the importance of maintaining, and restoring, habitat for the recovery and long-term survival of the spotted owl. The Recovery Plan also relies on federal lands to provide the major contribution for recovery (USDI Fish and Wildlife Service 2011).

The Recovery Plan describes reasonable recovery criteria and recovery actions that are considered necessary to recover a listed species. Recovery criteria serve as objective, measurable guidelines to assist in determining when an endangered species has recovered to the point that it may be downlisted to threatened, or that the protections afforded by the ESA are no longer necessary and the species may be delisted. Recovery actions are the Service's recommendations to guide the activities needed to accomplish the recovery criteria.

The Recovery Plan states due to "The continued decline of the spotted owl populations and low occupancy rates in large habitat reserves, and the growing negative impact from barred owl invasions of spotted owl habitats (Forsman et al. 2011, Dugger et al. 2011 and 2016), which is greater than anticipated in the NWFP. We recommend increased conservation and restoration of spotted owl sites and high-value spotted owl habitat to help ameliorate this impact".

The *Somes Bar Project* was designed to meet the objectives of the Recovery Plan as follows:

- Recovery Action 10 (RA 10) requires that agencies:
  - "Conserve spotted owl sites and high value spotted owl habitat to provide additional demographic support to the spotted owl population".
  - "When planning management activities, Federal and non-federal land managers should work with the Service to prioritize known and historic spotted owl sites for conservation and/or maintenance of existing levels of habitat."

  Because the SRNF strives towards recovery of the spotted owl, all NSO ACs receive the highest level of protection. This goes beyond the requirement of RA 10. There are 10 known NSO ACs included in the analysis area for the *Somes Bar Project*. Care was taken to avoid habitat downgrade or removal within deficit NSO ACs, and no NSO ACs would be taken (indirect or direct) as a result of habitat treatments. Commercial and fuel treatments would not remove or downgrade suitable nesting/roosting or foraging habitat. In addition, the USFWS requires a 70-acre nest grove protection zone. This project exceeds the 70 acres around each known AC, which was incorporated into the project design (see the project BA for specific information relating to nest groves). No commercial treatment would occur within the nest groves.
- Recovery Action 32 (RA 32) states:
  - "Maintaining or restoring forests with high-quality habitat will provide additional support for reducing key threats faced by spotted owls" and "Protecting these forests should provide spotted owls high-quality refugia habitat from the negative competitive interactions with barred owls that are likely occurring where the two species' home ranges overlap. Maintaining or restoring these forests should allow time to determine both the competitive effects of barred owls on spotted owls and the effectiveness of barred owl removal measures."

Forsman et al. (2011) recommended that all potential NSO habitats should be considered, not just old growth. The Six Rivers definition of suitable nesting/roosting NSO habitat includes mid-mature (starting at 21-inch dbh), late-mature and old-growth seral stages. All potential habitat was considered during project evaluation, and all high quality habitat (no matter what seral stage) was considered during project design. Low-quality habitats were evaluated for habitat improvements measures. If the habitat could benefit from a silvicultural or fuels treatment, then it was considered for the project.

The definition of NSO habitat used for this project was based on the definition found in the SRNF LRMP, Recovery Plan and field verified by biologists with extensive experience with the species. The LRMP and Recovery Plan definitions were based on extensive amounts of published literature and represent the best available science for the Six Rivers habitat types.

All high-quality NSO nesting/roosting habitat and nest groves were dropped from commercial treatment on this project. Commercial and fuels treatments within and adjacent to these areas would help protect existing high-quality nesting/roosting/foraging (NRF) habitat from human-caused and wildfires. This project meets the intent of RA 32 and the need to reduce inter-specific competition between spotted and barred owls.

- Recovery Action 6 (RA 6):
  - "In moist forests managed for spotted owl habitat, land managers should implement silvicultural techniques in plantations, overstocked stands and modified younger stands to accelerate the development of structural complexity and biological diversity that will benefit spotted owl recovery."

The *Somes Bar Project* is designed to restore and accelerate development of important habitat characteristic for the spotted owl. This includes plantations and overstocked stands that, if treated, would increase the available habitats for the spotted owl and help reduce inter-specific competition between the barred owl and the spotted owl. Treatment of these stands would have an immediate benefit to the spotted owl. This project meets the intent of RA 6 by reducing fuel loading in dense plantations and by increasing development of important habitat components for the NSO.

The proposed project treatments would meet or exceed the KNF LRMP guidelines recommend five (5) snags per acre averaged across a 100-acre area (Table 4-4 of the KNF LRMP, Table I-1 of the LRMP FEIS provide standards for snag retention). The project would meet or exceed the KNF Forest Plan standard and guide 6-16 (Chapter 4 pg. 4-25) for CWD.

- Maintain 5 to 20 pieces of CWD per acre in various stages of decay.
- Leave large logs, conifer and hardwood, sound and cull of at least 20 inches in diameter and about 40 cubic feet in volume when they are available. Down logs should reflect the mix of species in the stand.

The *Somes Bar Project* has protected all high quality habitat (not just old growth, but also late-mature and some mid-mature stands (RA 32)), all spotted owl territories (not just high priority sites (RA 10)) and is designed to restore and accelerate important habitat characteristic for the spotted owl (RA 6) in young overstocked stands. Such long-term protection of owl habitat is consistent with the recommendations in the Recovery Plan.

The Recovery Plan states, "Dugger et al. (in press) found an inverse relationship between the amount of old forest within the core area and spotted owl extinction rates from territories" when barred owls were present. The Recovery Plan also states due to the "growing negative impact from barred owl invasions of spotted owl habitats (Forsman et al. 2011, Dugger et al. in press)…, We recommend increased conservation *and restoration of spotted owl sites and high-value spotted owl habitat to help ameliorate this impact*" (emphasis added). Barred owls have been documented using a wider range of forest types (younger seral stages with more fragmentation) than spotted owls (Hamer 1988, Herter and Hicks 2000, Kelly et al. 2003, Hamer et al. 2007, and Irwin et al. 2018). Consequently, the loss of late-successional old-growth forest and increased fragmentation of these forests would decrease the amount of suitable habitat for spotted owls. In other words, without treatment of non- or poor-quality habitats in deficit core areas we may lose these sites to barred owls. The Recovery Strategy of Recovery Plan supports "active forest management" and states that "In addition to describing specific actions to address the barred owl threat, this Revised Recovery Plan continues to recognize the importance of *maintaining and restoring high value habitat for the recovery and long-term survival of the spotted owl*" (emphasis added).

The *Somes Bar Project* treatments within owl territories, including core areas, are designed to accelerate the development of old forest characteristics, and increase structural diversity which would improve habitat conditions within spotted owl territories. The project meets the objectives of the Recovery Plan.

Barred Owl

Barred owls are recognized as a significant threat to the recovery of the NSO (USFWS 2011). The Recovery Plan addresses barred owls under RA 32 and RA 10, which are found under the "Barred Owl Recovery Actions". The barred owl recovery actions were developed under the assumption that barred owls now occur at some level in all areas used now or in the past by spotted owls. This is true for the *Somes Bar Project* area as well. Northern spotted owl surveys within the project area have shown barred owl occupancy within the project area. The Recovery Plan addresses the threat to the NSO from the barred owl through the preservation of existing high-quality habitat (RA 32) and preservation of high priority NSO territories (RA 10). The Recovery Plan also addresses the need to restore additional habitat for the owl in order to ameliorate the impact of the barred owl. Implementation of RA 10 and RA 32 standards fully meets the best available barred owl mitigation measures by protecting, maintaining and restoring spotted owl habitat.

The Recovery Plan was informed by Forsman et al. (2011) and Dugger et al. (2011). The Recovery Plan states due to "The continued decline of the spotted owl populations and low occupancy rates in large habitat reserves, and the growing negative impact from barred owl invasions of spotted owl habitats (Forsman et al. 2011, Dugger et al. 2016, Holm et al 2016, and Irwin et al. 2018), which is greater than anticipated in the NWFP. We recommend increased conservation *and restoration of spotted owl sites* and high-value spotted owl habitat to help ameliorate this impact".

Recovery Action 32 specifically states “Maintaining or restoring forests with high-quality habitat would provide additional support for reducing key threats faced by spotted owls” and “Protecting these forests should provide spotted owls high-quality refugia habitat from the negative competitive interactions with barred owls that are likely occurring where the two species” home ranges overlap. Maintaining or restoring these forests should allow time to determine both the competitive effects of barred owls on spotted owls and the effectiveness of barred owl removal measures”. High-quality nesting/roosting NSO stands and nest groves were dropped from commercial treatment on the *Somes Bar Project* due to this recovery action and the need to reduce inter-specific completion of the owls and restoration activities are proposed for non-habitat or low-quality habitat stands.

Recovery Action 10 requires that agencies “Conserve spotted owl sites and high value spotted owl habitat to provide additional demographic support to the spotted owl population”. Maintaining all historic ACs is a standard SRNF and KNF protection measure. The SRNF and KNF database includes NSO ACs that predates the 1990 listing of the NSO. All historic ACs (currently occupied or not) that meet the criteria of an AC (described in the USFWS survey protocol) are considered during project evaluation. Within the NSO Analysis area for NSO, the area has 14 historical ACs mapped. Ten of these ACs were included in the analysis for this project. The other four NSO ACs were dropped from analysis due to location and review by the Level 1 team. All 14 ACs were found to be active at some point in time from as early as the 1990s. To date the project area has had three (3) years of surveys to protocol (2015 to 2017). No NSO were detected at any of these sites in 2017. All high quality nesting/roosting habitat, regardless if it was located within an active AC, was dropped from commercial consideration during project design. In addition, the USFWS requires a nest grove protection zone of a minimum of 70-acres around each known AC, which was exceeded for this project and incorporated into the project design. No commercial activities would occur within the nest groves. The *Somes Bar Project* meets RA 10.

The *Somes Bar Project* has protected all high-quality habitats (not just old growth), all spotted owl territories (not just high priority sites) and is designed to restore, maintain, and accelerate important habitat characteristic for the spotted owl. “Maintaining or restoring these forests should allow time to determine both the competitive effects of barred owls on spotted owls and the effectiveness of barred owl removal measures” (II-67 of the 2011 Plan). Protecting these forests should provide spotted owls high-quality refugia habitat from the negative interactions with barred owls that are likely occurring where the two species’ home ranges overlap. The project would not exacerbate competitive interactions between the two species. Without the implementing the additional protection measures and recovery actions of the Recovery Plan, the barred owl may be successful in out-competing the spotted owl. It is imperative to the spotted owl’s recovery to take such actions. The project is meeting the objectives of the Recovery Plan.

Fire

Another threat to the NSO addressed by the Recovery Plan is wildfire. The Recovery Plan identifies stand-replacing wildfire as one of the three top threats to the recovery of species stating, “currently the primary source of habitat loss is catastrophic wildfire…” The Recovery Plan further notes that wildfire size and frequency have been increasing in the western United States and that acres burned are expected to continue to increase due to climate changes and past land management practices. This overall increase in acres burned translates to a corresponding increase in the acres of spotted owl habitat lost to fire. While the risk of habitat loss to wildfire varies by location, the Recovery Plan emphasized that the Klamath region is one of the main areas at risk:

- "Fire-prone provinces (including) California Klamath scored high on threats from ongoing habitat loss as a result of wildfire and the effects of fire exclusion on vegetation change."
- "In view of the increasing risk posed to northern spotted owl habitat by wildland fire in the dry forests of the California Klamath Province, the Recovery Plan calls for management actions that result in forests that are more fire resilient and fire-resistant."

However, the area's dry, hot summers and extreme departure from its historic fire return interval mean that owl habitat within many areas of the Forests is at risk of being lost to, or significantly degraded by, severe uncharacteristic fire. The 1999 Megram Fire (120,000 acres), 2002 Biscuit Fire (500,000 acres), the 2008 Lightning Complex (45,000), 2013 Butler (22,932 acres), 2013 Salmon Complex (15,004 acres), 2014 Beaver Fire (32,307 acres), 2014 Happy Camp Complex (131,389 acres), 2014 Man Fire (15,645 acres), 2014 July Complex (3,362 acres), 2014 Little Deer (5,503 acres), 2015 Saddle Fire (1,541 acres), 2015 Fork Complex (36,562 acres), 2015 Mad River Complex (5,746 acres), 2015 River Complex (71,493 acres), 2015 Route Complex (17,095 acres), 2015 South Complex (28,724 acres), 2017 Orleans Complex, and the 2017 Marble Fire (319 acres) and many other fires within the range of the species that has removed or downgraded suitable NSO habitat demonstrates that fire risk on the Forests and within the range of the species is genuine (Davis et al. 2015, Davis 2015). Active management to reduce the fire hazard and increase resilience, as well as to accelerate the development of higher quality NSO habitat, should contribute to the spotted owl's persistence and recovery. Such long-term protection of owl habitat is consistent with the recommendations in Forsman et al. (2011) as well as the Recovery Plan and 2012 Revised NSO Critical Habitat Rule.

Impacts to Pacific Northwest forests from wildfire appear to be increasing along with fire occurrence, size, and intensity. Although some researchers disagree on the magnitude of these changes and what to do about them (e.g., Hanson et al. 2009, Hanson et al. 2018, Jones et al. 2016, and Rockweit et al. 2017), most researchers believe, as does the USFWS (USDI 2012b), that these changes are happening, and that active management should be considered (e.g., Hessburg et al. 2007, Healy et al. 2008, Heyerdahl et al. 2008, Kennedy and Wimberly 2009, Latta et al. 2010, Littell et al. 2009, 2010, Spies et al. 2010, Perry et al. 2011, Syphard et al. 2011, Waring et al. 2011, Jenkins et al. 2012, Marlon et al. 2012, Miller et al. 2009, 2012). Thus, this project takes the active management intervention approach rather than a passive approach to restoring NSO habitat. This approach is what was envisioned by the NWFP, the Recovery Plan, and the 2012 Revised NSO Critical Habitat Rule.

Prey Species

In this portion of the northern spotted owls range (below about 4,100 feet in southern Oregon and northern California), dusky-footed wood rats (*Neotoma fuscipes*), are the most important prey species of spotted owls, both in frequency and biomass (Forsman 1975, Barrows 1980, Solis 1983, Forsman et al.

1984, Ward 1990, Carey et al. 1992, Zabel et al. 1995, Ward et al. 1998, Forsman et al. 2004, and Hansen and Mazurek 2010).

In a study conducted on the SRNF, Sakai and Noon (1993) found the highest abundance of woodrats occurred in 15- to 30-year-old plantations resulting from past clearcut timber harvest. The study used radio telemetry to track the movement of woodrats and found that although the woodrats inhabited younger stands, woodrats would often cross distinct ecotonal boundaries between forest types. Woodrats tracked during evening telemetry sessions made intermittent, short distance movements into adjacent old-growth forests occupied by spotted owls. A substantial number of radio tagged woodrats were killed by predators, with carcasses most often found in adjacent old forest. This is presumably because younger, dense plantations are difficult if not impossible for the owl to forage in and must wait until the prey leave these refugia to be preyed upon.

Ward et al. (1998) found that owls foraged along late-seral forest edges where dusky-footed woodrats were more abundant. Woodrats living in or dispersing from adjacent shrub lands may be more available for owls hunting along the ecotonal edges between habitat types. Edge or transitional habitats appear to be more important to foraging spotted owls when woodrats dominate the diet (Zabel et al. 1995, Ward et al. 1998). Edges may provide cover to conceal owls from predators while making them inconspicuous to wood rats.

These results suggest that the infrequent use of younger stands by foraging spotted owls is not due to low abundance of prey. Simply increasing prey densities within a stand may not result in an increase in prey available to spotted owls if their foraging efficiency is low in these stands (Rosenberg et al. 1994). High tree densities and homogeneous canopies in second-growth forests may reduce flight maneuverability and the ability of owls to capture prey (Rosenberg and Anthony 1992). However, silvicultural procedures that maintain or enhance woodrat populations adjacent to spotted owl habitat may benefit spotted owls (Sakai and Noon 1993, Irwin et al. 2007).

Stands occupied by woodrats gradually decline in suitability. Data from Sakai and Noon (1993) suggest that this occurs when the dominant trees (usually Douglas-fir) begin to over top and eventually suppress the low-to-mid-canopy level vegetation (less than 3 to 6 meters). In the inland forests of northwestern California, the decline in habitat quality occurs in regenerated stands at about 40 to 50 years after harvest. To enhance dusky-footed woodrat populations, Sakai and Noon proposed retaining brush patches during precommercial thinning and creating brush patches in younger stands. The existence of shrub fields or younger stands adjacent to older forest may increase the availability of woodrats to spotted owls that exploit prey from a variety of habitats but spend the majority of their time hunting in late seral stage forests (Sakai and Noon 1993).

The northern flying squirrel (*Glaucomys oregonensis;* Arbogast et al. 2017) is a smaller component of the biomass collected by the spotted owl in this portion of the province. In northwestern California, flying squirrels constitute only 9.3 percent of the biomass of NSO diet, while dusky-footed woodrats constitute 70.9 percent of the biomass of NSO diet (Ward et al. 1998).

Forsman et al. (1984) described potential negative impacts to flying squirrels through the timber harvest; however, the conditions described by Forsman occurred in heavily thinned mature and old growth stands. No high-quality nesting/roosting habitat is being commercially treated during implementation of the *Somes Bar Project*. Thinning might also affect flying squirrels through reduction or development of other important resources, such as shrubs, hardwoods, arboreal lichens, or deformed trees and snags (Williams et al. 1992, Carey 1995). The project would protect these important habitat components. Hansen and Mazurek (2010) found “mixed” results in relation to the flying squirrel, with some studies showing no effect at all from the thinnings compared to unharvested stands.

Northern Spotted Owl Habitat Types

Suitable NSO habitat is commonly separated into nesting/roosting, foraging, and dispersal habitat; these habitat types are described in detail in the NSO Recovery Plan (USDI Fish and Wildlife Service 2011). Nesting/roosting is generally described as mid- to late-seral forests that contain stands of large trees with high canopy cover, multilayered canopies, and nesting platforms. Foraging habitat can be described as slightly reduced canopy cover, fewer large trees, and enough space for NSO to maneuver through the trees for hunting prey when compared to nesting/roosting habitat. Dispersal habitat contains a moderate level of canopy closure and trees large enough to provide shelter and potential foraging opportunities for traveling NSO, but does not contain adequate amounts of other essential habitat components for long-term NSO occupation, reproduction or survival. Determination of NSO habitat suitability also considers many factors including size of stand and adjacency to other habitat types, which owls may use. For this analysis, *suitable habitat* is defined as stated above in this paragraph and is generally referencing nesting/roosting and foraging habitat unless otherwise specified.

Spatial Bounds

For known NSO territories, NSO habitat would be evaluated at two spatial scales 1) home range and 2) core areas (Figure 3-30). Based on the median home range estimate for NSO pairs in the California Coast Range (Douglas-fir/mixed conifer zone), 1.3 miles is the home range radius and 0.5 miles is the core radius for evaluating habitat conditions of and potential impacts to home ranges and core around the nest location (Thomas et al. 1990, USDI Fish and Wildlife Service 1992, 2009, 2012). The core and home range analysis would be limited to the home ranges that overlap the *Somes Bar Project* perimeter. Therefore, the spatial boundary is the home ranges that intersect the project perimeter plus the entire project area.

Analysis Indicator 1 – Risk to Reproduction

Reproduction is one of the primary elements of a species existence and effects to reproduction can have a significant effect on any population. The amount of suitable habitat within both the home range and core has been shown to influence NSO productivity and survivorship (Bart 1995, Franklin et al. 2000, Dugger et al. 2005). Based on results of these studies, the USFWS has concluded that significant effects to reproduction are not likely to occur if management activities retain a higher proportion (at least half or 250 acres) of the core area’s high quality habitat and 1,086 acres of suitable habitat in the home range (outside the core) (USDI Fish and Wildlife Service 2009). Core areas falling below these habitat acre levels may affect the productivity and survival of NSO. Older forest is more likely than other vegetation classes to provide NSO with suitable structures for perching and nesting, a stable, moderate microclimate at nest and roost sites, and visual screening from both predators and prey.

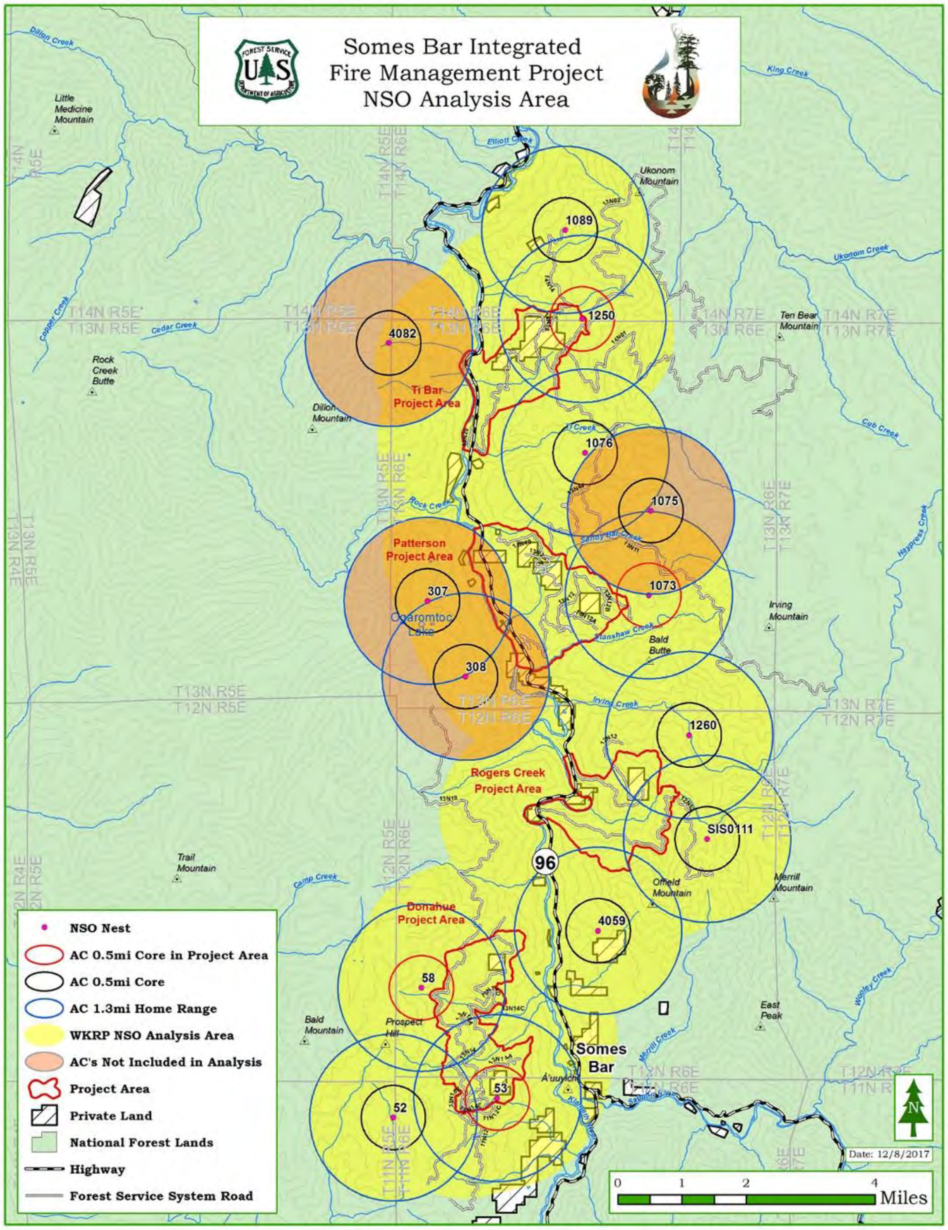

Figure 3-30. Northern spotted owl (NSO) analysis area.

This analysis would calculate the change in NSO habitat (nesting/roosting, foraging, or dispersal habitat) within the core and home range resulting from the action alternative. The changes in NSO habitat would be analyzed and compared to the suggested levels of habitat as described by the USDI Fish and Wildlife Service (2009), published research, and professional judgement.

Assumptions for Risk to Reproduction

- Occupancy and reproductive success is based on the amount and quality of habitat in the activity center (AC).

- o Roadside treatments in existing NSO habitat would result in maintaining habitat thus habitat would remain functioning at the current habitat type after treatment.
- o Project treatments would maintain nesting/roosting habitat at 60 percent canopy closure and foraging habitat at 40 percent canopy closure.
- o Habitat burned during the 2017 fires at low (<50 percent basal area removed per RAVG data) severity in the analysis area would still function as it did pre-fire.
- o New landing and new temporary road construction would result in loss of habitat for the footprint of the landing and road prism if the landing construction occurs within suitable habitat.

Criteria for Assessing Risk to Northern Spotted Owl Reproduction

The desired condition for this analysis indicator is to minimize the amount of NSO habitat affected by the project actions. The amount of NSO habitat would be assessed for all known ACs and these acres of habitat would be interpreted into four categories based on the criteria below (Table 3-17).

Table 3-17. Criteria used for Northern spotted owl risk to reproduction analysis Indicator.

Risk to Reproduction	Criteria[29]
Very Low	In the core, >400 acres of NRF (≥250 NR must occur in the core), AND In the home range, >935 acres of NRF.
Low	In the core, >250 acres being NRF, AND In the home range, >1,086 acres NRF.
Moderate	In home range, 665 to 1,336 acres of NRF (≥500 acres NRF must occur in core and home range combined).
High	In home range, <665 acres of NRF.

Risk to reproduction is split into four categories representing the relative level of effect resulting from the action alternative. Using the existing quality and amount of habitat within the AC (composed of core and home range), the acres of NRF habitat would be calculated as the existing condition and the AC would be placed into one of the four categories. Then the action alternative effect on habitat would be calculated and compared to the existing condition. Note that an AC cannot have a reduction in risk. For example, an AC that meets the conditions of moderate given the existing habitat condition can only remain as moderate or increase to high risk based on the action alternative. However, an AC currently at high risk would continue to be a high risk regardless of the level of effects from the action alternative.

A high risk means that reproduction is not likely to occur in the AC because the low number of habitat acres occurring in the core and home range. Moderate level represents the ACs likely to have difficulty in finding resources and would likely need to traverse openings (areas without overstory tree canopy) or use areas of low-habitat quality to find enough resources. These challenges may result in lower survival or reproduction potential for the pair occupying moderate level ACs. Low-level ACs have enough habitat in the core and home range to support reproduction, but the habitat may not be distributed in large patches. Generally, many of the active ACs on both forests can be described as containing similar amount of

[29] *Core* is 0.5-mile radius from the center of the activity center. *Home range* is 0.5- to 1.3-mile radius from the center of the activity center.

habitat as described for the “low” level category. The final category, very low, represents the quality and distribution habitat that has been associated with successful reproduction over the species range, but these conditions are not common on either Forest typically because the patches of NR are relatively small and are spatially separated.

Analysis Indicator 2 – Changes to Critical Habitat

The California Coast Range (Klamath West) is considered a “fireprone” area because of its frequent fire return intervals and existing vegetation condition that likely elevates the potential of fire (USDI Fish and Wildlife Service 2012). Within fire-prone areas, resource agencies planning vegetation management in critical habitat for the NSO are encouraged to ameliorate current threats of on-going habitat loss from uncharacteristic fires and vegetation change that are largely related to past fire exclusion (USDI Fish and Wildlife Service 2012). Resource agencies are also encouraged to work toward maintaining or enhancing the characteristics of older forest and providing large habitat blocks and associated interior forest conditions. Regional variations should be taken into account. In the area of the California Coast Range, this means providing mosaics of interior habitats and edges to provide for the diversity of prey for NSO.

Critical habitat is generally described as the specific geographic area occupied by the species at the time of listing plus areas that contain the physical and biological features that are essential to the conservation of endangered and threatened species and may need special management or protection. Instead of providing general recommendations that cover the entire critical habitat area, critical habitat was split into units and subunits to provide specific recommendations because units or subunits may provide different functions to aid in the recovery of the species. For the spotted owl, the *Somes Bar Project* overlaps a portion of the Klamath units KLW6 and KLW7. These units are intended to enhance or protect existing essential biological or physical features, reduce the loss of habitat to wildfire, reduce change in habitat as a result of fire exclusion, and buffer competition with barred owls, but the primary function for these subunits is to support the survival, reproduction, and dispersal of NSO (USDI Fish and Wildlife Service 2012).

Primary constituent elements (PCEs) are the physical and biological features that provide the essential life history requirements of the species. The 2011 CHU designation identifies the primary constituent elements for NSO as those physical and biological features that support nesting, roosting, foraging, and dispersal. These PCEs are quoted from the critical habitat rule (USDI Fish and Wildlife Service 2012):

PCE 1, Forest Type

Forest types that support the NSO across its geographic range. Within the California Coastal Range (Klamath West), these include mixed conifer/mixed conifer-hardwood, mixed evergreen, Douglas-fir, white fir, and Shasta red fir. These forest types may be in early-, mid- or late-seral stages

These activities can occur in early-, mid-, or late-seral forest types identified in the PCEs in the final rule. On the Forest, PCE 1 includes the mixed conifer and mixed evergreen type, the Douglas-fir type, the Shasta red fir type and a small amount of the moist end of the ponderosa pine, coniferous forest zones.

PCE 2, Nesting and Roosting habitat California Coast Range (Klamath West)

Stands for nesting and roosting are generally characterized by:

- Moderate to high canopy closure (60 to over 80 percent);
- Multilayered, multispecies canopies with large (20 to 30 inches or greater dbh) overstory trees;
- High basal area (greater than 240 square feet/acre);
- High diversity of different diameters of trees;
- High incidence of large live trees with various deformities (e.g., large cavities, broken tops, mistletoe infections, and other evidence of decadence);
- Large snags and large accumulations of fallen trees and other woody debris on the ground; and
- Sufficient open space below the canopy for NSOs to fly.

PCE 3, Foraging habitat in the California Coast Range (Klamath West)

Foraging habitat is generally characterized by:

- Stands of nesting and roosting habitat; in addition, other forest types with mature and old-forest characteristics;
- Presence of the conifer species, incense-cedar, sugar pine, Douglas-fir, and hardwood species such as big leaf maple, black oak, live oaks, and madrone, as well as shrubs;
- Forest patches within riparian zones of low-order streams and edges between conifer and hardwood forest stands;
- Brushy openings and dense young stands or low-density forest patches within a mosaic of mature and older forest habitat;
- High canopy cover (87 percent at frequently used sites);
- Multiple canopy layers;
- Mean stand diameter greater than 21 inches;
- Increasing mean stand diameter and densities of trees greater than 26 inches increases foraging habitat quality;
- Large accumulations of fallen trees and other woody debris on the ground; and
- Sufficient open space below the canopy for NSOs to fly.

PCE 4, Dispersal habitat in the California Coast Range (Klamath West)

Dispersal (i.e., transience and colonization) habitat is generally characterized by:

- Stands with adequate tree size and canopy cover to provide protection from avian predators and minimal foraging opportunities; in general this may include, but is not limited to, trees with at least 11-inch dbh and a minimum 40 percent canopy cover;
- Younger and less diverse forest stands than foraging habitat, such as even-aged, pole-sized stands, if such stands contain some roosting structures and foraging habitat to allow for temporary resting and feeding during the transience phase; and

- o Habitat supporting the colonization phase of dispersal, which is generally equivalent to nesting, roosting, and foraging habitat as described in PCEs (2) and (3), but may be smaller in area than that needed to support nesting pairs.

Assumptions for Changes to Critical Habitat

- o Roadside treatments in existing NSO habitat would result in maintaining habitat thus habitat would remain functioning at the current habitat type post-treatment.
- o Commercial and fuels treatments would maintain nesting/roosting habitat at 60 percent canopy closure and foraging habitat at 40 percent canopy closure.
- o New landing and new temporary road construction would result in the loss of habitat for the footprint of the landing and road prism if the landing construction occurs within suitable habitat.

Criteria for assessing NSO Critical Habitat analysis

The desired condition for this analysis indicator is to minimize the effects to NSO critical habitat. The analysis estimates the number of critical habitat acres affected by the action alternative. Given the types of treatment proposed for this project, we focus the reporting of effects on habitat as degrade, downgrade, or remove. Degrade means the effects on the habitat are minimal and the habitat remains functional at the same level prior to treatment. Downgrade means the habitat has been affected to the point where it would not continue to function at its initial level and it would drop down one level in habitat type. For example, foraging habitat receives treatments that results in removing canopy cover and structure to the point that the foraging habitat functions as dispersal habitat. Removal means the once functional habitat is not habitat after treatment.

The acres of critical habitat downgraded or removed by the action alternative would be presented along with the proportion of the change in critical habitat within the portion of critical habitat subunit within the analysis area.

Affected Environment for Northern Spotted Owl

The area proposed for treatment (5,570 acres) occurs within Subunit KLW7 of the NSO Critical Habitat Unit 09 (Klamath West; USDI Fish and Wildlife Service 2012). The analysis area for NSO is 46,243 acres of which 37,447 acres occurs within two critical habitat subunits. A small portion of Subunit KLW6 (2,867 acres) of Critical Habitat Unit 09 (Klamath West) occurs within the analysis area. No proposed treatment would occur in Subunit KLW6. The remaining 34,580 acres is KLW7 and proposed treatment would occur in this subunit. Treatment of LSR is proposed for 49.4 acres, specifically in LSR Ten Bear RC349 and LSR100-KL0058. This treatment would be manual prescribed fuels and 11.9 acres of mechanical treatment removing trees less than 20-inch dbh. The *Somes Bar Project* area is dominated by dense early- and mid-successional habitats (53 percent), with late-successional habitats comprising about 24 percent of the area. An estimated 1,369 acres of late-successional habitat and about 2,969 acres of mid-successional habitat occurs within the project area. Within the treatment area, the primary objectives are treating dense early and mid-seral stands, enhancing resiliency of oak woodlands, reintroducing fire, and establishing functioning resilient heterogeneous forests at multiple scales.

The forest conditions of the *Somes Bar Project* area is representative forested conditions resulting from natural ecological processes (i.e., fires), past management, and fire suppression. Approximately 3,079 acres of federal and non-federal timber harvest have occurred in the watersheds since 1966. These projects were implemented prior to the 2012 Critical Habitat Rule and the habitat has been reevaluated. Most plantation and natural stands identified for thinning are uniformly dense and lack horizontal and vertical diversity. Natural ("minimally-managed") stands commonly have scattered trees exceeding 30-inch dbh, contain a mix of size classes, large logs and snags, and contain conifer and hardwood species diversity. Identified plantation stands contain densely spaced trees with interlocking crowns; therefore, the growth potential under current conditions is limited.

The ecological diversity found throughout the Western Klamath Mountains is reflected in diversity of vegetation types and terrain in the *Somes Bar Project* area. Forest stands occur as a result of soil type, aspect, disturbance history, and slope position. Currently vegetation diversity is high but the structural diversity is lacking in many areas. This lack of structural diversity is primarily due to the absence of naturally occurring mixed severity fires and the stand complexity resulting from this type of disturbance. Large residual conifer and hardwood trees are scattered through the stands that are dominated by mid-successional trees throughout the project area, the majority of which are surrounded by small and mid-sized Douglas-firs. Young dense conifer plantations (1960s through early 1990s) have not yet been thinned and are scattered throughout the project area. In addition, without the influence of naturally occurring mixed severity fire oak woodlands have become encroached with conifer.

Analysis Area for Northern Spotted Owl

The analysis area includes 10 NSO ACs that have been active at some point since the early 1980s (Table 3-18). The numbers in this table reflect pre-treatment conditions. The analysis area is about 46,243 acres in size; the analysis area contains approximately 15,369 acres of nesting/roosting, 12,615 acres of foraging, and 8,047 acres of dispersal habitat. Within the analysis area, an additional four NSO ACs were dropped from consideration. Three (3) of the ACs are located on the west side of the Klamath River (307, 308 and 4082) and the fourth AC (1075) had minimal acres overlap (1.89) and therefore was dropped (Yost and Bettaso 2018).

Many of the ACs within the analysis area have not been active for many years typically related to a change in habitat conditions (e.g., fire or previous management), but in most cases, the reason for no activity is unknown. These sites maybe occupied by barred owls or have a lack of continuous survey effort. In addition, there are a few ACs with questionable origin and appear to have been established based on a single observation with no evidence of reproduction. Although a single observation does not necessarily warrant an ACs designation, we are analyzing all possible ACs based on data from the forest and California Department of Fish and Wildlife (CDFW) databases.

Table 3-18. Northern spotted owl activity centers (ACs) within analysis area (pre-treatment).

AC Number	AC Name	0-0.5 mi Radius		0-1.3 mi Radius		Total NRF Acres (0-1.3 miles)	Most Recent Detection Year	SPOW Detection(s)
		NR	F	NR	F			
1250		201	125	1,330	914	2,244	2015	Male
53	Donahue Flat	150	150	986	814	1,800	2014	Pair
58	Scorpion	269	123	1,381	712	2,094	1995	Male
1073		271	85	1,340	699	2,039	1992	Male
1076		127	109	1,439	784	2,223	2015	Male
1089		259	106	1,228	883	2,117	1996	Pair
52	Wilder Creek	251	60	1,498	659	2,157	*2014*	*Male*
1260		376	26	1,762	502	2,264	*1993*	*Male*
SIS111		319	43	1,433	498	1,931	2015	Unknown Sex
4059		263	117	1,473	935	2,408	1996	Pair
Totals				***13,870***	***7,400***	***21,277***		

Analysis Indicator 1 – Risk to Reproduction

Based on habitat in known cores and home ranges, about 80 percent of the ACs analyzed in the project area are at a "low" risk to reproduction. One of the ACs has a very low risk to reproduction while the other ACs has a moderate risk to reproduction. In other words, the NSO ACs in the project area would likely have a high likelihood of being reproductively successful and contain enough suitable habitat to reproduce successfully if occupied.

Analysis Indicator 2 – Change in NSO Critical Habitat

The project focal areas and the analysis area overlap with the NSO critical habitat Subunit KLW7 (34,580 acres) and a small portion of KLW6 (2,867). Critical habitat Subunit KLW7 contains 12,662 acres of nesting/roosting, 8,679 acres of foraging and 6,013 acres of dispersal habitat. No treatment would occur within KLW6 but it does fall within the analysis area for the project.

Environmental Consequences to Northern Spotted Owl

Direct and Indirect Effects of Alternative 1 (No Action)

No action would have no "direct effects" to NSO habitat or individuals. The *Somes Bar Project* area would remain in the existing condition for an undetermined amount of time. The lack of treatment would retain all the remaining habitat and important legacy structures (e.g., large trees/snags and woody debris) to aid in the development of NSO habitat by providing physical structure as the stand regenerates. Fire modeling predicts increased losses or degradation of late successional habitats. Stands would remain in overstocked conditions with a lack of structural diversity and decreased prey base for NSO foraging. Since NSO and their prey are associated with large trees/snags and logs, Alternative 1 would maintain all large trees/snags and large woody debris. However, the lack of treatment would not aid in reducing fuels that would likely increase the potential of the project area experiencing fire levels that may interrupt habitat regeneration and maintenance of these features on the landscape. The lack of treatment would result in increased stand densities, increased fire severity, overstocking and potential loss of hardwoods due to competition with conifer.

The lack of treatment would however, affect the rate of habitat development (overstocking and competition), stand complexity, and risk of future high severity fire consuming suitable habitat thus risking reproduction of NSO as well as to critical habitat.

Direct and Indirect Effects of Alternative 2 (Action Alternative)

All of the known NSO ACs within the analysis area would have some type of treatment in the home range and four would have treatment in the core, but the level of affects would vary. For Analysis Indicator 1, a "very low" risk is desired—one (1) of the ACs met this criterion before treatment and Alternative 2 would not affect this AC's risk level. None of the eight ACs in the "low category" would increase in risk level. The ACs in the "moderate category" remained at the same risk level. None of the NSO ACs within the project area was ranked at the high-risk category.

Alternative 2 would result in the removal of critical habitat and nesting/roosting/foraging/dispersal (NRFD) habitat within the KLW7 subunit. The removal of habitat is due to new road and landing construction within the project area. During project design, the group ensured that suitable habitat removal (NRFD) did not occur within NSO ACs cores (0 to 0.5 miles) that were deficit in habitat. New road or landing construction that occurred within deficit NSO ACs was dropped from treatment (Table 3-19). New landing or road construction that removed suitable NRF habitat occurred in NSO home ranges that were not deficit in habitat. The process of evaluating each new road and landing construction avoided the possibility of "indirect take" to an NSO ACs. The habitat removal during new road and landing construction occurred in small isolated patches scattered across the proposed treatment area.

Roadside hazard tree treatment would remove trees that pose a risk to human safety including trees that meet the tree hazard guidelines. In addition, fuels treatments would remove some understory in portions of the roadside treatment resulting in degrading but maintaining the understory habitat. These treatments are not expected to downgrade or remove suitable habitat and habitat should function at pre-treatment levels. Commercial and fuels treatments would maintain NSO nesting/roosting habitat at 60 percent canopy closure and foraging and dispersal habitat at 40 percent canopy closure post-treatment. The proposed commercial treatments would maintain habitat suitability and function post-treatment. Smoke disturbance would be mitigated by survey efforts prior to implementation.

Overall, the amount of NSO habitat across the range of the species has been on the decline primarily because of large fire events that resulted in removing many acres of habitat (Davis et al. 2015, Davis 2015). The 2017 fires added to this negative trend in the amount and quality of NSO critical habitat on the SRNF. However, the 2017 fires within the NSO analysis area for the *Somes Bar Project* burned at lower intensities and did not remove large areas of suitable habitat. The NSO habitat baseline for the analysis area was adjusted after the 2017 fires and a new baseline was established for the project area.

Table 3-19. Proposed treatments by activity center.

Activity Centers	Habitat type	Thinning (comm, pct, or biomass)		Fuels Treatments		Temporary Roads & New Construction		Landing Construction		Total Treatment Acres	% Total Treatment	Total Treatment Acres	% Total Treatment
		0.5 mi acres	1.3 mi acres	0.5 mi acres	1.3 mi acres	0.5 mi acres	1.3 mi acres	0.5 mi acres	1.3 mi acres	0.5 mi acres	0.5 mi	1.3 mi acres	1.3 mi
1250	F	4.8	83.8	37.3	714	0.27	1.5	0	5	42.37	34	161.7	18
	N/R	0.1	25.3	7.6	74.4	0	.56	0	1.41	7.7	4	102.27	8
	Non	13	64.5	33.2	92.3	0.29	1.26	1.75	5.66	48.24	27	163.72	14
	Total	17.9	174.2	78.1	238.1	0.56	3.32	1.75	12.07	98.31	20	427.69	13
53 Donahue Flat	F	16.8	18.9	27.3	73.6	0	0	0	0	44.1	29	92.5	11
	N/R	7.2	12.4	31	162.3	0	.01	0	0	38.2	25	174.71	18
	Non	40.6	196.9	52.8	287.2	.79	4.1	2.91	12.08	97.1	48	500.28	31
	Total	64.6	228.2	111.1	523.1	.79	4.11	2.91	12.08	179.4	36	767.49	23
58	F	2.3	100.2	11.3	101.4	.01	1.27	0	2.25	13.61	11	205.12	29
	N/R	2.2	85.6	42.4	261.1	.03	1.18	0	1.74	44.63	17	349.62	25
	Non	15.3	200	8.8	129	.56	3.2	1.5	17.32	26.16	24	349.52	27
	Total	19.8	385.6	62.5	491.5	.6	5.65	1.5	21.31	84.4	17	904.26	27
1073	F	4.1	21.1	0.2	72.8	0.18	0.32	1	1.33	5.3	6	95.55	14
	N/R	1.4	8.3	5	50.3	0.07	0.11	0	0	6.4	2	58.71	4
	Non	8.1	96.7	0.2	158.7	0	2.88	0.5	7.08	8.8	6	265.36	20
	Total	13.6	126.1	5.4	281.8	0.25	3.31	1.5	8.41	20.5	4	419.62	12
1076	F	0	0.5	0	2.5	0	0.35	0	0	0	0	3.35	0
	N/R	0	4.6	0	61.4	0	0.11	0	0.66	0	0	66.77	5
	Non	0	0	0	1.7	0	2.85	0	0	0	0	4.55	0
	Total	0	5.1	0	65.6	0	3.31	0	0.66	0	0	74.67	2
1089	F	0	0.3	0	5.2	0	0	0	0	0	0	5.5	1
	N/R	0	0	0	4.9	0	0	0	0	0	0	4.9	0
	Non	0	1.1	0	9.4	0	0	0	0	0	0	10.5	1
	Total	0	1.4	0	19.5	0	0	0	0	0	0	20.9	1

Activity Centers	Habitat type	Thinning (comm, pct, or biomass)		Fuels Treatments		Temporary Roads & New Construction		Landing Construction		Total Treatment Acres	% Total Treatment	Total Treatment Acres	% Total Treatment
		0.5 mi acres	1.3 mi acres	0.5 mi acres	1.3 mi acres	0.5 mi acres	1.3 mi acres	0.5 mi acres	1.3 mi acres	0.5 mi acres	0.5 mi	1.3 mi acres	1.3 mi
52	F	0	0	0	10.9	0	0	0	0	0	0	10.9	2
	N/R	0	0	0	26.4	0	0	0	0	0	0	26.4	2
	Non	0	15.2	0	99	0	0.55	0	0.5	0	0	115.25	3
	Total	0	15.2	0	136.3	0	0.55	0	0.5	0	0	152.55	4
1260	F	0	5.7	0	101.7	0	0.05	0	0	0	0	107.45	21
	N/R	0	6.7	0	56.4	0	0	0	0	0	0	63.1	4
	Non	0	3.5	0	114.5	0	0	0	1	0	0	119	10
	Total	0	15.9	0	272.6	0	0.05	0	1	0	0	289.55	9
SIS 111	F	0	0.1	0	127	0	0	0	0	0	0	127.1	26
	N/R	0	0	0	130.9	0	0	0	0	0	0	130.9	9
	Non	0	4.3	0	144.6	0	0	0	0.5	0	0	149.4	10
	Total	0	4.4	0	402.5	0	0	0	0.5	0	0	406.9	12
4059	F	0	3.5	0	45	0	0.1	0	0	0	0	48.6	5
	N/R	0	0	0	30.9	0	0	0	0	0	0	30.9	2
	Non	0	10.6	0	51.2	0	0.13	0	0.5	0	0	62.63	6
	Total	0	14.3	0	127.1	0	0.23	0	0.5	0	0	142.13	4

Cumulative Effects

Future actions are included in the *Aquatic Restoration Project*, which is under development. California Department of Forestry and Fire Protection's (CAL FIRE) website does not indicate if there are any additional timber harvest plans currently planned on private lands. The direct and indirect effects of Alternative 2 plus cumulative effects resulting from other actions within the analysis area did not change the risk level for any of the ACs (Table 3-20 and Table 3-21).

For Analysis Indicator 2, the cumulative effects would not result in any additional acres of critical habitat being removed. The direct and indirect effect of this alternative (about 76 acres of NRFD habitat) plus the cumulative effect (about 0 acres of NRFD habitat) from other projects would remove about 76 acres of critical habitat (NRFD habitat) totaling about 0.2 percent of the NRFD habitat for the portion of critical habitat in the analysis area.

Summary of Effects by Analysis Indicators (NSO)

Table 3-20. The number of NSO sites within each level of risk to reproduction (Analysis Indicator 1).

Risk to Reproduction	Current Condition	Alterative 2
Very Low	1	1
Low	8	8
Moderate	1	1
High	0	0

Table 3-21. Change in NSO critical habitat analysis Indicator 2.

Critical Habitat Subunit within Analysis Area	Critical Habitat Acres in Analysis Area	Nesting/ Roosting		Foraging		Dispersal	
		Current	Alternative 2 Acres	Current	Alternative 2 Acres	Current	Alternative 2 Acres
KLW6	2,867	1,495	0	470	0	532	0
KLW7	34,580	12,662	-6	8,679	-12	6,013	-58

Forest Service Sensitive Wildlife Species

Analysis of project impacts to Forest Service Sensitive species is required by FSM 2670 through the preperation of a BE. All Forest Service Sensitive wildlife species known or thought to occur in the project area (based on habitat and range), were evaluated for this project. It was determined that the project would have no impact on certain Forest Service Sensitive species, based on either the lack of habitat, lack of detections during surveys, or the fact that habitat would not be impacted. In additon, surveys and limited operating periods (LOPs) could be used as a mitigation to reduce the risk that project actions would impair a species reproduction.

Species that would not be affected by this project include the greater sandhill crane (*Grus canadensis tabida*), great gray owl (*Strix nebulosa*), Siskiyou Mountains salamander (*Plethodon stormi*), cascade frog (*Rana cascadae*), northern red-legged frog (*Rana aurora aurora*), Tehama chaparral snail (*Trilobopsis tehamana*) and mardon skipper (*Polites mardon mardon*).

The following summarizes the effects analysis of those Forest Service Sensitive species and/or habitat that may be affected by this project. The BE prepared for this project contains the affected environment for each species, description of indicators to base effects on as well as the assumptions upon which the analysis was done.

Bald Eagle

The two known sites along the Klamath corridor are Green Riffle and Soldier's Creek bald eagle nest sites. The Green Riffle bald eagle nest is 0.55 miles from the Rodgers Focal Area. The Soldiers Creek bald eagle nest is 0.17 miles from the Ti Bar Focal Area.

Indicator: Level of Disturbance

Disturbance of eagle nest sites can affect eaglet survival. The most common activities likely to occur in this project that may disturb eagles is noise created by equipment.

Alternative 1 (No Action)

The lack of treatment would have no effect on disturbing nesting eagles in the short- or long-term. The lack of treatment would result in increased stand densities, increased fire severity, overstocking and potential loss of habitat and nest trees within or adjacent to the nest stand.

Alternative 2 (Action Alternative)

In order to mitigate this concern, a PDF would minimize the risk of creating noise that may result in noise disturbance. Smoke disturbance would be mitigated by survey efforts prior to implementation.

Northern Goshawk

The *Somes Bar Project* area was surveyed for goshawk. One goshawk nest was detected and the site produced offspring in 2015. No other sites are known to occur within the project area.

Indicator – Level of Disturbance

Little information is available about the direct effects of disturbance on nesting goshawks. However, goshawks generally exhibit a high level of vulnerability during the incubation stage. The LRMP S&Gs recommend a noise-disturbance distance buffer of 0.25 miles around nest sites (pp. 4-29).

Indictor – Risk to reproduction

The amount and quality of nesting habitat can affect the success of a nest. The LRMP recommends that management in the goshawk primary nest zone (0.5 mile radius around nest site) maintain at least 60 percent canopy cover over 300 acres (primary nest zone equals 504 acres; KNF LRMP p. 4-29).

Alternative 1 (No Action)

One goshawk site was located during survey efforts for the *Somes Bar Project*. This site has sufficient habitat to reproduce and the site produced two young in 2015. Without treatment, it would be expected that this site would continue to be active. The No Action Alternative would not disturb this goshawk nest site. In the long term, the lack of disturbance is expected to continue without action.

Alternative 2 (Action Alternative)

Alternative 2 would have treatment within 0.25 miles of the nest site (Rudy's Nest). However, a PDF would be used to avoid disturbance of this nest location during the sensitive part of nesting. Therefore, Alternative 2 would have a low risk of disturbing the known goshawk nest site. Smoke disturbance would be mitigated by survey efforts prior to implementation.

Fisher, Marten, and Wolverine

Fisher

Fisher appear to be common within the project and analysis area. There have been many observations of fisher near or within the project area over the last 20 years. Baited camera station surveys have been conducted within the project area: positive detections have been made at many of the stations within the focal areas in the two (2) years of sampling from 2016 to 2017. No den sites have been found.

Marten

The distribution of marten on the east side of the Forest along the Klamath River corridor is not well known due to the lack of consistent and reliable observations. Surveys for forest carnivores have been described above (see fisher) within the *Somes Bar Project*, and during fisher survey efforts a marten was detected in 2016. This marten was most likely a dispersing individual. No den sites have been found.

Wolverine

There are no verified records of wolverine on the SRNF: however, incidental sightings of wolverines have been reported on the northern part of the Forest. Most of the sightings occurred in the 1970s and 1980s. Surveys were conducted in the *Somes Bar Project* area in 2016 and 2017 using baited camera stations. No wolverine were detected. We are assuming the wolverine could be present in the project area and would use the same basic habitat as the fisher.

Indicator – Level of Habitat Alteration

Fisher, marten, and wolverine occupy similar habitat of late-successional, dense conifer forest. These species are commonly found at different elevations with some overlap. All three of these species move across the landscape using higher or lower elevation conifer forests even though the elevation may be outside the average elevation range for the particular species.

Indicator – Change in Fisher Home Range

Fisher home range selection is important because the home range must provide sufficient resources for survival and reproduction. Some of the basic characteristics of home range selection appear to be related to tree canopy closure, tree size class, percentage of conifer, and openness (area with little overhead cover; Carroll et al. 1999, Weir and Corbould 2010). However, the amount and distribution of these habitat characteristics can affect a fisher home range. Fisher can be split into three habitat categories: denning/resting, foraging, and movement. Denning/resting habitat is typically the least common on the landscape followed by foraging. Movement habitat, which provides overhead cover for fisher to move from one patch of denning/resting habitat to another and avoid predation, is more common.

The loss of overhead cover creates openings that may affect the function of a fisher home range. Fishers avoid crossing large openings and moving around large openings while staying within habitat may not be feasible for a home range to function. A fisher home range needs about half of the home range with at least 50 percent canopy cover and 30 percent of the home range with 20 percent overhead cover.

Alternative 1 (No Action)

Fisher, marten, and wolverine are forest dependent species that are strongly associated with older forests with dense canopy cover. The project area is currently in an overstocked dense condition with canopy closure typically above 90 percent. The No Action Alternative would have no "direct effects" to fisher, marten, or wolverine habitat or individuals. Unfortunately, Alternative 1 would not help to protect existing habitat. The overstocked stands and increased competition would increase the likelihood of future high severity fire possibly threatening more denning/resting habitat and increasing fragmentation of home ranges. Therefore, Alternative 1 would not affect the level of habitat alteration or the amount of habitat needed for a fisher home range.

Alternative 2 (Action Alternative)

Alternative 2 would most notably affect seven (7) of the watersheds. The proposed treatments would result in seven of the watersheds changing in level of habitat alteration from low to moderate. Three of the watersheds remained at the same level of habitat alteration given the effects of Alternative 2.

Of the watersheds analyzed for impacts one of the watersheds is above 20 percent habitat alteration (Natuket-Klamath). Two are above 15 percent, but below 20 percent habitat alteration (Ogaromtoc-Klamath, and Rodgers Creek). The other four are below 15 percent, but above the 10 percent criteria for a low level of habitat alteration.

Ten of the watersheds met the criteria of possibly containing or contributing to a fisher home range. These ten watersheds are likely to contain enough habitat and could contribute to a fisher home range after proposed treatments.

Pallid Bat, Townsend's Big-eared Bat, and Fringed Myotis

Pallid bats

Surveys have not been conducted within the project area, but because suitable large tree roost sites are fairly common and it is reasonable to conclude that pallid bats are present within the project area. Suitable roost sites for pallid bats in the form of large trees and snags do occur in the project area. Other structures, including buildings and bridges, also occur within or adjacent to project area, but are much more limited.

Townsend's big-eared bats

Surveys have not been conducted and no known locations occur within the project area. Caves or open mines are not known to occur within the project area; however, suitable roost sites for Townsend's big-eared bats in the form of large diameter trees are scattered throughout the project area. Thus, it is reasonable to assume that Townsend's big-eared bats are present in the project area. Surveys would not be conducted for this species.

Fringed myotis

Little is known on the species abundance and distribution, although potentially suitable roost sites exist within the SRNF. This species is known to roost in caves, mineshafts and abandoned buildings. There are no detections of this species in the project area and no known roost sites within the project area.

Indicator – Risk of disturbance

The KNF LRMP recommends no timber harvest within 250 feet of a roost site (S&G pg. 4-32; i.e., hibernacula or maternity).

Alternative 1 (No Action)

Three potential sites were identified within the project area. For Alternative 1, the lack of action would not affect bats. The lack of disturbance created by treatment and fuels treatments would maintain any hibernaculum or maternity sites. Therefore, for Analysis Indicator 1, the risk of disturbance is no effect.

Alternative 2 (Action Alternative)

The action alternative would have direct and indirect effects for Analysis Indicator 1. All of the known sites within the project area would have a low or moderate risk of disturbing a possible bat maternity or hibernacula. Given the period when treatment is most likely to occur (summer and fall months), treatment is not likely to disturb a possible hibernacula. The treatments may disturb a maternity because maternities are active from April to August, but are most sensitive during the early spring when the offspring are not capable of flight. Although unlikely, the two sites with a moderate risk of disturbance could affect a maternity, but more realistically, treatment greater than 250 feet is only likely to disrupt foraging bats. The site identified as a historic cave is ranked as low because of the site is over 0.5 miles from proposed treatment units. Although caves can possess features that are desirable for bats this site has not been checked in the field for occupancy. Maternities are not common because bats need specific cave environment conditions and although this site maybe a historic mine it may not have the criteria to be suitable as a site.

Willow Flycatcher

Surveys have not been conducted within the project area. No nest site locations are known within or adjacent to the project area. Willow flycatchers have been detected upriver on the KNF. The distribution and amount of willow flycatcher reproduction is not well known on the Forest, but reproduction is possible. We are assuming that flycatchers are present on the Forest and reproduction is most likely to occur in riparian areas primarily in the low gradient and larger waterways. The remaining waterways within the project area would be high gradient and less suitable or would not contain suitable vegetation for willow flycatcher reproduction.

Indicator – Habitat alteration

It is difficult to translate the number of territories actually affected by the proposed activities, but it can assume based on the average size of territories that even one acre of riparian habitat could affect willow flycatchers. Therefore, small changes in habitat associated with reproduction could have large effects on the willow flycatcher, if present.

Alternative 1 (No Action)

The flycatcher would continue to use available habitat within the project area. In the long-term, the habitat could be lost due to due lack of proposed treatments. For Analysis Indicator 1, the lack of action would have no effect on risk to habitat alteration.

Alternative 2 (Action Alternative)

The direct and indirect effects on willow flycatcher habitat is low for (100 percent) of the 7th-field watersheds in the analysis area. Most of the effects are the result of fuels treatments in riparian reserves. The primary habitat identified in the watersheds is along the Klamath River corridor. This habitat falls within the treatment polygons but the river corridor has isolated pockets of suitable willow habitat. The fuels treatments in these areas would be difficult because nothing would carry fire over sand and rock bars.

Western Bumblebee

In general, bumblebees prefer open meadow like areas with a high diversity of plant structure with an abundant amount of flowering plants (Hatfield et al. 2012). Habitat can also extend into agricultural fields or orchards where flowering agricultural plants can provide similar food resources (Hatfield et al. 2012). There is little information regarding the western bumblebee on the SRNF. The nearest confirmed detections were of two bumblebees in 1997 in the Marble Mountain Wilderness on KNF. Within the project area, most of the large openings occur on private property.

Indicator – Habitat disturbance

The desired condition for bumblebee is a low level of disturbance. The western bumblebee like other species of bumblebees is sensitive to habitat disturbance. In the project area, high quality wet meadow habitat and large openings are difficult to find.

Alternative 1 (No Action)

There is almost no suitable habitat for the western bumblebee in the project area. Alternative 1 would have no direct effect to the western bumblebee or its habitat. Any existing habitat within the project area would provide nesting and foraging opportunity for bumblebees.

Alternative 2 (Action Alternative)

The action alternative would have low levels of effects on the disturbance level on the western bumblebee. Treatments are not likely to occur in wet meadow habitats over 5 acres in size. The majority of large opening and wet meadows in the project area occur on private property or east of the project area in the Marble Mountain Wilderness.

Foothill Yellow-legged Frog

Surveys for the foothill yellow-legged frog have not been conducted in the project area. The majority of in-stream environments within the treatment area are not suitable for the foothill yellow-legged frog as they are characterized by steeper gradients and/or fast currents. However, along the Klamath River corridor and the lower tributaries it is reasonable to assume that this species is present. We are assuming that the frogs occur in the area and that the Klamath River has appropriate oviposition habitats along the river and in the lower reaches of stream confluences to the Klamath. Foothill yellow-legged frogs have been located in higher reaches of tributaries in the post-breeding and over-wintering seasons.

Indicator – Risk of disturbance

Alternative 1 (No Action)

Under the No Action Alternative, the scenario of a large, uncontrolled wildlife fire with high intensity burn coverage could devastate both upland and riparian habitats. In the case of a wildfire burning through riparian habitat, direct take of individuals would likely occur in areas of intense burn. Indirect take from fire may occur with the increase in sediment loading associated with fires (Sankey et al. 2017), that would be transported down tributaries and into the Klamath River, exacerbating the coverage of egg masses or filling interstitial spaces used by tadpoles.

Alternative 2 (Action Alternative)

The total amount of stream riparian reserves within the project area is approximately 2,122 acres, with mechanical treatments occurring in 147 acres in the outer 80 feet of the riparian reserves. Since adults are reported to rarely move outside of the 39-foot distance from the stream line, the level of impact to the species should be nominal. Manual fuels treatments to reduce ladder fuels occur within the 2,122 acres and prescribed fire would be allowed to back in from outside the riparian reserve buffer. Within the riparian reserves, actions are designed to minimize ground disturbance and maintain canopy cover while reduction the risk of a higher intensity wildfire.

Southern Torrent Salamander

Suitable habitat can be found throughout the SRNF, particularly on the western coastal ranges. This species is associated with seeps, small streams, and waterfalls in wet or mesic coastal-forested habitats (Welsh and Lind 1996, Diller and Wallace 1996). Changes to forest canopied and the hydrology of seeps and streams can affect southern torrent salamanders. Surveys have not been conducted for Southern torrent salamanders in the *Somes Bar Project* area but potentially suitable habitat is present within the project area along the upper-most reaches of perennial creeks. A southern torrent was found during spotted owl survey efforts in 2017 in the Ti Bar Focal Area. Habitat for this species is present in the planning area. Pre-project surveys for this species would not be conducted.

Indicator – Risk of disturbance

Alternative 1 (No Action)

Under the No Action Alternative, the scenario of a large, uncontrolled wildlife fire with high intensity burn coverage could devastate both upland and riparian habitats. In the case of a wildfire burning through riparian habitat, direct take of individuals would likely occur in areas of intense burn. Indirect take from fire may occur with the increase in sediment loading associated with fires (Sankey et al. 2017), that would be transported down into riparian habitats, exacerbating the filling of interstitial spaces used by southern torrent salamanders for all life stages

Alternative 2 (Action Alternative)

The total amount of stream riparian reserves within the project area is approximately 2,122 acres, with mechanical treatments occurring in 147 acres in the outer 80 feet of the riparian reserves. Since adults are reported to rarely move outside of the wetted channel of the stream, the level of impact to the species should be very small as no actions occur within the stream channel. Manual fuels treatments to reduce ladder fuels occur within the 2,122 acres and prescribed fire would be allowed to back in from outside the riparian reserve buffer. Within the riparian reserves, actions are designed to minimize ground disturbance and maintain canopy cover while reduction the risk of a higher intensity wildlife.

Western Pond Turtle

There have been no surveys conducted specifically for turtles, however, there is little suitable habitat for the species on the *Somes Bar Project*, due to the geology and geomorphology occurring upslope of the main stem of the Klamath River.

Indicator – Risk of disturbance

Alternative 1 (No Action)

Under the No Action Alternative, the scenario of a large, uncontrolled wildlife fire with high intensity burn coverage could devastate both upland and riparian habitats, to include both nesting benches and over-wintering habitats. In the case of a wildfire burning through nest benches or over-wintering habitat, direct take of individuals would likely occur in areas of intense burn if occurring when turtles have moved up from the Klamath River to over-wintering site in late September and fires occurring at that time or later. Indirect take from fire may occur with the increase in sediment loading associated with fires that could change subsequent nutrient sources leading to a trophic cascade event not suitable to turtle prey species (Emeko et al. 2016).

Alternative 2 (Action Alternative)

Within the 7th-field watershed with a buffer zone from 330 feet (100 meters) to 1,640 feet (500 meters), there is 5,261 acres of potential habitat, with 778 acres of habitat being treated by mechanical, manuals or prescribed burn treatments, or 15 percent of the analysis area being treated. With either mechanical or manual treatments, all 778 acres would have a prescribed burn treatment, and affect the 15 percent of potential nest sites or over-wintering habitats. The heat from fire could have direct impact on any stage of the turtles in the treatment areas, but would likely be of a lower intensity burn than an uncontrolled wildfire. Turtles may escape effects of fire by residing under soil in a low-intensity scenario, permitting perpetual existing in the area.

Cumulative Effects for Forest Service Species

Table 3-22. Summary of the Proposed Action and its effect on each federally listed and Forest Sensitive species.

Species	Determination
Federally Listed Species	
Northern spotted owl (NSO)	May affect, not likely to adversely affect.
NSO Critical Habitat	May affect, not likely to adversely affect.
Forest Sensitive Species	
Bald eagle, northern goshawk, fisher, marten, wolverine, pallid bat, Townsend's big-eared bat, fringed myotis, willow flycatcher, western bumblebee, foothill yellow-legged frog, southern torrent salamander, western pond turtle	May impact individuals, but is not likely to result in a trend towards federal listing.

Summary of Effects to TEK Focal Species

Fisher

In general, fisher dispersal is affected by the reduction in fisher habitat and the distance between patches of habitat (Weir and Corbould 2010). The desired condition is to maintain all potential suitable habitat for these species within a 7th-field watershed. Ten of the watersheds met the criteria of possibly containing or contributing to a fisher home range. These ten watersheds are likely to contain enough habitat and could contribute to a fisher home range after proposed treatments.

Northern Spotted Owl

See above for discussion of northern spotted owl.

Roosevelt Elk

The proposed treatments and the level of habitat alteration would have beneficial effects in the watersheds for Roosevelt elk. The goal of the proposed treatments is to promote a mosaic of habitat types across the landscape. Fire suppression over the last 100 years has simplified calving and wintering habitats. Encouraging mixed severity fire on the landscape would reduce conifer encroachment in hardwoods, increase perennial grass diversity and increase structural diversity providing hiding cover for calving and calves during the reproductive period. In addition, without the influence of naturally occurring mixed severity fire oak woodlands have become encroached with conifer. The Proposed Action would benefit calving and wintering habitats, and reduce conifer encroachment within the project area. The proposed treatments would also reduce the risk of hiding cover loss by high severity fires in the watershed.

New temporary roads total 0.6 miles and use on existing temporary roads is 8.1 miles. The temporary roads would be closed once implementation on project activities is complete. Road densities open to vehicular traffic are not expected to increase within the project area.

In addition, in the riparian reserves, only 147 acres would be commercially treated. These riparian reserves serve as corridors and networks within the focal areas providing connectivity to patches of security cover and calving habitats. Implementing this project would provide adequate security cover for elk and improve wintering habitat for this species.

Pacific Giant Salamander

The risk of disturbance to the Pacific giant salamander would be *low* following the criterion developed for the species and the amount of habitat used being treated by the Proposed Action. The reported available research on movement and habitat use has the species highly associated with use of the inner 80-foot buffer that would have no mechanical treatment in the stream tributaries occurring in the four focal areas. Within fish bearing stream reaches (320 foot riparian reserve widths), no mechanical treatment would occur within 240 feet. The impacts of fall prescribed fires that would be allowed to back-down into the inner 80-foot riparian reserves would occur at a temporal and spatial extent that would be minimal for any given single season. For prescribed fire down within the Klamath River floodplain, and associated riparian habitat along the Klamath River, fall burns would not likely impact species, as most of the larvae would have achieved metamorphic climax and begun dispersal up associated tributaries, as would that adults have moved earlier in the summer post-breeding activities. For adult Pacific giant salamanders moving or dispersing during winter rains, habitat modifications may be at a *moderate* risk in areas where large woody material (LWM) has not be retained on the landscape.

Willow

Willow is a TEK focal species and is being managed for basket making material. The direct and indirect effects on willow (*Salix* spp.) habitat is *low* for (100 percent) of the 7th-field watersheds in the analysis area. Most of the effects are the result of fuels treatments in the riparian reserves. The primary habitat identified in the watersheds is along the Klamath River corridor. This habitat falls within the treatment polygons but the river corridor has isolated pockets of suitable willow habitat. The fuels treatments in this area would be difficult because nothing would carry fire over sand and rock bars. Suitable habitat was not identified in the interior of the project area because the stream channels became incised and alder was more prevalent in these areas. Therefore, the number of watersheds within each of the levels of habitat alteration did not change with the effects of Alternative 2. The direct and indirect effects on willow (*Salix* spp.) habitat is *low* for (100 percent) of the 7th-field watersheds in the analysis area.

Management Indicator Species

Under the NFMA, the Forest Service is directed to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives" (PL 94-588, §6(g)(3)(B)). The 1982 regulations implementing NFMA require that "Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area" (36 CFR 219.19). *Management indicator species* (MIS) is a concept used by the agency to serve as a barometer for species viability at the forest level. Population changes of MIS are believed to indicate the effects of management activities.

The SRNF and KNF LRMPs use MIS to assess potential effects of project activities on the various habitats and habitat assemblages with which these species are associated. Forty-one fish and wildlife species have been selected as MIS or assemblages for a variety of habitats that are potentially affected by resource management activities on the forest (LRMP IV-97). The potential impacts to MIS were analyzed and the results are summarized here. The full report is located in the project file (Yost and Bettaso 2017b).

Seral stages in the project area range from shrub to mid-mature stands with smaller patches of late-mature and old growth. The project is designed to improve habitat conditions through the acceleration of late-successional habitat characteristics, while still maintaining current functional habitat. Canopy closure would be maintained in late-successional habitats, vegetation species diversity and composition would be maintained, and retention of snags and downed logs would be retained at 80 to 100 percent of the average numbers found within mature and old growth stands within the forest.

This project would degrade but maintain a approximately1,836 acres of early seral stage habitat due to shaded fuelbreaks, commercial and pre-commercial thinning in early seral stands (shrub through early mature). For species that utilize early seral habitat (such as the lazuli bunting) this represents 32 percent of the early seral stage habitat in the project area.

No commercial harvest would occur in high quality late-successional habitat; however, shaded fuelbreak construction would occur in late-successional habitat along the main roads. Ridgetop shaded fuelbreak treatments would degrade but maintain habitat that are considered suitable for late successional associated species. These fuel treatments would degrade but maintain approximately 0.08 percent of the suitable habitat for these species available in the project area. In two locations, the shaded fuelbreak would be approximately 150-feet wide on either side of the road. Only brush and small diameter trees (less than 4″ dbh) would be handpiled and burned. No overstory trees would be removed. All exiting snags and downed wood would be retained, unless the former poses a safety hazard. There would be minor habitat degradation for understory species such as the Pacific wren and ruffed grouse within the project areas through the removal of brush and small diameter (less than 8″ dbh) trees; however,in the long term, reduction of fuel ladders in these areas would improve adjacent habitat areas resilience to fire disturbance. Overstory canopy closure would be maintained, ground disturbance would be limited to existing roads and skid trails, vegetation species diversity and composition would be maintained, and retention of snags and downed logs would be retained at 80 to 100 percent of the average numbers found within mature and old growth stands within the Forest.

All riparian reserves have a no-commercial treatment established within 80 feet of the stream channel (inner 80 feet) and limited commercial treatment based within the outer 80 feet, with equipment exclusion requirements in the remaining riparian reserves (approximately 160 feet total riparian reserves width). Fuels treatments would be allowed to back down into the riparian reserves. In addition, handpiling of material less than 4 to 6 inches would be allowed within the riparian corridor. This would reduce “flashy fuel” accumulation in the riparian reserves. Adjaenct to perrnial streams, willow, a TEK focal species, is found and is being managed for suitable basket making material. Little to no true riparian habitat exists within the units given the lack of riparian vegetation associated ephemeral and intermittent stream courses within the project area. However, in the long-term project implementation has the potential to improve riparian habitat conditions through the release of conifer and hardwoods/shrubs from thinning, generating a secondary canopy. The project would maintain high levels of coniferous canopy closure within the project area adjacent to riparian reservess. Implementation of the project would maintain and improve riparian habitat conditions.

Understory burning may also cause short-term habitat degradation through the loss of small woody debris; however, burning would occur under specific weather and moisture condition designed to minimize damage to the residual stand, maintain large woody debris, and maintain at least 50 percent of the duff layer. Some minor local increases in fuels may occur from project generated slash, but due to proposed post-harvest fuel treatments, fuel loading would not be a threat to the treated areas. In the long term, reduction of fuel ladders would improve stand resilience to fire disturbance.

Understory burning the black oak/white oak assemblage would reduce conifer encroachment and protect and enhance the habitat in the long-term. MIS species such as the black-tailed deer and Roosevelt elk (TEK focal species) would benefit from burning these areas.

The *Somes Bar Project* would not adversely impact MIS. Although shaded fuelbreak construction would degrade habitat for species such as the Pacific wren and ruffed grouse, the majority of the project would improve/restore habitat conditions for all MIS by thinning (both commercial and precommercial) young, homogenous stands, accelerating the development of multi-storied conditions and other late successional habitat characteristics. In addition, development of strategic fuelbreaks would help protect existing habitat from stand replacing fire.

Survey and Manage

One S&M species occurs in the project area. No known sites for the red tree vole are known to occur in the project area. The Oregon red tree vole (*Arborimus longicaudus*) is a Category C species, which require pre-disturbance surveys. Red tree vole strategic surveys were conducted on the KNF in 2000. In 2002, random grid strategic surveys were conducted on the KNF. In 2015, random line transects were conducted in suitable habitat in all four focal areas for the *Somes Bar Project*. Recent research has defined the distribution of the red tree vole north of the Klamath River corridor. Only one of the focal areas (Donahue) is in the described range of *Arborimus longicaudus* (Forsman et al. 2016). In 2015, random line transects were conducted in all four focal areas (Ti Bar, Patterson, Rodgers, and Donahue). No red tree vole nests were documented in or adjacent to the project area in 2000, 2002, or 2015. These surveys serve to comply with the NWFP ROD for all species that may occur in the project area (Moore and Connaughton 2014; Bettaso, Yost and Hoover 2017). The red tree vole is not be analyzed further in this document.

The blue-gray taildropper (*Prophysaon coeruleum*) occurs on the Orleans RD (Survey and Manage Protocol 2003). The blue-gray taildropper is a Category A species that typically has pre-disturbance surveys and is listed to occur on the Orleans RD. The *Somes Bar Project* occurs primarily on the Ukonom RD (97 percent) which is outside of the range of this species. Three percent of the project area occurs on the Orleans RD. This portion of the project is located in the Donahue Focal Area. Review of the NRIS database and numerous surveys for SRNF projects has not detected the species on the Orleans RD or the Ukonom RD. Species collected during survey efforts include other species of *Prophysaon,* including *P. dubium*) and other undescribed *Prophysaon* species by taxon expert Dr. Barry Roth. There were and no detections of *Prophysaon coeruleum*. Of the 183.9 acres in the Donahue Focal Area occurring on the

Orleans RD, 34 acres (18 percent) are proposed for mechanical treatment, 68.2 acres (37 percent) are proposed for manual prescribed fuels treatment units, and the remaining 17.3 acres (9 percent) of mastication treatment that would be followed by manual treatments and prescribed burns. This would be a total of 119.5 acres (65 percent) of the 183.9 acres within the Donahue Focal Area proposed for treatment on the Orleans RD. The remaining 64.4 acres would be excluded from commercial treatment because of mitigation (FWS) including the designated northern spotted owl nest grove, and private land. The Pechman Rule also provides exemption for fuels treatments and in commercial stands less than 80 years of age. This species would not be discussed further in this document.

The *Somes Bar Project* would not adversely impact S&M species. Although the treatments may degrade/modify habitat, overall the project would improve/restore habitat conditions for all S&M species by thinning (both commercial and precommercial) young, homogenous stands, accelerating the development of multi-storied conditions and other late successional habitat characteristics. In addition, development of strategic fuelbreaks would help protect existing habitat from stand replacing fire.

Migratory Bird

Diverse natural communities are highly dependent upon the disturbance factors (such as fire regimes) that develop the structure and function of ecosystems. Communities can undergo negative changes in species composition and richness without these disturbance regimes or from the changes that result from a history of active management (reviewed in Atwilla 1994). In the Pacific northwest, Kennedy and Spies (2004) cite declines of diversified early-seral forests and broadleaf (hardwood) components of conifer-dominated landscapes federal lands resulting from years of fire suppression and the focus of old-growth conservation. Under current management policies, similar trends have in the same area on federal and non-federal lands have been modeled for the future (Spies et al. 2007).

Negative impacts to songbird populations have been observed to occur as a response to large-scale vegetation changes (Drapeau et al. 2000). Specific to hardwood associated bird communities, Betts et al. (2010) also hypothesized that declines of songbirds in species in the Pacific Northwest were due to the combination of forest succession and increased intensified forestry. This study found positive associations of many songbird species with the amount of broadleaf and young broad leaf forests at broad spatial scales.

Understanding the type and extent of disturbance and other ecological mechanisms in landscapes of interest are critical when considering management approaches (ibid). The North American Bird Conservation Initiative (2011) has identified the restoration of fire regimes as one of the most important challenges for forest managers nationwide. That synopsis details some successes and challenges to restoration projects including successful prescribed fire treatments and silvicultural practices that promote hardwood regeneration. The *Somes Bar Project* proposes management that attempts to recreate conditions and reintroduces ecological processes conducive to migratory songbirds.

On December 12, 2008, an MOU was signed by the Forest Service and the USFWS to promote the conservation of migratory birds. This MOU directs agencies to evaluate the effects of proposed actions on migratory birds, focusing first on species of management concern along with their priority habitats and key risk factors. Mechanical treatment of forested habitats do have the ability to mimic the effects of fire, but efficacy of these treatments may depend whether or not they replicate food availability or predation conditions that are created by natural fire. As fuels reduction activities are implemented in the Western Klamath region, these activities should be closely monitored with respect to their effect on bird abundance and demography. For the Six Rivers and Klamath national forests, the migratory bird species of management concern include species listed under the ESA as Threatened or Endangered, species designated by the Regional Forester as Sensitive species and species listed under S&Gs 8-21 through 8-34 of the KNF LRMP as MIS for project level assessment (Yost and Bettaso 2017b). There have been no site-specific surveys for migratory birds within the project area.

Watershed Values – Water Quality, Geology and Fisheries

Introduction

The protection of water quality and quantity is an important part of the mission of the Forest Service (Forest Service Strategic Plan for FY 2015-2020, June 2015). Management activities on NFS lands must be planned and implemented to protect the hydrologic functions of forest watersheds, including the volume, timing, and quality of streamflow. All management actions must be consistent with the Aquatic Conservation Strategy (ACS) objectives including riparian reserve S&Gs (see *Appendix E*). Riparian reserve widths of two-site potential tree-heights on fish-bearing streams and one site-potential tree-height on non-fish-bearing streams were established when the NWFP was adopted. Riparian areas provide the ecological functions and processes necessary protect water quality and to create and maintain habitat for aquatic and riparian-dependent organisms over time, dispersal corridors for a variety of terrestrial organisms and connectivity of streams within a watershed (FEMAT 1993). After 15 years under the riparian reserves system, 70 percent of the watersheds had improved and 18 declined (Lanigan et al. 2012). The primary factors for improvement were an increase in the number of large trees (>20 inches dbh) in riparian areas and reduction in road densities in watersheds. Watersheds in which conditions declined have recently experienced high intensity wildfires (Reeves et al. 2016).

This section discloses the analysis of direct, indirect and cumulative effects associated with proposed actions, while preventing adverse impacts to water quality and quantity, and fisheries resources (KNF LRMP (section IV, pp. 18-20, 25, 107-114) and SRNF LRMP (section IV, pp.46-49, 70-71), Clean Water Act, ESA). Beneficial uses most sensitive to water quality and quantity impairments in the project area are cold freshwater salmonid fishery, Native American cultural use and subsistence fishery. Residences in the project area depend on these tributaries as their lone source for domestic use.

Southern Oregon Northern California Coast coho are listed as threatened under ESA. The Middle Klamath River Coho Salmon Population reflects a moderate extinction risk under the *SONCC Coho Salmon Recovery Plan* (NMFS 2014). High-severity fires are identified as a key threat under the Recovery plan as they can torch, and damage vegetation and tree roots, decrease soil porosity, and cause chronic erosion (see *Fire and Fuels* section). High severity fires can also introduce large quantities of sediment (along with large wood) into streams via post fire landslides with the sediment posing a high threat to all life stages of coho within the Middle Klamath. Chinook and steelhead, Forest Service Sensitive species are located in the project area as well.

The forest plans require geologic investigations for ground or vegetation-disturbing activities on potentially unstable land, where potential geologic hazards exist, before the development of any new or existing rock or earth material quarries, and where there exist potential impacts to cave and groundwater resources (USDA Forest Service pgs. 4-18, 19, 20). Geologic investigations must include identification of geologically unstable lands, distribution of rock types and relevant structural features, geomorphic terrain with landslide potential, known special interest areas, caves, groundwater developments, and rock material quarries by use of existing databases, and include recommendations for additions or exclusions. Each geologic resource is addressed where applicable, and additional attention is given to unstable lands and treatments within unstable lands (Cabrera 2017).

Affected Environment

Risk of Wildfire

When wildfire eventually occurs, high rates of fire intensity can significantly reduce vegetative cover. With the exception of the 160 acres that burned in the 2017 Marble Fire in the Patterson project area, the rest of the area has not had a wildfire in the vicinity in at least 100 years. At present, the majority of the project area is at risk for active or passive crown fire (see the *Fire and Fuels* section for more details). In the event of an uncharacteristically high severity wildfire, water quality would be detrimentally affected by removal of vegetation and re-activation of landslides (Mikulovsky et al. 2012), all of which increase the potential for erosion. The potential loss of vegetative cover in riparian reserves would result in reduced streamside shading and increased stream temperatures. Fire-excluded landscapes are especially vulnerable to adverse changes in forest hydrology when stand-replacement wildfires inevitably occur (Keane et al. 2002). Peak flows usually increase substantially after large, intense wildfires, which presumably increases surface and mass erosion, resulting in substantial increases in sedimentation rates, ultimately lending to poor water quality until suitable vegetative cover is reestablished (Dwire et al. 2016).

Riparian Reserves

Ecologically diverse riparian corridors are maintained by active natural disturbance regimes, including fires that operate over a range of spatial and temporal scales. However, the role of fire, the streamside factors that influence fire properties and the response of riparian and aquatic communities to fire can differ widely, depending on characteristic of both e the fire and the riparian area (Dwire et al. 2016). Fire regimes in riparian areas relative to adjacent uplands vary depending on the physical features of the watershed, location within a given watershed, vegetation type and fuel characteristics, and disturbance and land use history (Olson and Agee 2005, Van de Water and North 2011). In the Klamath Mountains of Northern California, Skinner (2003) found that the median fire return intervals were approximately twice as long in riparian reserves as in upland sites, indicating that fires occurred less frequently in riparian areas. However, fires can be less severe or as severe as in adjacent uplands, depending on the local topography, vegetation characteristics (especially fuel moisture and loading), and fire weather (Dwire et al. 2016).

Headwater streams are among the most dynamic portions of aquatic ecosystems (Naiman et al. 1992). Tributary junctions between headwater streams and larger channels are important nodes for regulating material flows in a watershed (Benda et al. 2004).

Scientific Considerations for riparian conservation areas along non-fish bearing streams (Reeves et al. 2016)

- *Effect on microclimate and water temperature:* Relative to temperature effects, non-fish-bearing streams tend to be narrow channels in steeper constrained valleys (Moore et al. 2005). Near-stream vegetation and topographic features often shade the entire channel in such settings (Janische et al. 2012). In addition, water temperatures in headwater streams are strongly influenced by in-channel substrate (ibid). Neither of these factors would be affected managing vegetation within riparian reserves.
- *Effect on amphibians:* Olson et al. (2007) reviewed studies of the effects of harvest inside and outside of riparian reserves on microclimate conditions and amphibians. They concluded that the relatively narrow buffers can be effective in maintaining microclimates 33 to 66 feet from the stream center. Headwater streams may also serve as connection corridors within and between watersheds (Olson and Burton 2014). Most amphibians moved along the stream within 45 feet of the channel (Olson and Kluber 2014). Maintaining for downed wood in the riparian areas would further reduce potential impacts on terrestrial salamanders.
- *Effects on wood recruitment:* Since the publication of FEMAT (1993) report, new examinations of studies on the sources of wood (Spies et al. 2013) and information in Gregory et al. (2003) suggest that about 95 percent of the total instream wood inputs from the adjacent riparian area came from distances that ranged between 0.46 to 0.82 of a site potential tree height (82 to 148 feet) from the stream which is less than FEMAT's 0.95 of a site potential tree height (Reeves et al. 2016) Thus more wood recruitment comes from the inner half of a site potential tree-height than assumed in FEMAT; therefore, managing the outer half of the riparian reserves should maintain wood recruitment process in non-fish-bearing streams (ibid).

Fuel Treatments in Riparian Reserves

The immediate goal of most fuel-reduction treatments is to change vegetative structure and reduce fuel continuity to reduce crown fire behavior and potential wildfire size and intensity. Results of the study by Arkle and Pilliod (2010) indicate that the effects of prescribed fires are much smaller and shorter-lived to the effects of wildfire, especially uncharacteristically high severity wildfires. The effects of mechanical treatments on riparian species composition are more complex, and could result in longer-term changes, depending on magnitude of environmental impacts, such as soil compaction.

A recent publication, *Riparian Fuel treatments in the Western USA: Challenges and Considerations* (Dwire et al. 2016) described the following considerations for managing fuels in riparian areas:

- Riparian areas are part of the landscape and may need fuel treatments based on fuel loading within and in surrounding uplands. Reducing the risk of uncharacteristically high severity fire in riparian areas can limit the effects to riparian dependent species such as TEK focal species willow and Pacific giant salamander as well as limit the spread of invasive species.

- Fuel reduction treatments can potentially assist in riparian and stream restoration by returning fuel loads and vegetation, and result in more spatially diverse range of habitat components with long-term benefits for multiple wildlife species, including TEK focal species Roosevelt elk.

Riparian zones in the *Somes Bar Project* area were delineated by forest hydrologists, geologists, and fisheries biologists and totaled 3,072 acres. Unstable and potentially unstable geologic landforms were assessed and buffered. Stream riparian areas consisted of perennial, intermittent, or ephemeral streams, and the area on each side of these channels between 160-foot-slope distances for “non-fish bearing” streams up to 320-foot slope distances for “fish bearing” streams. These “fish bearing” streams include the mainstem Klamath (20 miles) and the lower portion of Burns, Kennedy, Ti, Sandy Bar, Stanshaw, Rogers, Teneyk, Natuket and Donahue Flat creeks for a combined additional nine miles of the wider riparian reserve boundaries. All streams have a definable channel and evidence of annual scour or deposition in order to be included in the riparian reserve system. Forested ponds, wetland features and associated aquatic vegetation have designated equipment exclusion zones.

Riparian reserves are represented in the lower elevations of the watersheds by the TEK focal species Willow (primarily located along the mainstem Klamath River) and the Pacific giant salamander. The riparian reserve system provides travel corridors for wildlife species, including Roosevelt elk and Pacific fisher, two more TEK focal species. Before the NWFP, timber harvest occurred in what are now designated riparian reserves. Much of the riparian areas would burn like adjacent uplands, as the riparian vegetation terrain and topography are similar to surrounding uplands. Fuel abundance/accumulation is likely to be similar to the uplands.

Forest plan direction allows for silviculture and fuels treatments within riparian reserves when needed to meet ACS objectives. Fuel reduction treatments can potentially assist in riparian and stream restoration when actions include the return to fuel loads and vegetation that supports ecosystem processes and natural disturbance regimes, including restoring fire to the landscape (Dwire et al. 2016).

Geology

The project area lies in the west central area of the Klamath Mountains, which are comprised of sets of roughly parallel, north-south trending, arcing concave eastward belts extending from northwestern California through southwestern Oregon (Irwin 1989). The deep inner gorge canyon of the Klamath River bisecting the steep upland topography of the project area, as well as the disrupted and sheared nature of much of the bedrock, combined with high rainfall-runoff effects in the wet Mediterranean climate, combine to effect high rates of mass movement (landsliding) and sediment delivery. The major floods in 1955, 1964, the 1970s, 1986, 1995 and 1998, to name a few, have resulted in extensive landslide delivery to the Klamath River, often damaging or removing Highway 96. Large prehistoric landslides are evident in all four focal areas. Of these, the Ti Bar earthflow has by far the greatest contemporary activity and concerns for project-related effects. Deep-seated landsliding in the Ti and Rogers Creek focal areas is largely associated with shearing along faults and inner gorge activity. The Donahue Flat and Patterson focal areas are occupied by a large prehistoric landslide that are mostly dormant now though exhibit characteristics of dormant earthflow terrain such as frequent springs, hummocky terrain, and broad, steep concavities with well rounded, deeply weathered breaks in slope but no abrupt scarps. All active shallow landslides, inner gorges, and areas within earthflows that have evidence of activity within the past 400 years (USDA and USDI 1994b) such as toe zones, bowed and leaning trees, abrupt scarps, tension cracks, disorganized and incised stream networks, and sag ponds, and that impact watercourses were mapped and included in riparian reserves as is required by the KNF and SRNF LRMPs (USDA Forest Service 1995 pp. 44-50, USDA Forest Service 2010 p. IV-44).

Unstable Lands

There are no geologic special interest areas, or caves in project area. No groundwater or rock quarry developments are proposed. The SRNF has no samples or tests for presence of naturally occurring asbestos within or near the project area. No mechanical treatments would be applied and no temporary roads used within ultramafic and serpentine bedrock. Strategic firelines are planned on serpentenite soils within the Patterson Focal Area, but they are fuelbreaks—not handlines—and would not disturb the soil. The geologic resource addressed in this analysis is related to proposed ground disturbing treatments within unstable lands.

Unstable lands have been mapped as riparian reserves in the project area. The forest plans prohibit timber harvest on extremely unstable lands defined as active landslides, inner gorges, toe zones of dormant landslides and severely dissected granitic terrain (USDA Forest Service 1995, glossary p. 7).

No commercial harvesting would occur within extremely unstable lands. Ground disturbing activities are proposed on approximately 15 acres (1 percent of all mechanical timber harvest units) of riparian reserves associated with unstable lands on nearly dormant sections within large, deep-seated earthflows. The activities proposed are significantly distant from extremely unstable lands in order to prevent any triggering of mass movement, and pose low risk of sedimentation because sites are low gradient and slope away from stream channels.

Water Quality

The hydrologic function most vulnerable to the Proposed Action is quality of streamflow. Proximity of ground disturbance to riparian reserves in an important factor controlling sediment delivery (Rashin et al. 2006). When compared to the other proposed actions, mechanical fuel-reduction treatment methods and associated connected actions within riparian reserves have potential to cause measurable ground disturbance, which could impact water quality by altering background sedimentation rates in the short term.

Because the project is spread across three 6th-field watersheds, and at most encompasses roughly 13 percent of the Reynolds-Klamath River watershed, it is very unlikely that enough vegetation would be removed to cause detectable changes in peak flows in the analysis area. For rain-dominated zones (below 2,500 feet in elevation in the project area), changes in peak flow can only be detected where 29 percent of the area is harvested (Grant et al. 2008). For areas where rain-on-snow events can occur (above 2,500 feet in elevation in the project area), the detection level for peak flow increases is 19 percent, including harvested acres and the area in roads. The magnitude of observed changes in peak flows from management activities diminished with increased watershed area (ibid).

Temperature

In 1996, the Klamath River was listed for nutrient and temperature impairment under §303(d) of the Clean Water Act. The basis for the listing was associated with aquatic habitat degradation in the main-stem due to excessively warm temperatures and algae blooms associated with high nutrients, water impoundments (reservoirs) and agriculture diversions. While the main-stem Klamath is listed as impaired, its smaller tributaries within the project area provide year-round excellent cold freshwater quality and have no agriculture diversions, impoundments, or significant water withdrawals that would alter water quality or quantity (*Ishi Pishi Ecosystem Analysis* 1998). Throughout the Klamath River watershed in California, the 303(d) listing has prompted many individuals, groups, Indian Tribes, and agencies to actively work together to enhance and restore water quality. Their past and present efforts have improved water quality conditions in the Klamath River and its tributaries (*Action Plan for the Klamath River TMDL*, California State Water Resources Control Board 2010). The North Coast Regional Water Quality Board has adopted a waiver of waste discharge (The Waiver) that includes conditions to implement the Klamath TMDL Action Plan for activities on USFS land. This project would meet all requirements associated with The Waiver.

Elevated water temperatures are common water quality concerns in the Klamath River basin. Solar radiation is the most important source of radiant energy affecting stream temperatures. Shading from overstory vegetation along the stream channel has a significant effect on temperature. A study conducted in western Oregon (comparable vegetation types and geology as in the project area) of thinning treatments and the effects on stream temperature showed that thinning in primary shade zones (area adjacent to stream channels that provides stream shade during periods of greatest solar loading) along 6 miles of stream led to a 4 degree (F) increase in temperature (NWFP Temperature TMDL Implementation Strategy 2010). In dense riparian areas such as in the project area, optimum shade can be provided by the primary shade zone alone (ibid). Near-stream vegetation and topographic features often shade the entire channel in such settings (Janische et al. 2012). Water temperatures in headwater streams are also strongly influenced by in-channel substrate (ibid). Neither of these factors would be affected managing vegetation within riparian reserves. The table below displays findings relative to minimum widths of primary shade zones needed maintain suitable shade. All proposed buffer widths are greater than the widths recommended in Table 3-23 below. Canopy cover would not be affected in the inner riparian reserve and the 147 acres treated mechanically would not significantly change canopy. Given the project conservative protection of the primary shade zone, increase in stream temperature is unlikely. In the long term, a more fire-resilient stand would promote and maintain appropriate shade over time, provide for larger trees and a diversity of desired species in the riparian area.

Table 3-23. Minimum width of primary shade zone (feet) based on slope and tree height.[30]

Tree height	Hill Slope Percent		
	<30	30 to 60	>60
<20 feet	12	14	15
20 to 60 feet	28	33	55
>60 to 100 feet	50	55	60
>100-140 feet	70	75	85

Chemical Contamination

Project operations would adhere to all best management practices (BMPs) pertaining to containment and prevention of all petroleum product spills from reaching water bodies. Heavy equipment fueling would only occur on roads and landings. Chainsaw fueling or storing of fuel would not occur adjacent to stream courses. Spill trays and absorbent padding would always accompany fueling or storage of fuel and oil during operations. Containers of fuel and oil are removed daily off-site. Chemical contamination would not occur.

Water Quantity

Water drafting to support prescribed burns and dust abatement for watering roads could occur from developed water sources near the project area. It is unlikely that flows would be affected from the drafting as relatively small amounts would be removed and the area would be continually recharged from upstream. Best management practices require less than 10 percent of base flow be drafted at any given time. For these reasons, implementation of the project would not adversely impact the volume or timing of streamflow.

Fisheries

Within most miscellaneous mid-Klamath tributaries of the project, anadromous and resident fish habitat is very limited due to channel steepness and existing gradient barriers (e.g., slopes >8 percent over a >200 foot distance). In general, suitable tributary fisheries habitat mostly occurs within lowermost reaches, within low-to-moderate stream gradients, found near their confluence with the Klamath River mainstem. Anadromous fish streams potentially affected by project activities (see Table 3-24). Critical Habitat is defined as all potentially accessible streams and adjacent riparian zones.

Table 3-24. Miles of coho habitat by project focal area.

Project Focal Area	Tributaries to Klamath River	Miles of Coho Habitat	Fish Bearing (Steelhead/ Rainbow Trout) Miles
Ti Bar	Burns Creek	1.4	3.4
	Kennedy Creek		
	Ti Creek		
Patterson	Sandy Bar Creek	0.6	4.6
	Stanshaw Creek		
Rogers	Rogers Creek	0.9	2.7

[30] Source: Northwest Forest Plan Temperature TMDL Implementation Strategy 2010.

Project Focal Area	Tributaries to Klamath River	Miles of Coho Habitat	Fish Bearing (Steelhead/ Rainbow Trout) Miles
Donahue	Teneyck	0.63	1.9
	Unnamed tributary (North of Teneyck Creek)		
	Natuket		
	Donahue Flat Creeks		
Project wide	Klamath mainstem	16.4	16.4

The SONCC Coho Recovery Plan identified one of the key limiting threats is related to risk of high severity fire. High-severity fires can torch and damage vegetation and tree roots, decrease soil porosity, and cause chronic erosion. High severity fires can also introduce large quantities of sediment into streams posing a high threat to all life stages of coho. This project addresses specific recovery actions including developing a plan for firebreak stewardship and defensible space, implementing fire-safe community action plans in identified areas and reducing stand densities through prescribed burning and thinning to reduce high severity fire. Reducing the risk of wildfire would also benefit Chinook, steelhead and other aquatic organisms, including TEK focal species.

Environmental Consequences

Methodology

This section describes methods used to evaluate proposed treatments within and adjacent to riparian reserves, including unstable areas, and the effects of the proposed actions to water quality and fisheries. Analyzing the effects to coho salmon serves as a surrogate for other aquatic resources including Chinook, steelhead, and Pacific lamprey.[31] In addition, cumulative effects from the Proposed Action, as well as ongoing, future and past actions in the last 30 years, are quantified using the Equivalent Roaded Acres (ERA) method.

LiDAR imagery recently acquired in the project area provided a digital elevation model (DEM), and from this, a stream delineation model was utilized to reveal precise locations of stream channels and extent of unstable terrain in the project area. Stream-delineation model results, along with unstable terrain were validated on the ground by qualified earth scientists and fisheries biologists in 2016 and 2017. Subsequently, riparian reserves layers were created to assist with project planning efforts, quantify proposed treatment acres and refinement of PDFs for riparian reserves, including unstable lands.

Additional analysis for fisheries effects is based upon Forest Service, Karuk Tribe and CDFW available fisheries data; fisheries surveys and assessments of aquatic habitat suitability; a review of best available information related to existing aquatic resources and potential impacts, and professional judgment (Cyr, Forest Service fisheries biologist). A BA/BE was prepared for consultation with National Marine Fisheries Service (NMFS; Cyr 2018) and analyzed the potential effects to fish and their habitat based on the effects to seventeen indicators (water quality, barriers, stream habitat complexity, etc.) of anadromous fish habitat conditions. Effects of the project to an indicator may be neutral (no effect),

[31] See Biological Assessment/Biological Evaluation for aquatic threatened, endangered and Forest Service Sensitive aquatic species in the project record for a complete analysis (Cyr 2018).

discountable (extremely unlikely to occur), insignificant (effects cannot be meaningfully measured, detected, or evaluated), or significant (effects able to be measured). Furthermore, effects may be either positive or negative.

Spatial and Temporal Context for Effects Analysis

The extent of watershed effects is dependent on the watershed size and the issues of concern (MacDonald 2000). The 5,570-acre planning area where these effects would occur is the scale used for assessing direct and indirect effects from individual proposed actions. For cumulative watershed effects (CWE), the analysis area is the 6th-field watersheds containing proposed treatment acres (Figure 1-1). Most of the treatment units are located in the Ti Creek-Klamath River and Reynolds Creek-Klamath River watersheds. Approximately 120 acres are located in the Boise Creek-Klamath River watershed (Table 3-25).

Table 3-25. Percent of project area in the analysis area.

6th-Field HUC Watershed	Watershed Acres	Project Area Acres in Watershed	Percent Project Area in Watershed
Boise Creek-Klamath River	31,343	120	0.4
Reynolds Creek-Klamath River	34,611	4,487	13
Ti Creek-Klamath River	13,623	1,045	8

Using the entire 5th-field watershed with the ERA model would dilute the effects of all projects that are occurring or planned in the foreseeable future. Hence, the ERA model to assess cumulative effects would be run for the three 6th-field watershed where the proposed actions are planned (Figure 3-31).

Alternative 1 – No Action

Direct and Indirect Effects to Water Quality and Coho Salmon

Indicator – Mechanical treatments within riparian reserves, high severity wildfire effects risk reduction.

Unit of measure – Acres

Duration – Long Term

Under the No Action Alternative, no fuel reduction treatments or associated connected actions would be implemented. There would be no direct effects to water quality or coho salmon under the No Action Alternative, as it maintains the current condition in riparian reserves.

Short-term indirect effects to fire-excluded landscapes would likely increase vegetation cover and woody debris inputs to riparian reserves, decrease stream temperatures, and delay and reduce peak flow runoff.

In the event of a large storm event, there is the risk that the stream crossings in the legacy roads could fail and deliver up to 1,100 cubic yards of sediment. Threatened and sensitive fish species occupy habitat ranging between 1.0 and 1.7 miles downstream of these legacy road treatment sites. Any of these road failures may cause effects at the site, but the potential for effects to resident and anadromous fish found downstream is negligible, and the expected response would be insignificant.

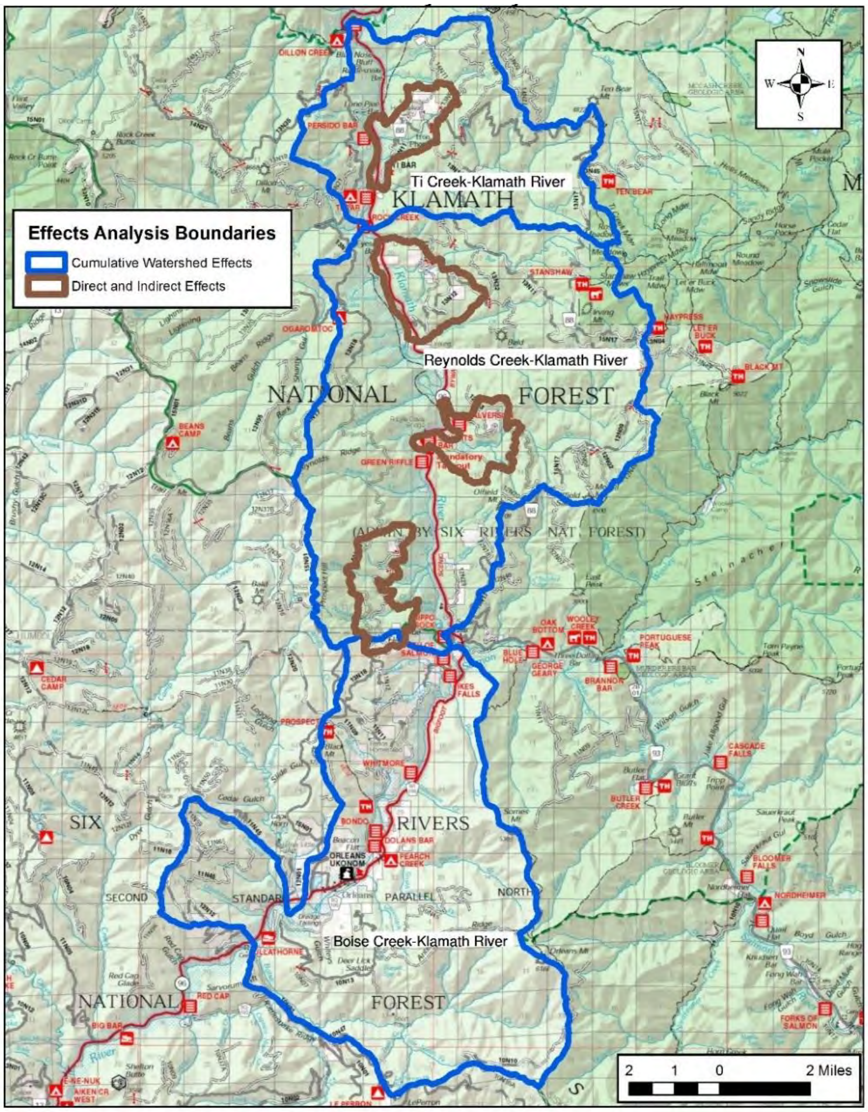

Figure 3-31. Watershed effects analysis boundaries.

Direct and Indirect Effects to Water Quality and Coho Salmon

Indicator – Reducing the risk of high-severity fire

Unit of measure – Acres

Duration – Long term

A summary of fire occurrence for this portion of the Klamath Mountains bioregion is described in the *Fire in California's Ecosystems* (Skinner 2006) and the *Project Fire and Fuels Report* (Spain 2017). Fire exclusion and past management activities have altered the fire regime within the *Somes Bar Project* area. Under Alternative 1, there would be no fuel reduction treatments and therefore no direct and indirect management related sediment delivery. No thinning or placement of strategic fuelbreaks would occur. Forest density, and surface and ladder fuels, are expected to increase, and forest health within riparian reserves is expected to continue to decline. This project area would remain vulnerable to having a stand replacement wildfire, especially on upper and mid slopes, and east and southeast facing aspects (see *Fire and Fuels* section). The predicted fire behavior indicators related to rate of spread, flame length and intensity are expected to increase if this landscape were left untreated, with the potential for wildfire to spread across multiple drainages causing additional impacts to more riparian reserves and aquatic habitats.

Under this No Action Alternative, SONCC Coho Recovery Plan restoration actions identified as MKR.7.1.9 and 8.1.2, which were prioritized to conserve and recover this species, would not occur. Therefore, the elevated high severity fire threat to this Middle Klamath coho population is expected to increase over time.

Cumulative Effects

Unit of measure – Equivalent Roaded Acres

Duration – Long term (5 to 15 years post treatment)

In assessing CWEs, all past, current and reasonably foreseeable actions on both private and public lands were assessed within all affected watersheds and related to beneficial uses and sensitivities within these watersheds (KNF LRMP EIS Appendix G, SRNF LRMP pp. IV-71, 1-10 and 11; FSH 2509.22 Ch. 20). The KNF and SRNF LRMPs incorporated S&Gs from the ROD for Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the NSO—also referred to as the NWFP. Methodology incorporates an Equivalent Roaded Acres (ERA) model used by the Pacific Southwest Region. The ERA model is a measure of hydrologic disturbance of a watershed. Disturbances, such as roads, timber harvest and wildfire, are converted into ERAs, approximating the amount of disturbance associated with 1 acre of road. The total ERAs are divided by the watershed area (acres) and multiplied by 100 to obtain the percent ERA for affected watersheds. This percentage is then compared to the Threshold of Concern (TOC) that is established in the LRMPs. Where ERAs approach or exceed a given watershed's TOC, further fieldwork would be necessary to ascertain whether CWE are present and if land management activities would adversely add to those effects and result in detrimental impacts to beneficial uses.

Results of the ERA model indicate that current conditions of the watersheds in the project area are well below the TOC for adverse CWEs. The current conditions of Ti Creek and Reynolds Creek watersheds are due in a large part to the NWFP revisions in 1995, of which both the KNF and SRNF LRMPs were updated to align with this new direction. Aquatic Conservation Strategy objectives were established, paving the way for extensive watershed analyses and subsequent restoration of sediment sources. In response to this new direction, the SRNF completed the *East Ishi Pishi Road Restoration Environmental Assessment* (2001). As a result, approximately 156 miles of road were stormproofed and 62 miles of road decommissioned. Additionally, the bulk of past timber harvest areas are well over 30 years old and much of the hydrologic processes impacted by past timber harvest activities have since recovered, and there have been limited timber harvesting (primarily commercial thinning for hazardous fuels reduction) in the Ti and Reynolds creek watersheds.

The No Action Alternative represents the current baseline for the project area. The most recent additions to the ERA calculations are the Marble, Ukonom and Haypress wildfires in 2017. Table 3-26 shows the existing ERA, representing the No Action Alternative.

Table 3-26. Existing Equivalent Roaded Acres (ERA) values by watershed.

6th-Field HUC Watershed	Watershed Acres	Total Existing ERA	Total Existing ERA (%)	Threshold of Concern (%)
Boise Creek-Klamath River	31,343	241	0.8	13.7
Reynolds Creek-Klamath River	34,611	1,680	4.9	8
Ti Creek-Klamath River	13,623	579	4.3	8

A likely potential adverse impact to cumulative effects could come from a high severity wildland fire. The effects of high severity fire in this area include an increase in erosion and creation of hydrophobic soils. In addition, there could be adverse effects to water quality by increased nutrients from ash, sediment bulking due to accelerated erosion, and loss of vegetative control of watercourses creating scouring of stream-banks. If the wildland fire was large in acreage it could lead to increased erosion rates and subsequent detrimental cumulative effects to the watershed in which it occurred. In 1999, the lightning caused Megram Fire (located in the Trinity River watershed, a major tributary to the Klamath River) eventually grew to almost 50,000 acres. More than half of these acres burned at high or moderate severity. It was estimated that short-term surface erosion rates could increase by 80-fold as a result of the wildfire (*Horse Linto, Mill, and Tish Tang Watershed Analysis*, USDA Forest Service 2000b).

Alternative 2 – Proposed Action

Direct and Indirect Effects to Water Quality and Coho Salmon

Indicator – Mechanical treatments within riparian reserves

Unit of measure – Acres

Duration – Short term (1 to5 years post treatment)

As discussed previously under the *Affected Environment* section, quality of streamflow (increased sedimentation) is the primary water quality factor that can be adversely impacted when ground-disturbing actions occur within riparian reserves.

Sediment movement can be episodic or chronic. In the Klamath Mountains region, the most common of sediment movement happens in response to large storm events. Ground disturbing activity within and adjacent to riparian reserves can potentially add to sediment delivery. Proximity of ground disturbance to streams is an important factor for controlling sediment delivery.

Effects to coho salmon (and other aquatic biota) are based on the proximity of the sediment to occupied habitat, the probability of the sediment affecting any life stage or habitat components and the magnitude of the effect (Cyr 2018).

Sediment Delivery from Fuels Reduction

Fuels reduction methods are categorized as manual, mechanical, and prescribed burning. Manual and mechanical methods are employed in preparation for prescribed burning, including follow up maintenance burning cycle to maintain desired condition.

Manual fuel reduction treatments are aimed at cutting small-diameter ladder fuel vegetation, followed by and handpiling of cut material, in preparation for follow up prescribed burning. Manual fuel reduction methods are conducted with only with hand carried mechanized tools (e.g., chainsaws and loppers). Manual treatments are limited to cutting and stacking vegetation, without disruption to the ground surface, thereby maintaining suitable ground cover and posing very low to no risk of sediment delivery regardless of the proximity of the activity to riparian reserves. For these reasons, proposed manual treatments would not pose a threat to water quality from sedimentation.

Mechanical fuel reduction treatments include conventional timber harvesting techniques, such as ground or cable based yarding systems. Mechanical methods are used to thin and remove ladder fuels and reduce competition between Douglas-fir species and other more fire resilient hardwood and conifer species (e.g., black oak and sugar pine). Because all of the units identified for mechanical treatments are in previously managed stands that were either high graded or clear cut, there are ample existing skid roads and old logging roads with which to operate on, thereby decreasing the need for new skids or temporary roads. There were no riparian reserve designations when these units were logged in the early 1960s. Much of the riparian reserve areas within the units are now dense thickets, dominated by Douglas-fir species. Consequently, much of the riparian reserve areas in the plantations within the project area would benefit from fuel reduction actions, and some mechanical treatments within the outer 80 feet of riparian reserves are warranted. Management within riparian reserves must demonstrate how activities would maintain riparian reserves and meet the ACS objectives. The NWFP recognized the need to manage within riparian reserves to address legacy issues of old silvicultural practices that encroached or even eliminated large trees within riparian areas and adjacent stream channels such as in plantations (LRMP pp. IV-49, IV-110). Project design features require any heavy equipment that operates within the riparian reserve do so in such a manner (linear passes and no turning of machinery) that does not displace or compact soils. The use of modern equipment (e.g., feller bunchers or excavators) reduces, or avoids soil displacement and compaction during implementation (Poff 1996). Equipment exclusion areas around springs and wet areas would be buffered 25 feet from the edges of the riparian vegetation and delineated on the ground. All efforts would be made to stay on existing roads and skid trails wherever possible or necessary to minimize soil compaction.

Interdisciplinary team (IDT) members representing disciplines of hydrology, soils, geology, forestry and fisheries carefully evaluated potential impacts from heavy equipment use within riparian reserves and ground based cable harvesting (endlining) outside of riparian reserve buffers. Because this is a fuel reduction project, the intent is to remove smaller diameter trees, while retaining the larger, more fire resilient trees in the stand. Canopy cover would not change, as over story trees would not be removed. No equipment or other ground disturbing activities would occur within the inner 80 feet of the riparian reserve (immediately adjacent to the stream channel) or within active landslides, providing for adequate buffers and filtering of soil that may have become displaced in the outer riparian reserve, thus posing a low risk to sedimentation. Kreutzweiser and Capell (2001) found no significant input of sediment when machine travel was greater than 10 feet from streams and harvesting equipment did not create channeled flow paths. Manual and mechanical would not result in significant expose of disturbed soil (See *Soils Resource* section) with the implementation of BMPs (see *Appendix D*) In the outer 80 feet of riparian reserves approximately 45 acres of mechanical treatments are recommended for endlining and 101 acres for ground based equipment, which includes 18 acres of mastication. Mastication includes using low impact type equipment, which typically is a small to medium size excavator with a rotary head operated to shred small diameter vegetation in dense stands. In general, masticator use would be limited and used along existing skid roads, logging spurs or firelines. Masticators would primarily be utilized only to maintain enough open space for hand pile placement and to break up the fuel profile to better insure desired prescribe burning effects.

Prescribed fire actions include handpile burning, understory and jackpot burning. Prescribed burning would generally occur as follow up actions for manual and mechanical treatments, but also can be the sole treatment prescribed. In many cases, it is important to break up the horizontal and vertical fuel composition prior to prescribe burning to meet project objectives of low to moderate severity fire effects, flame lengths up to 6 feet with minimal torching (less than 10 to 15 percent of the treatment area). Low to moderate severity fire effects would maintain a minimum of 60 percent canopy cover and 50 percent ground cover retention. Multiple entries of prescribed burning, ranging approximately from 2- to 7-year cycle, are included in the proposed actions. No direct ignition is planned to occur with riparian reserves. Ignition Prescribed fire would be permitted to back or flank into a riparian area, with the condition that fire effects would be of low to moderate severity. Ignition may occur within riparian reserves to insure desired fire effects.

No mechanical fuel reduction units are found adjacent to occupied coho salmon habitat or within the inner 80 to 160 feet of all riparian reserves. The 18 treatment units (13 manual only units and 5 prescribed burn only units) are found near tributaries or the Klamath River mainstem where coho occupy habitat however, based on the lack of ground disturbance and adherence to project objectives of low to moderate severity fire effects sediment production over time is expected to be negligible.

Sediment Delivery from Connected Actions

New temporary road construction is limited to approximately ½ mile of road and is not located within riparian reserves. All pre-exiting temporary road and landing footprints proposed for use and within the outer 80 feet of riparian reserve were analyzed by the ID Team in the field. The hydrologist and fisheries biologist carefully reviewed all proposed use of temporary roads and landings in or adjacent to riparian reserves. All existing road and landing footprints brought forward for use within riparian reserves have a low risk of delivering sediment to waterways. Low risk for sediment delivery is best characterized as having gentle travelway gradients, minimal earthwork needed to make useable for vehicles, and no road-stream crossings. All temporary roads needed for more than one field season, would be physically closed to vehicle traffic and left in a free draining condition throughout the rainy season. When no longer needed for project work, all temporary roads would be decommissioned. Decommissioning includes installing water bars, installing a physical barrier to prevent motor vehicle access, and seeding with native grasses where appropriate.

Proposed strategic fuelbreaks and handlines would be constructed using hand-held tools (such as, chainsaws, loppers, shovels, and McLeods), have limited impact on canopy closure and do not create significant ground disturbance near riparian reserves that could lead to off-site sedimentation. These actions are limited in scope, primarily located on ridgetops away from inner riparian reserves. Strategic fuelbreaks are designed to facilitate planned and unplanned ignitions, and as such would be maintained throughout the life of the project. Fuelbreaks require minimal soil disturbance. An approximately 2-foot-wide scrape (supported with 100-foot thinning of ladder fuels) is the actual ground disturbance associated with these features. As mentioned before under manual treatments, thinning of small diameter trees is not a ground disturbing action. Fuelbreaks would have waterbars installed at the appropriate spacing, dependent on slope steepness, to prevent erosion and subsequent sedimentation during the rainy season. Handlines also have a 2-foot-wide scrape, but are supported with only a 6-foot-wide brush cut and are more of a temporary feature designed and located to support planned ignitions.

Approximately five (5) miles of Maintenance Level (ML) 1 roads would be brought into service for the life of the project. Most of these roads require routine maintenance to be useable. Routine maintenance includes brushing for visibility and grading for drainage control. All ML 1 roads used for this project would be closed during the rainy season and left in a free draining condition. The travelway on road 13N14A does require one crossing fill to be reconstructed, which is approximately 1.2 miles above coho habitat. This work entails installing a properly sized culvert (to meet the predicted 100-year flood flows) and importing clean rock and fill to bring it up to standard. The roadbed would be outsloped at the crossing to minimize diversion potential. This work would only occur during the dry season and would not require any dewatering prior to installation. When employed, these design features insure that the proposed activities would have a low risk of sediment delivery downstream of the work area.

Also included in the proposed actions is the restoration of six (6) segments, 1.1 miles total of legacy roads discovered in the project area. All of these legacy site treatments are found greater than 1.2 miles upstream of occupied coho habitat. Restoration of legacy sediment sources in the project area is a requirement to receive a Waiver of Waste Discharge (Order No. R1-2015-0021) from the North Coast Regional Water Quality Control Board. Restoration of legacy roads includes removing one culvert and associated fill, storing fill in stable locations, covering of excavation sites and storage areas with suitable material to minimize surface erosion until native vegetation is reestablished, seed with native grass where needed, placing waterbars or dips to prevent water from concentrating on the roadbed, and decompacting the travelway. Earthen log barriers are installed at locations that would effectively block motor vehicle access. All restoration work would occur during the dry season, have appropriate erosion control plans developed, and be closely monitored by qualified personnel experience in road restoration activities. In the short term, there is a slight possibility of off-site sedimentation during the first few winters until suitable ground cover is reestablished. In the long term, hydrologic function would be restored and actually reduce the cumulative effects from roads in the watershed.

None of the connected actions occur within coho habitat; therefore, there are no direct effects. Due to the project location, which is mostly found within mid-to-upper slopes (upstream of coho salmon distribution and critical habitat), proposed PDFs, BMPs, and minimization measures for reducing sediment, only very negligible amounts of sediment may be delivered to stream channels. Thus, the potential for exposing coho salmon (all life stages) and other previously described fish species located downstream to increased suspended sediment and turbidity caused by project activities is negligible, and the expected response to a negligible increase would be insignificant.

Summary of Ground Disturbing Actions within Riparian Reserves

Table 3-27 shows the extent of actions that are planned to occur within riparian reserves and have the potential to impact water quality by increasing background sedimentation rates in the short term. No mechanical treatments occur adjacent to coho habitat; however, 18 treatment units over 10 watersheds (13 manual only units and 5 prescribed burn only units) are found near tributaries or the Klamath River mainstem where coho occupy habitat. As part of these treatments, handlines in riparian reserves would occur only where necessary to minimize undesired fire effects and would not create significant ground disturbance near riparian reserves that could lead to off-site sedimentation.

Table 3-27. Summary of ground disturbance within riparian reserves.

Water Quality Indicators	No Action (acres)	Proposed Action (acres)
Fuel reduction treatments	0	157
Temporary roads	0	12
Level 1 road refurbishing	0	4
Landings	0	7
Legacy road restoration	0	2
Totals	***0***	***182***

Analysis of the proposed actions reveals that less than 182 acres of ground disturbance would occur within riparian reserves upstream of fish bearing portions of the stream. The vast majority of these actions occur within the outer 80 feet of the riparian reserves, leaving the inner riparian reserve (80 feet for non-fish bearing streams) function as a filter to sediment movement. Project design features, wet weather operating standards and BMPs are incorporated into the Proposed Action specifically to further insure a low risk to water quality as a result of implementing this project. While the No Action Alternative would have no ground disturbing action in riparian reserves, hence no effect to water quality, the Proposed Action is the alternative that would, in the long term, protect water quality by greatly reducing the chance of high severity wildfire in project area. Fuel reduction treatments can influence wildfire severity. Fuel reduction treatments conducted on the neighboring district (Lower Trinity RD) a few years prior to the Megram fire in 1999, reduced high burn severity to three percent of the acres treated (USDA Forest Service 2000b).

Cumulative Effects

Unit of measure – Equivalent Roaded Acres

Duration – Long term (5 to 15 years post treatment)

To assess the potential for the project to add to cumulative effects, the extent all proposed and connected action within the analysis watersheds were examined. In addition, effects of past projects and wildfires in the watersheds were also examined. The ERA model is designed to determine whether past and present land management activities in a given watershed approach or exceed a TOC whereby changes in peak flows and hence sedimentation might occur.

The ERA methodology has both strengths and weaknesses. Strength of the ERA methodology is the ease with which the analysis can be duplicated and understood. It is also a CWEs model that incorporates acres of land management disturbance and recovery times associated with those disturbances, an attribute, which is missing in many other CWE analysis models. A weakness of the ERA model is that it is mostly a computer analysis that is primarily based on management-related hill-slope disturbance. It does not directly assess physical or biological processes in stream channels, nor does it account for the time lag associated with routing sediment delivered from a given activity. Recovery times in the ERA model apply only to the site of a given treatment, not to the recovery of downstream impacts. In predicting post project ERAs, the model assumes all proposed actions happen at the same time, and does not account for the phasing and time between each entry.

Results from the ERA model (see Table 3-28 and *Appendix F*) indicates that implementation of the project would not push the affected watersheds near or beyond the TOC, indicating that implementation of the Proposed Action would not result in added detrimental CWE. Field investigations within the affected watersheds corroborate the ERA model estimation of low risk of CWE and indicate that past management actions have few legacy impacts. Approximately 1 mile of legacy road sediment sources discovered in the project area would be rehabilitated, further reducing impacts from past management actions.

Low impact and limited in scope, treatments within riparian reserves are designed to reduce ladder fuel concentrations and promote long1term heterogeneity.

Table 3-28. Total equivalent roaded acres (ERA) percentages by watershed for Proposed Action.

Name of 6th-Field HUC Watershed	Total Existing ERA (%)	Threshold of Concern (%)	Total Predicted ERA (%)
Boise Creek-Klamath River	0.8	13.7	0.8
Reynolds Creek-Klamath River	4.2	8	6.4
Ti Creek-Klamath River	4.1	8	5.2

Based upon the analysis of direct, indirect and cumulative effects, the risk to water quality and fisheries habitats is low. The Proposed Action would not result in adverse added cumulative effects that threaten the long-term water quality and ACS objectives. Proposed new temporary road construction is extremely limited (approximately 0.6 miles) and are not hydrologically connected (no stream crossings). Implementation of forest plan S&Gs, BMPs, utilization of erosion control plans, adherence to wet weather operating plans, as well as the extensive PDFs, when combined provide a solid foundation to protect water quality while still achieving fuel reduction objectives in the project area.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

All alternatives comply with the KNF and SRNF LRMPs, originally published in 1995.

Aquatic Conservation Strategy

The Aquatic Conservation Strategy (ACS) outlines specific objectives regarding forest goals in the management of aquatic and riparian resources (KNF 4-25 and SRNF IV-107). Project NEPA decisions must be consistent with the wording regarding ACS consistency, including consistency with the nine ACS objectives described in the 1994 NWFP ROD (p. B-10) and in the May 22, 2007 Memorandum.

Project implementation does not prevent attainment of ACS objectives at the HUC 6 and larger scales in the short-term, and promotes attainment of ACS objectives in the long-term. Fuel treatments are in accord with recommendations in the *Ishi Pishi Ecosystem Analysis* (1998). Cumulative watershed effects would remain below threshold for adverse watershed effects. Minimal disturbances are not expected to adversely affect anadromous fish and habitat because PDFs would contain effects to the project site and the effects are negligible in the action area. The project would maintain and help restore many of the Indicators of the HUC 6 subwatersheds in the short term and are expected to improve aquatic habitats and watershed conditions for fish populations in the Kennedy-Ti Creek and Irving-Reynolds Creek composite subwatersheds, and in the lower mid-Klamath River in the long term.

Clean Water Act

The alternatives, as proposed, would comply with the Clean Water Act, Porter-Cologne Water Quality Control Act, applicable water quality control plans, and the North Coast Regional Water Quality Control Board waiver of waste discharge requirements. A waiver application would be filed after the Decision Notice is signed.

The Basin Plan for the North Coast contains water quality objectives, implementation plans for meeting those objectives, and other policies of the State Water Quality Control Board and the federal government, which are applicable to timber and fuel treatment projects. The water quality standards in the Basin Plan that most closely apply to this project are sediment, turbidity, temperature and dissolved oxygen.

The standard for sediment states that sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses. The standard for turbidity states, “turbidity shall not be increased more than 20 percent above naturally occurring background levels”. Relative to water temperature, the Basin Plan states that water temperature of receiving water bodies shall not be altered, and at no time shall the temperature of any cold water be increased by more than 5°F. Similarly, dissolved oxygen concentrations shall not fall below 6.0 mg/l.

Stream temperature and dissolved oxygen would not be altered as a result of the Proposed Action. Extensive riparian reserve buffers and maintaining canopy cover at approximately 60 percent in 145 acres mechanically treated in the outer 80 feet would protect stream temperatures. Current dissolved oxygen concentrations are in the range of natural concentrations and would not be altered. Effort was made to reduce the risk of sedimentation and turbidity relative to the Proposed Action. The Basin Plan states that controllable water quality factors shall not cause further degradation of water quality when it has already been established as degraded, and efforts to restore the impaired beneficial uses of these watersheds must be made. The water quality analysis of this project has focused on minimizing delivery of management-related sediment and improving the long-term sediment regime for the project area.

Endangered Species Act

The Fish BA/BE for the *Somes Bar Project* (Cyr 2018) contains a detailed analysis of effects and determinations on SONCC coho salmon and its designated critical habitat, essential fish habitat (EFH) for coho and Chinook, and Forest Service Sensitive species as further summarized below.

The Fish BA/BE analysis resulted in the determination of “may affect, not likely to adversely affect” coho salmon and its critical habitat due to a negligible potential for sediment to reach occupied habitat through a combination of all actions. More importantly, the BA/BE documented the Proposed Action would result in key recovery actions being implemented on 5,570 acres of the Mid-Klamath population of coho salmon to reduce the risk of high severity fire.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (PL 104-267), requires federal agencies to consult with National Oceanic and Atmospheric Administration (NOAA) Fisheries on all actions and proposed actions authorized, funded or undertaken by the agency that may adversely affect EFH.

All EFH assessments must include: 1) a description of the proposed action; 2) an analysis of the effects, including cumulative effects of the proposed action on EFH, the managed species and associated species, including life history stages potentially affected; 3) the federal agency’s views regarding the effects of the action on the EFH; and 4) proposed mitigation, where applicable (50 CFR 600.920(g)(2)). The information prepared under a BA for formal or informal consultation under the ESA (50 CFR 402.12) may serve as the EFH assessment curtailing the need for separate analysis.

Effects to EFH related to the project were analyzed using habitat data derived from available historical fish species inventories and habitat assessments on record at the Orleans/Ukonom RD. The project may affect Chinook or coho salmon EFH; however, fuel reduction treatments would reduce the long-term risk of uncharacteristically high-intensity wildfire.

Forest Service Sensitive Aquatic Species

A BE was prepared for the Forest Service aquatic sensitive species that are located in the analysis area (see Region 5 list by Forest dated July 2015; Cyr 2018). The analysis resulted in a “may impact individuals but would not lead to a trend towards federal listing” for Upper Klamath Trinity River Chinook salmon, Klamath Mountain Province steelhead trout, as well as, Pacific and Klamath River lampreys. Again, the slight risk of an insignificant amount of sediment reaching these species habitat is far outweighed by reducing the risk of high severity wildfire and the potential impacts that would bring. The project would have no effect on western brook lamprey, California floater, pristine springsnail, and chace juga, as they are not located within the project boundaries.

Soil Resources

Introduction

Soil management objectives with this project 1) keep soil in place: minimize erosion and sedimentation by adhering to BMPs and maintaining effective soil cover at or above minimum levels specified herein; 2) minimize and/or mitigate secondary soil quality impacts (compaction, displacement, severe burning) by applying PDFs specified herein, which mainly aim to limit severity and aerial extent of such impacts; and 3) monitor project activities as they occur, particularly mechanical treatments and prescribed burning, to ensure acceptable soil cover levels are maintained.

The following analysis summarizes the key points from the Soils specialist report (Young 2017). That report describes the soils in the project area, provides an assessment of current soil conditions, and analyzes the potential effects that treatments under the Proposed Action are expected to have on the soil resource. Operational restrictions and mitigations that would help minimize adverse effects on soil quality and productivity are included in the form of PDFs as outlined in *Chapter 2*. The report includes the regulatory framework and applicable S&Gs that were used to evaluate soil condition and potential impacts of proposed treatments; a description of the methods used to assess the effects of the project on soils; a description of the affected environment, and assessment of the current condition of soils, including effects of past management activities; an assessment of the direct, indirect, and cumulative effects of the Proposed Action on the soil resource; and appendices containing soil and slope maps, an activity unit by soil map unit crosswalk table (used to identify units with “sensitive” soils for priority attention in field review), and erosion hazard rating (EHR) calculations.

The Proposed Action is in compliance with FSM direction and all S&Gs that are intended to prevent substantial and permanent damage or degradation that affects inherent ecosystem processes. Substantial and permanent soil impairment is defined as detrimental changes in soil properties (physical, chemical, biological) that result in the loss of the inherent ecological capacity or hydrologic function of the soil resource, over the mid-term (*substantial*, beyond the duration of the project) to long-term (*permanent*, beyond a land management planning period), respectively (FSM 2250). Soil management direction is applied to lands dedicated to growing vegetation; it is not applied to areas dedicated to other uses, such as roads, trails, administrative and recreation sites, etc.

Both *severity* and *extent* of detrimental disturbance are important considerations that must be evaluated together to assess potential adverse impacts on soils of the activity area. As such, detrimental disturbance can be allowed on a small portion of a unit—this does not constitute adverse impacts; conversely, minor disturbance can be allowed in most of a unit, this likewise does not necessarily constitute adverse impacts. Detrimental disturbance in greater than 15 percent of the area is used to constitute adverse impacts. The indicators for this analysis include soil stability, soil porosity, soil organic matter, and soil hydrologic function.

Affected Environment

There have been past entries into the project area to harvest timber, implement prescribed burns, construct firebreaks, and respond to wildfire with suppression activities. Portions of the project area remain detrimentally disturbed, most commonly in plantations. Persistent disturbance is primarily compaction located in old landings, old temporary roads, and some primary skid trails near landings; some old temporary roads also have significant displacement. The assessment of current soil condition and past disturbance extent is based upon ocular estimates of disturbance collected when field reviewed. Severity of persistent past disturbance was assessed qualitatively (i.e., for compaction, inspecting soil for platy structure, and presence and distribution of fine to medium roots to estimate whether root growth pattern was affected (excluded or restricted)).

Soil Cover (Soil Stability)

Bare soil was occasionally noted during field investigations, but was rarely observed in most units, and when noted was always small isolated patches (such as windthrow mounds) without significant sediment movement. The only exception was a few segments of old temporary roads, which were identified as legacy sites for repair actions. All mechanical and other units surveyed had ample ground cover (>95 percent cover) to prevent soil loss from erosion. This is quite typical in a forested setting with decent site quality, both for units with no management history and those not entered for a decade or more. The average depth of fine organic matter, focused on duff, was 1 to 4 inches thick.

Soil Porosity (Compaction)

Attention given to assessing the soil condition, particularly for proposed mechanical ground-based units. Detrimental compaction was visually assessed during unit field reviews and using LiDAR imagery. Many of the old temporary roads and landings could be seen with the LiDAR. The majority of the plantations and some of the non-plantations on slopes generally less than 40 percent still exhibit signs of detrimental compaction. Most of the detrimental compaction appeared to occur on old roads and landings, and some (but not all) primary skid trails in proximity of landings. Secondary skid trails further out from landings were observed to have little to no compaction that would qualify as detrimental. It was also observed on fine-loamy soils, notably Goldridge, the well-used old skid trails, landings and temporary roads persist on the landscape, and naturally recover very slowly (as in several decades). Less-frequented old skids (with fewer passes) are assumed to be okay, since the more heavily trafficked ones are so very close to the threshold.

Field investigations conclude that historic temporary roads and landings may all be assumed to be over the detrimental threshold in terms of severity. Only a subset of old main skid trails have detrimental compaction. However, old skid trails were universally assessed as occupying less than 15 percent areal extent in proposed units, so all units currently meet applicable compaction standards.

Organic Matter

Organic matter currently exists in kinds and amounts sufficient to prevent significant nutrient cycle deficits, and to avoid detrimental physical and biological soil conditions, as described below. Kinds and amounts based on ocular surveys in units were universally consistent.

Soil Organic Matter (Displacement, Severe Burning)

Evidence of severe burning (from past pile burning or underburns) was not found in any of the proposed units. Old piles that had been burned were seen and inspected in a few units, which presumably burned hot, but sufficient time has passed such that effects of burning have apparently recovered, with no heavily oxidized or charred surface soils found. These piles were also acceptably “clean” or free of topsoil, so it was reckoned that brush rakes had been used in previous machine piling operations, with favorable results. Other soil displacement was only viewed as significant on a few segments of old temporary roads, the same segments having compaction and evidence of erosion, as discussed.

Fine Organic Matter (Nutrient Cycling)

Fine organic matter, including litter, duff, and woody material less than 3 inches in diameter, currently occurs on about 95 percent of the area (visually estimated), and on average is 1 to 4 inches deep. This is considered sufficient for nutrient cycling purposes, and all proposed units currently meet applicable standards.

Large Woody Material / Coarse Woody Debris

Large woody material (LWD) and coarse woody debris (CWD), terms used in the two LRMPs, are interchangeable and specifications for retention are virtually the same—five (5) to 20 logs per acre, greater than 20 inches diameter and at least 10 feet long or 40 cubic feet in volume, and spanning a range of decomposition classes, as available on site. Coarse woody debris levels were visually assessed during surveys by the soil scientists and/or wildlife biology crews. Non-plantation stands all currently meet or exceed this level of CWD. Plantations generally do not, and would not in the foreseeable future, lack trees that large in the living stand for recruitment. In accordance with standards, where currently existing CWD is deficient, five (5) logs per acre is not required post-activity, but existing logs greater than 12 inches diameter should be conserved to meet the intent of the standard.

Infiltration and Permeability (Soil Hydrologic Function)

Water infiltration is reduced in areas of units that were previously managed with mechanical ground-based entry, specifically on the old main skid trails, landings and temporary roads that are considered detrimentally compacted. This is generally estimated to be about 5 to 10 percent aerial extent of these units, and not exceeding 15 percent in any units. Soil water movement in other units without intensive management history is essentially unaffected.

Subsurface permeability is naturally slower in soils with clay loam subsoil (i.e., Clallam deep, Goldridge, Aiken), which is generally unaffected by surficial impacts unless exposed by displacement. Complete topsoil displacement was not observed in any substantial portions of any of the proposed units, except for some segments of a few of the old temporary roads. Erosion hazard rating infiltration-permeability ratings are currently 1 to 4, well below the 6 to 8 that the forest plan uses as a standard.

Besides the EHR water-movement rating standard, impaired hydrologic function is conventionally indicated by signs of erosion. In ocular surveys, minor sheet erosion was only noted on a select few of the old temporary roads. Also noted was that re-deposition of fines generally occurred over short distances (<10 to 20 feet), so the eroded soil materials and nutrient capital remains on site. There were no larger contiguous areas (>100 square feet) with signs of erosion to be of concern. Current soil hydrologic function of soils is judged as acceptable and meeting applicable standards in greater than 95 percent of the project area, with the exception as noted on a select few of the old temporary roads.

Environmental Effects

The proposed project involves multiple purposes and needs, primarily alteration of fuels and forest structure as a prerequisite for reintroduction of fire as a more frequent and active element upon the landscape, in a more culturally traditional manner to restore cultural vegetation characteristics. Past management activities have occurred in a large portion of the project area, with some portion of a "footprint" persisting and observable today. The No Action Alternative incorporates these past effects, and is analyzed as a baseline or yardstick to compare the end result of new and additive effects from the Proposed Action, if implemented.

Methodology

In addition to information obtained from the two LRMPs and the NRCS Web Soil Survey (publicly available soil information). Soil resource information was field-verified to 1) validate the soil mapping coverage; 2) gather information on site-specific soil properties; 3) assess current soil conditions as affected by past management activities; and 4) develop predictions on soil response to the proposed treatments within the units (Young 2017).

A LiDAR bare earth DEM was available for the project area. This was highly valuable for mapping old temporary roads, as well as creating high-resolution slope gradient maps; these maps were prepared and carried in the field during site visits, which made field review much more efficient. Steep inclusions within mechanical ground based units could be easily identified spatially in GIS, and this was very accurate in the field. Ocular estimates, aided by LiDAR, were made for the overall detrimental soil conditions for each of the ground-based treatment units.

The Region 5 Soil Erosion Hazard Rating System (USDA Forest Service 1990) was used to rate the risk of soil erosion for all soils in the project area. This system uses various physical soil properties along with climate and site-specific factors to rate soils for hazard of sheet and rill erosion. This system can also be used to determine the amount of surface cover necessary post-activity to avoid raising the erosion hazard rating to a higher risk level, and to determine the slope gradient at which EHR becomes higher with other site factors held constant. Hazards of gully erosion or mass wasting are not addressed with this procedure; these are evaluated on site during site visits.

Spatial and Temporal Bounding of the Effects Analysis

For soil resource analysis, the analysis area for direct effects is bounded spatially by the entire "footprint" of the project activity units, as this is the full extent of direct soil disturbing activities. For indirect and cumulative effects, the analysis area is likewise the same as the proposed project area (unit areas only). Although surface runoff egressing the project units has a potential to indirectly affect adjacent downhill slopes, it is only relevant where 1) runoff may be expected to occur, and 2) site-specific topography indicates runoff could pose additional off-site scouring, erosion, or water quality concerns. It is an assumption that runoff and erosion concerns are expected to be controlled on-site through effective BMPs and drainage controls. Thus, the analysis area for soils equals the proposed project area.

The analysis is further bounded in time by the foreseeable future period during which effects of this project could persist as detectable, significant effects. Some soil impacts, such as cover reductions, can naturally recover quite quickly from needlecast and other organic debris deposited on the forest floor. Others, such as compaction and effects of displacement, can persist for decades. In general, expectation for temporal longevity of effects is discussed as short-term (<5 years), mid-term (5 to 20 years), or long-term (>20 years) effects. For cumulative effects, the analysis is bounded in time by past, present, and reasonably foreseeable future projects.

Analysis Indicators

Four indicators were chosen that best address relevant soil issues in the project area and measure compliance with forest plan S&Gs. The indicators include:

1. Soil stability (soil cover for erosion prevention),
2. Soil porosity (limiting aerial extent of compaction),
3. Soil organic matter (displacement, severe burning and CWD), and
4. Soil hydrologic function (infiltration and permeability)

The unit measure for each indictor is percentage area (acres) not meeting desired conditions, as set forth from applicable Forest Plan Soil Quality Standards (SQS) and/or S&Gs.

Alternative 1 – No Action

Direct Effects of No Action

Direct effects of the No Action Alternative would be of no immediate effect at all on the soils, as soil disturbing project activities would not take place. Soil cover for erosion protection would not change. Present compaction levels would remain the same in the short-term, with very slow long-term natural recovery. Surface organic matter components would continue to accumulate faster than decomposition. Soil organic matter would be unaffected. Soil hydrologic function would be unaffected.

Indirect Effects of No Action

Indirect effects of the No Action Alternative would be the increased accumulation of organic matter in terms of surface and ladder fuels, with a corresponding continual increase in fire hazard. Fire hazard is not the probability of a fire ignition, but that a fire ignition (human or lightning caused) would result in a successful fire start and spread, and fire behavior would be more severe. Fire hazard already represents an unacceptable threat to specified values at risk within the project area, due to present vegetation composition. The No Action Alternative would do nothing to alleviate the hazard, or manage risks associated with watershed values.

The threat of wildfire to the soil resource should not be underestimated. As fire intensity increases, the potential for soil organic matter destruction, nitrogen volatilization, microbial mortality, structure and porosity destruction, inducement of water-repellency, and erosion are greatly elevated. High soil burn severity can severely damage soils and cause long-term declines in soil productivity and hydrologic function. Post-fire erosion is probably the single greatest risk to long-term productivity of soils in this Region. In extreme cases, soils cannot be revegetated without management intervention, or type conversion of vegetation communities may occur. Low to moderate severity fire is not usually considered a serious threat to soil resources, so to the extent that management activities can reduce the occurrence of high severity fire, soil resources benefit in the long term. High severity fire may have other resource benefits, depending on scale, but not for soils as an essentially non-renewable and irreplaceable resource.

Cumulative Effects of No Action

There would be no additional impacts to soils with the No Action Alternative, so there would be no additive effects of other past, present and reasonably foreseeable future actions, and therefore by definition no cumulative effects. Soils would continue to have natural ecological function and soil productivity would be unaffected relative to the current existing condition.

Alternative 2 – Proposed Action

Direct Effects of the Proposed Action

Direct effects are generally analyzed in the context of activity types and where they are expected to occur (i.e., what “footprint features” would be left behind and what are the soil impacts). The direct effects of these activities are very largely predictable based upon expected methods of operations and location of activities in terms of topography and soils and vegetation composition, the latter indicating types and amounts of removals or general treatment intensity.

Indicator: Soil cover for erosion prevention

Reduction of soil cover to varying degrees is a given by-product of proposed activities. This is acceptable given that residual soil cover still meets requirements for erosion prevention, generally 50 to 80 percent cover depending on activity type (tractor or burning) and soil surface texture (loam or sandy loam) per the KNF LRMP, p. 4-20, Table 4-2, copied below as Table 3-29.

The only sandy loams where the higher cover levels are specified are Clallam very deep (Map Unit 110) and Lithic Xerorthents (MU 300sr). Note however, these are guidelines, not standards. Site-specific EHR development (Soil Report Appendix C) indicates that greater than 50 percent cover is adequate to avoid a high erosion hazard, except only for Hugo soil, which occupies about 21 acres in the Donahue Focal Area, most of which is riparian reserve and all of which is proposed for manual/prescribed burn only. Donahue Units 2449, 2498, 2503, 2506 and 2509 require 70 to 80 percent cover maintained post-activity to avoid a high EHR, specifically in portions of the units mapped with these soils, and there upon slopes steeper than 55 percent.

All other areas have loam surface textures, and greater than 50 percent soil cover in the form of duff and litter is estimated as sufficient to avoid a high erosion hazard. Only prescribed (broadcast) burning activities have potential to exceed 50 percent cover losses, and then only if the burns are much hotter than planned. It is expected that burns would be conducted with target residual cover levels in the prescription, and all units should accordingly meet this requirement at unit-scale post-activity.

Table 3-29. Soil-cover guidelines for projects.

Soil Texture Class	Slope (%)	Minimum Total Soil Cover[32] (%)
Guidelines for Projects Using Tractors:		
Sandy loam or coarser	0-25	70
	26-35	80
Loam or Finer	0-35	70
Guidelines for Prescribed Burning Projects:		
Sandy loam or coarser	0-25	60
	26-45	70
	46	80
Loam or Finer	0-35	50
	36-60	60
	60	70

Indicator: Soil porosity (compaction)

The KNF has no compaction standard in its LRMP, but that forest has historically used the same standard as in the SRNF LRMP: detrimental compaction is a 10 percent reduction in total soil porosity, and this condition cannot occupy greater than 15 percent area of an activity unit. All units surveyed currently meet this standard. For proposed activities, this would practically apply only to units with mechanical ground-based activities. One PDF specifies limiting temporary roads and landings and skid trails to less than 15 percent unit area, and this is a conventional standard that the forest's sale administration staff is accustomed to implementing and achieving.

A handful of units are close to exceeding this standard currently with legacy tractor impacts, and these would require unit-specific measures to ensure compliance with the 15 percent area and avoidance of cumulative impacts. The following units require particular attention to reutilizing existing skid trails and landings (PDF) followed by subsoiling or at a minimum rock-ripping of main skid trails and landings when mechanical operations are complete; this is needed to ensure compliance with LRMPs.

- Donahue: Units 2409, 2467, 2493, 2500.
- Patterson: Unit 2242.
- Ti Bar: Units 2117, 2119, 2127.

It is thus expected that all units would meet this standard post-activity.

Indicator: Soil Organic Matter (SOM)

Soil organic matter (SOM) is organic matter and humus within the topsoil, which is crucial for nutrient and water holding capacity and long-term soil productivity. In Mediterranean climates, it is produced mainly

[32] Soil cover consists of low growing live vegetation (12 inches high), rock fragments (greater than 1/2 inch in diameter), slash (any size) and fine organic matter (charred or not) that is in contact with the soil surface. Fine organic matter refers to the duff, litter, and twigs less than 3 inches in diameter.

from annual fine-root turnover, and to a lesser extent from fine surface organic matter additions; these are long-term processes, and long timeframes are necessary to accumulate SOM. The SOM is then vulnerable to loss from erosion (export), severe burning effects (volatilization), and displacement (redistribution, but still generally on-site). Erosion is explicitly part of the project design to prevent and avoid. Therefore, severe burning has the greatest potential to cause some loss of SOM and nutrients in the top several inches of soil, precisely where they are most concentrated (Wells et al. 1979, McNabb and Cromack Jr. 1990). This is a concern with the extent and frequency of burning being proposed with this project.

That said, burns that aim to preserve greater than 50 percent duff cover for erosion prevention should likewise not be hot enough to significantly degrade SOM in the surface soil, except perhaps in small patches, as with pile burning. Broadcast burning prescriptions as practiced usually produce low to moderate soil burn severity (SBS), as opposed to 5 to 15 percent high SBS plus 30 to 40 percent moderate SBS typical for wildfires in this vicinity (BAER records, on file with author).

Both forest plans have a SOM standard of retaining 85 percent of total SOM in the top 12 inches of soil. Though not stated, this standard is aimed at avoiding excessive soil displacement; notably it is non-implementable because even an experienced soil scientist cannot objectively determine compliance, or lack of. That said, soil displacement effects are a lesser concern for SOM loss, because the displaced soil is still on-site unless eroded, so the nutrient capital is still accessible by plant roots. This was a much greater concern historically when large brushfields were "reclaimed" for conifer plantations by "topsoil windrowing" to remove root-crowns of sprouting species that would be aggressive competition for resources, along with removing nutrient and SOM rich topsoil. It became known that this practice was degrading to long-term soil productivity, particularly when windrows were spaced far apart and then many tree roots could not reach the enriched soil; such practices have not been conducted for several decades now.

Proposed activities, including burning activities, are expected to result in all units meeting applicable standards for SOM post-activity.

Surface organic matter (duff and fine litter)

Surface organic matter here is for nutrient cycling, as opposed to erosion prevention, which may or may not coincide as the same cover levels. Both forest plans specify at least 50 percent cover of duff and fine litter for soil productivity (with perhaps *more* needed for erosion prevention, as determined for the project). As already stated, it is expected that this level of soil cover would be met for all project units post-activity.

Furthermore, these are not clearcuts. A living forest canopy that continually adds litterfall to the forest floor would compensate in the short-term to cover small areas that may have burned hot or otherwise inadvertently removed more cover than desired. A healthy productive forest is the best case for self-maintaining favorable nutrient cycling, particularly on the more developed soils (Ultisols and Alfisols).

Coarse Woody Debris

Coarse woody debris is generally sufficient in non-plantations and deficient in plantations currently. Coarse woody debris contributes to SOM and habitat for arthropods that masticate fine organic matter into smaller particles that soil microbes can then utilize as food. Coarse woody debris becoming SOM is an even longer-term process than for duff and litter; and in a fire prone setting, most CWD probably never makes it to this state, but is consumed by fire sometime at higher levels of decomposition class. That said, the habitat value of CWD for arthropods, bacteria, and fungi is ecologically important. Field reviews were generally not quantitative in estimating CWD levels, so it is unknown whether non-plantations have enough "extra" CWD to compensate for plantations on a project-wide basis. Furthermore, CWD requirements are explicitly waived in strategic fuelbreak areas.

As with duff and fine litter, the extent and frequency of burning activities, specifically broadcast burns, have a real potential of consuming existing CWD and reducing overall levels of this resource. Since plantations do not have adequate size class of trees for CWD recruitment, the only practical management option is to protect existing CWD in non-plantations from mechanical disturbance and more importantly burning. Burn plans would need specific provisions to protect this resource. It is thus estimated in good faith that CWD would be protected to the extent practical, and CWD levels would increase over time, on average project-wide and eventually within plantations in the long term.

Infiltration and permeability (soil hydrologic function)

The Klamath has no soil hydrologic function standard in its LRMP; the SRNF LRMP specifies that infiltration and permeability would not be reduced to a rating of 6 or 8 under the EHR system. The primary impact to soil hydrologic function is compaction by ground-based equipment, which usually only affects surface infiltration, not permeability as this is based upon subsurface water movement that is typically below compaction depth. The water movement rating becomes a 6 if infiltration is reduced from rapid to moderate on a shallow soil (e.g., Deadwood), or an 8 if infiltration is reduced to slow (<0.6 in/hr.) on any soil. Of note, the EHR system was developed primarily for agricultural soils; forest soils nearly always have rapid to moderate infiltration rates, being naturally more porous than equivalent Ag soils. Reduction of infiltration to 0.6 inches per hour would be unusually severe levels of compaction, such as with a temporary road or winter-utilized landing (not frozen).

Soil hydrologic function is in good condition except in limited areas, namely segments of old temporary roads comprising less than 5 percent area in previous ground-based units. This function is potentially compromised where severe compaction from ground-based equipment is expected, specifically temporary roads and some landings if not rehabilitated. Project design features would limit heavy equipment traffic (including temporary roads, landings, and skid trails) to less than 15 percent area, which would satisfy the standard in all units, not just the SRNF where the standard applies. Project design features also specify rehabilitation of temporary roads and landings, including some legacy temp roads, so this condition is expected to be similar or improved on net-balance post-activity.

Indirect Effects of the Proposed Action

Indirect effects relative to soils include changes to the soil environment, reallocation of soil resources (water and nutrients) to fewer plants, changes in the distribution of organic matter upon and within the soil, and changes in potential soil damage from future wildfires.

The Proposed Action would create a short- to mid-term change in soil environment. Soil temperatures would be elevated due to opening the canopy and increased solar exposure of the soils. This would stimulate soil microbial and fungal activity and increase decomposition of soil organic matter and CO_2 efflux from the soils. This would also synergistically stimulate root activity of vegetation, also increasing CO_2 efflux but as importantly, increasing annual fine-root turnover, which is a primary input to soil C and organic matter. On balance, soil C attrition in CO_2 efflux would probably exceed accrual in root turnover for the first several years, then stabilize once revegetation and canopy expansion proceeds to shade the soil, then perhaps becoming a C sink from increased tree growth and vigor. This is all largely speculative, as current science has not yet formed reliable principles on effects of such practices, particularly belowground. Regardless, these effects would be temporary as the overstory canopy closes, understory fills in, and forest floor layers increase in depth over several years. Thus, such effects are expected to be short- to mid-term, minor, and not relevant to long-term soil productivity. The scale of the proposed activities is not large enough to make net carbon sink or source estimates relevant to local or larger scale climate effects.

With thinning as a silvicultural practice, residual stocking of trees is supposed to be high enough to fully occupy the site, so finite soil moisture and nutrient resources are still fully utilized, just reallocated to fewer individual trees. Therefore thinning should have little effect on soil moisture or nutrient status. Trees would increase growth rates, expand crown and root systems, and would generally be healthier and more resistant to drought and insect attack with more available water and xylem flow.

Increased organic matter mineralization rates, as mentioned above, can provide short term benefits to microbial activity and soil nutrient status, but as that nutrient capital is ‘used up’ more rapidly, it can also possibly lead to nutrient deficits later. Conservation of surface organic matter as proposed with these activities is intended to maintain adequate nutrient cycling and prevent nutrient deficits. Often overlooked, the root systems of trees and vegetation that are removed remain in the soil, and slowly decompose to provide organic matter inputs directly within the soil, as well as provide readily available growth pathways for new roots through compacted soil. This is currently thought by investigators to be the probable explanation for a general lack of negative effects on tree growth with extremely severe experimental compaction in the long-term soil productivity study (Powers et al. 2005, Ponder Jr. et al. 2012, Zhang et al. 2017, Busse et al. 2017). This experiment also tested effects of complete organic matter removals on soil nutrient status and tree growth, with no negative effects overall in the first 20 years to date. Thus, short-term pulse changes in organic matter presence and distribution upon the soil are not expected to significantly affect soil productivity.

Given direct localized impacts described above, mainly associated with ground-based operations, this should be balanced against a reduced potential for future wildfires to damage the soil in a more harmful fashion. On a regional basis, fire is considered a much larger threat to soil productivity than active management activities, because the cumulative annual ‘footprint’ of fire is dramatically larger, and it causes much more erosion, which represents the most irreversible and irretrievable kind of soil damage. However, it is also unknown with what severity a future wildfire would burn on these particular areas, depending not just on fuels, but topography and weather conditions at the time as they influence fire behavior. It is reasonable to assume that fuel reduction activities should help moderate future fire behavior, and therefore benefit soil resources, at a cost of management impacts today. This is considered acceptable, as long as management related impacts are minor in scale. Soil impacts associated with proposed activities are expected to be mostly minor in severity, and ultimately minor in scale.

In summary, indirect effects of proposed activities upon the soil resource are generally neutral or beneficial, are short-term in nature, and no adverse indirect effects are foreseen.

Cumulative Effects of the Proposed Action

Past timber harvest activities have occurred in a large portion (55 percent) of the project area. Several past projects are listed in the draft EA and are not repeated here. Most relevant for soils, regardless of past methods the remaining footprint of past activities can be observed in the field, and current condition assessed accordingly. Where past impacts cannot be observed today, they were likely minor impacts that have naturally recovered and are not significant today, or else they *would* still be apparent. This is bolstered by the finding that almost all of the lasting past impacts that *were* observed are not judged to be detrimental severity or significant in aerial extent today.

The only foreseen future project is the *Aquatic Restoration Project*. This project involves various activities aimed at instream habitat improvements and reconnection of side channels. Within these focal areas, work would involve heavy equipment, but access to instream work sites would utilize only existing roads and trails and no new or temporary access routes. Considering use of existing access and work focused on instream, this project is viewed as having negligible effects on terrestrial areas where this current project is to occur.

The Proposed Action by itself would not produce significant amounts of adverse direct or indirect soil impacts, using 15 percent area in detrimental soil conditions collectively as the threshold used to determine if soil impacts are significant, as per current management direction. Effects of reasonably foreseeable future actions are not expected to produce significant impairment of soil quality or productivity, because soil impacts are very limited to where soil standards do not apply. Thus there are no additive significant effects of past, present, and foreseeable future actions expected, and therefore by definition no significant cumulative effects for soil resources.

Statutory and Regulatory Consistency

All alternatives are consistent with the regulatory framework outlined above. Forest plan S&Gs and/or SQS are intended to comply with NFMA toward the end result of protecting soil productivity. Standards and guidelines and SQS indicators were used as the context to describe and analyze the extent and magnitude of expected soil impacts, spatially and temporally. In complying with these forest plan provisions, it is assumed that long-term soil productivity is maintained.

Mandatory Disclosures (NEPA)

The Proposed Action involves adverse environmental effects to soil resources that cannot be wholly avoided or mitigated. There would be measurable negative effects in specific areas (new temporary roads, landings, some skid trails); however, these are not expected to be long term or extensive enough to be significant at unit-scale. The aerial extent of these impacts is expected to comply with applicable standards (less than 15% area), and thus impacts are not considered to constitute a "substantial and permanent impairment" of soil productivity with respect to NFMA and R5 SQS. Project design features are developed in site-specific fashion and are intended to ensure compliance with the various elements of soil management direction. Physical soil impacts would be limited in aerial extent, and thus are considered acceptable for this project, in accordance with soil management direction.

Botanical Resources – Sensitive Plant and Fungi Species

Introduction

Sensitive species are those for which there is a concern for viability of the species based upon population trends or loss of habitat that would reduce the species existing distribution (USDA-USFS 2005, FSM 2670.5). Forest Service actions are to be designed and implemented in such a way as to not lead toward a loss of viability or a trend toward federal listing. In keeping with this direction, S&Gs from the SRNF LRMP (USDA Forest Service 1995) state that:

> *Before the NEPA process is completed, projects will be assessed through a biological evaluation to determine if management activities are likely to adversely affect sensitive plant resources. After completion of .the evaluation, proposed actions will be prohibited if they are found likely to jeopardize the continued existence of the species or the maintenance of the viable populations throughout their existing range. Appropriate mitigation measures will be required if activities are not prohibited (pg. 83).*

The KNF LRMP (USDA-USFS 2010) for Sensitive species considers that:

> *… management activities should imitate the natural ecological processes that created Sensitive habitat. The guidelines further state that fire and timber management can be used as tools for meeting this intent (pg. 27).*

This section summarizes the Sensitive species associated with the project area—their distribution and ecology—and the potential effects of the Proposed Action and the No Action Alternative on these species and their habitat. Information referenced below is drawn from the botanical BE for this project, which is a part of the project record (Hoover 2017a).

Affected Environment

Based upon a pre-field analysis which included a) review of the Forest Sensitive species database and associated spatial layers of known occurrences relative to the project area, b) assessment of the vegetative sub-series and stand age in which the project occurs and c) professional knowledge of Sensitive species habitat and distribution on the forest, the project area was stratified to target field surveys. Synthesis of this information resulted in survey efforts focusing upon units, or portions thereof, that coincided with mature forest types, specifically stands in the mid-mature to late-mature in the Douglas-fir or tanoak vegetative series. Within these stands, riparian areas were also surveyed. The exception to the mature forest affiliation was associated with one species, *Thermopsis robusta,* which is endemic to the middle

Klamath bioregion; this species is associated with relatively frequently disturbed settings such as road edges or setting subject to frequent wildfire.

Table 3-30 lists the Sensitive species known or detected as a result of project surveys, as well as species considered in the analysis. The latter refers to the fungi species that are on the Sensitive species list. The reasons for not undertaking surveys for this project are related to the biology of fungal organisms, specifically a) the "body" of the fungus is underground consisting of threads called mycelia that can extend several meters; b) the stage of the fungus that is observable above ground—the fruit—may not emerge annually or over consecutive years, thereby making project surveys infeasible; and lastly, c) the nature of the project, which is designed to retain habitat components for fungi.

Table 3-30. Sensitive species known or detected in project analysis and their general habitat.

Common Name	Scientific Name	Taxonomic Group	General Habitat	Number of Occurrences
Bug-on-a-stick	*Buxbaumia viridis*	Bryophyte	Mature forest-moist, riparian	2
Fascicled lady's slipper	*Cypripedium fasciculatum*	Vascular plant	Mature forest	1
Sulcaria lichen	*Sulcaria badia*	Lichen	Mature forests locally, conifer or hardwood substrate; also woodlands or open forest	3
False yellow lupine	*Thermopsis robusta*	Vascular plant	Early-seral, disturbed settings	3
Fungi				
None	*Dendrocollybia racemosa*	Fungus	Mature forest	None known
None	*Boletus pulcherrimus*	Fungus	Mature forest	None known
None	*Phaeocollybia olivaceae*	Fungus	Mature forest	1
None	*Sowerbyella rhenana*	Fungus	Mature forest	None known

Buxbaumia viridis (BUVI) occurs in mesic to moist settings and occupies well-rotted (decay class 4 and 5) logs or other forms of CWD of high water content. Relative persistence at an occurrence is dependent upon retention of suitable microclimate conditions, available substrate, and the extent of competition from other bryophytes or lichens that also occupy advanced decay class logs. It is fair to say that BUVI's persistence is ephemeral if not fragile at a given occurrence, making retention of habitat components for the species throughout a forested stand important to the conservation of this species.

In the project area, BUVI was located on advanced decay class logs associated with riparian settings. The Proposed Action associated with the respective units in which the species was detected is manual thinning and clearing of small diameter ladder fuels and shrub species where shrubs are highly concentrated to prepare the unit for subsequent prescribed burning. Burning would occur every two (2) to seven (7) years depending on the objective for the given unit and during the moist time of the year. The prescription also aims to maintain a minimum residual canopy cover of 60 percent in the 147 acres treated mechanically.

Sulcaria badia's (SUBA) habitat varies across its range. In the project area, SUBA occurs in mature forest yet it prone to those settings in the plant community that are well lit, which is consistent with this species occurrence in oak woodlands in other parts of its range. Given its habitat description ranging from well-lit plant communities and oak woodlands representing the dry end of the moisture gradient to conifer stand types representing the mesic end; it appears that this species is tolerant of a variation in moisture conditions. SUBA is geographically situated toward the middle of its range on the SRNF and here the species is documented in mixed hardwood-Douglas-fir forests, with the hardwood component comprised of madrone, tanoak, black oak, canyon live oak and big-leaf maple, and sugar pine as an associating conifer.

Lichens exchange water and gases through their "skin" and thus are influenced by changes in atmospheric moisture. In general, lichens are most susceptible to changes in their environment when the thallus (the body of the lichen) is hydrated. In this condition, lichens are most photosynthetically active, contrarily, no gas exchange occurs in air-dried lichens (Nash 1996). Reproduction is primarily from fragmentation, the breaking of the body of the lichen by wind, animals, or fallen limbs or branches; therefore, the dispersal of this species is limited to the extent of a given occurrence—the extent of thalli in the canopy of the trees. From the canopy, fragments can become entangled in the leaves, needles, twigs or branches of understory trees or shrubs or fall onto the forest floor as litter.

In the project area, SUBA was detected as litterfall and on small branches of understory Douglas-fir. It is presumed that the source of the understory material is located in the canopy of nearby mature trees. Mature trees serve as a relatively stable substrate over time that would allow for the establishment of this species, which is limited in its capacity to disperse.

SUBA is located in units where ground-based mechanical thinning via yarders or tractors, is proposed, followed by prescribed burns (two (2) occurrences) and where understory burning alone is proposed (one (1) occurrence). Mechanical thinning would retain a minimum of 40 to 60 percent canopy cover and all predominant trees; the latter considered "parent" substrate for SUBA. Retention patches are a part of the prescription where 0.25- to 1-acre areas would be retained to meet such objectives as reducing effects to inner riparian reserves and unstable areas, to occurrences of Forest Sensitive plant species. The prescription for understory burning associated with the other occurrence of SUBA aims for low-to moderate fire effects (average 4-foot flame lengths) yet there is potential for high fire effects to occur in pockets of units where this prescription is proposed. Season of burning would likely occur during the time when the thallus of SUBA is hydrated (fall to spring) and thus, most susceptible to changes in atmospheric condition associated with fires (i.e., smoke, heat).

Cypripedium fasciculatum's (CYFA) range is relatively wide, occurring in eight western states. More than half of the occurrences documented have fewer than 10 plants (Kaye and Cramer 2005). Besides the one occurrence found in the project (with a single non-reproductive plant), there are an estimated six occurrences on the Orleans and Ukonom RD. The last monitoring of most of the CYFA occurrences on the SRNF was in 2010; therefore, the current condition of the population on the within and proximal to the focal areas is unknown.

Cypripedium fasciculatum's existence and persistence in an area is related to its mycorrhizal relationships with associating plant species whereby nutrient exchange occurs. Reproduction is primarily through underground rhizome development. Dispersal beyond the local area hinges upon aerial dispersal of seed, which is less common. Dormancy is a part of the species' life history as well, whereby a plant may not emerge above ground for two or three years. Due to the relatively complicated reproductive history (e.g., dormancy phases), impacts to plants during the spring of the year when plants are emerging result in set-backs to flowering/fruiting that could extend over the following few years. For occurrences with few plants, this set back could result in loss of the occurrence.

Cypripedium fasciculatum is associated with mature forests under relatively high canopy cover (e.g., 60 percent). Sufficient forest canopy cover and structure to provide shade and filtered light is important to the ecology of this species: adequate forest floor moisture and forest floor organics, including logs, are needed to sustain their mycorrhizal associates; adequate understory temperatures and humidity are needed for plant establishment and growth (Kaye and Cramer 2005). The one occurrence in the project area was under greater than 60 percent canopy cover of tanoak and Douglas-fir, the latter, including sub-canopy trees and what appeared to be old-growth Douglas-fir trees (4-foot dbh) nearby. The habitat was also characterized by a high litter/duff layer that included a large log.

Cypripedium fasciculatum is located in a unit that is proposed for manual thinning and clearing of small diameter ladder fuels and shrub species, applying similar prescription designs associated with the units where SUBA was located, including size of trees to be removed, retention of minimum residual canopy cover of 60 percent and hand piling of slash for subsequent burning.

Thermopsis robusta (THRO) is endemic to the Mid Klamath River region, yet within that region, it is abundant with an estimated 20 occurrences on the Orleans RD and 19 on the Ukonom RD. Unlike the other species, which are associated with mature forest, THRO is associated with early successional habitats with little to no canopy cover and few associating species. Its long-lived seed bank and hard seed coat are adaptations to a habitat subject to disturbance, specifically wildfire, yet human-caused disturbances also create settings conducive to establishment of this species including road banks, landings/clearings.

In the project area, of the occurrences of THRO, two (2) were associated with an existing landing and the other along a road edge intermixed with Himalayan blackberry. There are patches of THRO along a road edge adjacent to private property as well.

Sensitive fungi potentially affected by this project include *Sowerbyella rhenana, Boletus pulcherrimus, Phaeocollybia olivaceae,* and *Dendrocollybia racemosa.* The ecology of these species range from decomposers thriving on forest floor litter and duff, to mycorrhizal species that establish and interdependent relationship with host trees to exchange nutrients and water, and a species that is parasite on decaying fungi. Only *Phaeocollybia olivaceae* has been documented in the project area in association with a manual/prescribed burn unit, but there is the potential for others to be present in the mature stands.

Common to all of these species are habitat conditions characterized by shady, mature stands with conifer or hardwood hosts and ample organic material on the forest floor. Management that retains living trees (the host) and the important underground linkages for mycorrhizal fungi via the myceliel network would maintain habitat parameters for mycorrhizal species (Amaranthus and Perry 1994). Likewise, management that retains overstory canopy and the litter and CWD of the forest floor would maintain habitat parameters for saprobes (decomposers; Norden et al. 2004). Germane to fire, the interval of burning can affect those fungi associated with late-successional forests in the short and long-term. Frequent fires (i.e., every 2 to 5 years) do not allow for accumulation of organic material on the forest floor and therefore, can significantly reduce below ground EMC fungal biomass (Hart et al. 2005, Tuininga and Dighton 2004, Wiensczyk 2002).

Environmental Consequences

Methodology

The spatial context for analyzing direct, indirect and in particular, cumulative effects, on rare species is at the local scale where the effects at the occurrence level of the population are most readily detected. Analysis of effects for rare taxa beyond the local scale is not often biologically meaningful due to variables associated with plant and fungal species dispersal capabilities (typically short-range), specificity in habitat requirements (e.g., presence/availability of CWD), variables associated with a given activity (e.g., variable density thinning versus clearcutting) and varying (and often unknown) thresholds of a species to disturbance. In the case of this project, the local scale spatially incorporates past, present, and foreseeable activities or events on public and private land that are within or adjacent to the respective focal area boundaries.

In keeping with the spatial scale, the temporal context for assessing past activities would coincide generally with those actions that occurred prior to development of land management plans for national forests (pre-1990s) which included management of rare species and those activities that were subject to rare species management under respective LRMPs. Documentation of Sensitive species such as *Cypripedium fasciculatum* date to the 1980s, whereas information on *Sulcaria badia* on the forest was in 2004 at the earliest. Forest planning efforts came along in the early 1990s. Given the affiliation with mature forest, it can be assumed that prior to the knowledge of rare taxa and Forest plan development, past logging on public lands, involving clearcuts or related prescriptions, negatively affected the rare plant species covered in this document. On private land, conversion of forests via clearcutting also occurred and likewise negatively affected these rare species. The other activity that might affect Sensitive species and their habitats is wildfire of high intensity; however, records on past wildfire indicate that within the focal areas, wildfires have been more or less absent since the early 1900s (thus the impetus for this project).

The foreseeable future activities are associated with continued implementation of OCFR, *Roots and Shoots Project*, implementation phases of the current project (*Somes Bar Project)*, and implementing the *Aquatic Restoration Project* that is in the planning stages. While not foreseeable, in the fall of 2017, the Patterson Focal Area was affected by the Marble Wildfire and is addressed below under cumulative effects.

Indicators used to compare effects of the alternatives vary by species, but in general, include the degree or extent of:

- Canopy removal, forest floor shading,
- Disturbance of forest floor litter, duff and CWD due to mechanical operations,
- Burn severity of the soil related to intense wildfire, pile burning,
- Sustained periods of smoke (for the lichen, *Sulcaria badia* only),
- Narrow prescribed burn fire return intervals (e.g., <5 years).

Alternative 1 – No Action

Direct Effects

There are no direct effects of choosing the No Action Alternative.

Indirect Effects

The ecology of all native plants and fungi in the Mid-Klamath bioregion (and beyond) includes wildfire as a natural disturbance. Even the Sensitive species in the project area associated with mature forests, including *Buxbaumia viridis* which is found within riparian settings, have evolved with wildfire at some intensity and interval. Where fuels have accumulated beyond their natural range of variability; the risk of losing occurrences of Sensitive species with very limited dispersal capability, requirements for shade and specific heat/humidity conditions, requirements for large CWD as well as forest floor organics, is real when faced with potentially extensive high intensity wildfire. Fire intensity is also a factor for *Cypripedium fasciculatum*, but damage to a given occurrence is affected by fire scale as well as the number of plants present at the time of fire. Localized, intense fire may only affect a portion of an occurrence with a relatively large number of plants. Dispersal is less limiting for *Cypripedium* than for *Buxbaumia* as the former can disperse through asexual means (rhizomes) and air dispersed seeds.

For *Thermopsis robusta,* an early successional species, while this species may expand to occupy post-wildfire settings and thus possibly benefit from the No Action Alternative, human-caused disturbance (i.e., roads and road maintenance) appears to serve as a surrogate to the effects of wildfire to stimulate the seed bank and clear competing vegetation; therefore; indirect effects of the No Action Alternative are not considered in relation to this species.

Cumulative Effects

Across the focal areas, there are an estimated 1,482 acres of plantation, clear-cut prior to the 1980s. It can be assumed that any of the target species associated with these clearcut areas are no longer extant. Private land constitutes approximately 800 acres. While not applicable to all private lands, it is assumed that developments associated with private property whether it included logging, building construction, or other clearings likewise altered habitat conditions to the detriment of the Sensitive plant species, *Buxbaumia viridis*, *Cypripedium fasciculatum,* and *Sulcaria badia* and Sensitive fungi species *Phaeocollybia olivaceae*. The extent and intensity of habitat alteration and clearing may also have affected the early successional species *Thermopsis robusta*.

While the lack of fire leading to potential for high intensity burn is identified above as having a negative indirect effect to those species associated with mature and older stands under the No Action Alternative, it is also related to cumulative effects as past land management practices involving clear cutting, with little to no management (thinning) after logging has led to excessive fuel loading within sections of the focal areas. Past land management practices have exacerbated the cumulative risk associated with the No Action Alternative.

Alternative 2 – Proposed Action

Direct Effects

The environmental consequences of the Proposed Action pertain to the alteration of habitat associated with mature and older stands as presented in the previous sections pertaining to the individual species or species group. Of the 1,420 acres of mechanical treatment (ground and cable) and mastication treatments, approximately 15 percent of those acres are in mid-mature and older stands. Of the manual and prescribed burn units, 34 percent are in mature stands and 48 percent of the understory burn units are in mature stands. Due to the limited extent and influence on mature and older stands, previously disturbed settings (i.e., existing landings), construction of new landings along roads (13 acres) and new temporary roads (0.6 miles) are not considered to pose a risk to the all target species associated with mature stands; therefore, these developments would not be considered further. An exception pertains to an occurrence of the early successional species *Thermopsis robusta*, which is located in association existing landings.

Overall, it is the desired future condition of the Proposed Action to restore the natural process of fire to the landscape to create heterogeneous forests and habitats therein, and at different scales, which would ultimately benefit native species that depend on periodic disturbance by fire.

The prescriptions associated with mechanical treatments include specific design features listed below that would reduce both direct and indirect effects to the Sensitive species associated with mid mature and older forests:

- Maintenance of 40 to 60 percent residual canopy cover,
- Retention of all predominant and dominant trees,
- Establishment of retention areas through a given unit covering 5 to 10 percent of unit in 0.25- to 1.0 acre sections that could include those associated with Sensitive species, and

Likewise, prescriptions for manual treatments and understory burns, in mid-mature and older forests where most of the Sensitive species occur, include the following features that, as incorporated, would reduce effects to Sensitive species:

- Maintenance of 60 percent residual canopy cover,
- Establishment of retention areas,
- An option to thin and hand pile or scatter fuels prior to reintroducing managed fire to reduce the risk of negative prescribed fire effects and,
- Adjustment of prescribed burn intervals to a 5 to 7 year interval in units coinciding with late successional forests to allow for accumulation of organic material on the forest floor.

Manual removal and prescribed burning are proposed in units supporting occurrences of *Buxbaumia viridis, Cypripedium fasciculatum,* and *Phaeocollybia olivaceae*. In addition to features of the prescription itemized above, buffers or retention areas were established for *Buxbaumia* and *Cypripedium* due to evaluation of ladder fuels and stems per acre—indicators of fire intensity—where these species occurred. Given the moderate to high rating for one variable at a *Buxbaumia* occurrence and a low to moderate rating, for another variable at the *Cypripedium* occurrence, as well as limitations to dispersal for both species, buffers were established. These buffers would allow for thinning of potential fuels within the buffer, but no pile burning. Treated material would be located outside the buffer for subsequent burning. In association with the *Cypripedium* buffer, fuels maintenance with prescribed burning could only occur during the fall/winter season of the year, before the plant emerges and at interval no less than 5 to 7 years. A buffer/retention area was also established for the known site of *Phaeocollybia olivaceae* for similar reasons associated with *Cypripedium*. The buffer is intended to reduce burn intensity that might result from pile burning. For ectomycorrizal fungi, such as *Phaeocollybia*, soil heating has been shown to affect fungi species when the temperature reaches 60 to 70 degrees; yet some fungi species survived heating at this level (Kipfer et al. 2010). In light of the variables and uncertainties associated with specific fungal response—fungal tolerance to soil heating, pile burning would not occur in the buffer but fuels removed in the buffer could, alternatively, be lopped and scattered.

Mechanical treatments followed by manual fuel removal and prescribed burning are proposed for units with *Sulcaria badia* and *Thermopsis robusta*. A buffer was established for *Sulcaria badia* only, for reasons akin to those associated with *Buxbaumia* and *Cypripedium*, reducing the risk of moderate- to high-intensity prescribed fire associated with post-mechanical treatment, and alleviating direct impacts from commercial thinning of likely “parent” trees of *Sulcaria badia.* The buffer/retention area would exclude all commercial activities and pile burning, but would include thinning of fuels—fuels to be located outside the buffer for subsequent burning.

One detection of *Sulcaria badia* was found within a unit prescribed for understory burning as the primary activity. To ensure that understory burning would be of low severity, a buffer/retention area was established around the detection that encompasses mature Douglas-fir trees, the likely host for the litter fall detection. Within the buffer, trees and shrubs (as applicable) would be thinned and thinned material would be located outside of the buffer for subsequent pile burning as applicable. Implementation of PDFs would result in no direct effects to *Sulcaria badia* at this occurrence.

For *Thermopsis robusta,* ground disturbance associated with commercial thinning, and even redevelopment of existing landings where there are some plants maintained proximal to the disturbed area, may benefit the species. *Thermopsis* is a disturbance “follower”; however, thresholds of certain disturbance intensities are not know. An example might be the amount of ground surface removed during redevelopment of a landing, which may also remove the seed bank for this species. A PDF for occurrences corresponding to existing landings next to Units 2454 and 2461 in the Donahue Focal Area, is the buffering or retention of *Thermopsis* plants that occur on the edge of the existing opening. These retained plants would provide a seed source that could germinate on the newly disturbed ground. For the other occurrences of this species, the nature of the disturbance proposed is not expected to result in negative direct effects to the species.

Furthermore, for all proposed actions, there are S&Gs from the KNF and SRNF LRMPs (USDA Forest Service 2010, USDA Forest Service 1995) that pertain to CWD and soil productivity, habitat components that are critical to Sensitive fungi, *Buxbaumia viridis* and *Cypripedium fasciculatum,* specifically from the KNF LRMP:

- **Biological Environment (6-16):** protect CWD from burning and yarding… and other activities that might otherwise destroy the substrate, retain CWD in forest patches…
- **Soil Productivity (3-4):** a minimum of 50 percent of the soil surface should be covered by fine organic matter following project implementation, if it is available on the site.

Indirect Effects

Indirect effects pertain to actions that impact (i.e., remove) host species for Sensitive fungi, sever mycorrhizal linkages for fungi and *Cypripedium,* (i.e., through intense burning and frequent burning), notably alter shading adjacent to occurrences of *Cypripedium* or *Buxbaumia*, or generate smoke that affects *Sulcaria badia* within the tree canopy. The extent of the indirect effect is related to the scale of disturbance and frequency. Example, retention of 60 percent canopy and predominant and dominant trees as a prescription feature for the manual treatments would lessen indirect effects related to alteration of habitat compared to clearcutting adjacent to the occurrence. Relative to atmospheric conditions, prescribed and understory burning in mature stands at intervals greater than five years might give "breathing" room, literally, to *Sulcaria badia* in the canopy. In addition to the prescription features, specifically listed above under "Direct Effects", the buffers established for these species are also intended to mitigate indirect effects that may occur associated with this project.

The potential indirect effect of the Proposed Action on *Thermopsis robusta* is associated with the potential for expansion of Himalayan blackberry along the road and border of a mechanical unit. Cable yarding activities including ground disturbance and removal of competing native vegetation may favor the spread of the blackberry. To reduce potential indirect effects to *Thermopsis*, a buffer was established that would exclude removal of trees adjacent to the *Thermopsis*/blackberry site and cable yarding related activities but would allow for manual burn related activities (i.e., removal of blackberry, pile where removed and burn) that might reduce the vigor of the blackberry and give advantage to *Thermopsis robusta*.

Cumulative Effects

The effects discussed above under direct and indirect effects for the target species associated with this project pertain to extent and severity of change to mature and older forest stands in particular changes in canopy cover, forest structure, quantity and composition of forest floor organics, large CWD, associating species and natural disturbance regimes. How the land corresponding to the occurrences of Sensitive species was managed in the past has a direct influence on the ability of forested stands to support these species today, so cumulative effects have and would influence viability of occurrences over time.

For this project, the spatial context for cumulative effects analysis is at the local scale since this is the appropriate scale of a population (plant and fungal). A population is the fundamental biological unit for a species. It is at this unit that effects are most readily detected. Local for this project spans the landscape within the focal areas.

In keeping with the spatial scale, the temporal context for assessing past activities would coincide generally with those actions that occurred prior to development of land management plans for National Forests which included management of rare species and those activities that were subject to rare species management under respective LRMPs. The foreseeable future activities are associated with implementation of OCFR, *Roots and Shoots Project* and the *Aquatic Restoration Project*.

Prior to land management plans, an estimated 1,482 acres of forest was clear-cut within the focal areas of this project. It can be assumed that any of the target species associated with these clearcut areas are no longer extant. Private land constitutes approximately 800 acres within the focal areas. While not applicable to all private lands, it is assumed that developments associated with private property whether it included logging, building construction, or other clearings likewise altered habitat conditions to the detriment of the Sensitive plant species, *Buxbaumia viridis*, *Cypripedium fasciculatum*, and *Sulcaria badia* and Sensitive fungi species *Phaeocollybia olivaceae*. The extent and intensity of habitat alteration and clearing may also have affected the early successional species *Thermopsis robusta* by complete removal of occurrences in the wake of logging, but given the variation of disturbance intensity, type of disturbance (mechanical versus fire) and proximity of disturbance to an occurrence, the variables are too broad to comment on past actions to this species.

Past projects in the focal areas that coincide with the introduction of land management plans and the NWFP—the latter bringing light to non-vascular and fungi species—include OCFR (2008) and *Roots and Shoots Project* (2015). For both of these projects, analysis was conducted for the Sensitive species that were on the respective Regional Forester Sensitive plant lists dated 2006 and superseded by a revised list in 2013. Both of these projects had features similar to the Proposed Action with an emphasis on thinning and prescribed burning to reduce wildfire effects. The *Roots and Shoots Project* only involved manual treatments and prescribed burning to promote the development and growth of cultural significant species. Of the target species for this project, *Buxbaumia viridis*, *Sulcaria badia* and *Thermopsis robusta* were all detected in OCFR as a result of project surveys. The former was located in the inner riparian reserve and thus ground-disturbing activities were restricted and for the other two species, no disturbance buffers were established as PDFs. Given the Proposed Action and prescriptions, activities associated with the *Roots and Shoots Project* were not expected to negatively affect any Sensitive species so, no surveys were conducted.

Foreseeable future actions would be associated with continued implementation of OCFR and the *Roots and Shoots Project*, implementation of the current project (effects addressed in this analysis) and it is anticipated that the *Aquatics Restoration Project* would also be in place. The latter is a programmatic document including instream habitat management and riparian vegetation restoration. Prior to design and on-the-ground implementation, the programmatic requires the involvement of resource specialists to determine if PDFs are needed to reduce negative effects. In the case of Sensitive plants and fungi species, botanical staff would review the project relative to potential to effect Sensitive plants and fungi species or their equivalent, implement surveys during the appropriate season as necessary and determine if alterations to the Proposed Action are needed.

In regards to the Marble Wildfire, of the focal areas within the project, only Patterson was affected by this fire, which burned 318 acres. The majority of the 318 acres burned at relatively low intensity and of the high-intensity areas, they were primarily comprised of vegetation in the early mature or shrub seral stages. Surveys of those mid-mature and older stands within the fire perimeter in 2015, prior to the wildfire, did not result in any detections of Sensitive species; therefore, the effects of this wildfire event on the target species is considered minimal to non-existent.

In summary, actions that resulted in the clear-cutting of mature and older forests during the 1950s-1980s likely negatively affected those rare plant and fungi species associated with this habitat. *Thermopsis robusta*, the only early successional species among those considered in this project, is an exception given its requirement for some level and types of disturbance as indicated by its presence is clearings, road edges and burned settings.

Recent past actions (1995 and later) and foreseeable future actions are guided by the respective LRMPs and associated S&Gs that address Sensitive species (or their equivalent, Species of Special Concern, in future Forest planning efforts). For *Thermopsis robusta,* implementation of the Proposed Action with the PDFs is not expected to have any negative direct or indirect effects to this species. For the other species considered, prescriptions that provide for retention of mature forest and their structure (i.e., partial canopy, CWD, predominant trees, forest floor vegetation mosaics) coupled with PDFs associated with recent past, present and future projects are intended to reduce the possibility of direct effects to Sensitive species and mitigate significant indirect effects. In light of the inherent uncertainties about some Sensitive species, such as the extent of the underground network of fungal mycelia of *Phaeocollybia olivaceae*, the distribution of *Sulcaria badia* in the forest canopy, and the dormancy and dispersal of *Cypripedium fasciculatum*, the Proposed Action may affect individuals of a given sub-population, but is not likely to result in a trend toward federal listing or loss of viability for these species.

Botanical Resources – Survey and Manage Species – Plants and Fungi

Introduction

Survey and Manage (S&M) is a category of species within the NWFP that are closely associated with late-successional or old-growth forests and where there is a concern for long-term persistence (USDA and USDI 2001). For certain categories of species, if an activity may is considered "habitat disturbing", then pre-disturbance surveys are required. In keeping with the most recent settlement related to S&M standards and guidelines (and the associated court order) exemptions to the S&Gs requiring pre-disturbance surveys are projects involving "hazardous fuel treatments where prescribed fire is applied and where commercial logging is not involved (except in stands younger than 80 years old)" (USDA Forest Service 2014).

Affected Environment

Habitat for S&M species is late-successional (mature) or old growth forests generally defined as forests with structural attributes associated with the later stages of stand development and include relatively large tree size, accumulations of LWM and logs, multi-layered and multi-species canopy, and moderate to high canopy closure. A plant or fungal species associated with late-successional forests have such ecological characteristics as stages or long periods of dormancy, limited dispersal capability, ectomycorrhizal relationships (that are related to certain species, spacing of host trees…), and substrate requirements only found in old forests (e.g., large advanced decay class logs).

The major proposed action for this project is hazardous fuels treatments—manual thinning of small trees, pile burning, and prescribed burning. This action would occur in late-successional forests. Mechanical treatments are planned to occur primarily in plantations and to a lesser degree, in non-plantations. Of the non-plantations, only an estimated 61 acres across three focal areas overlap with mid-mature and older stands. The intent of the mechanical treatments is to reduce ladder fuels or in the case of non-plantations, enhance the setting for cultural tree species of interest (i.e., thinning trees within the drip line and around such tree species true oaks, madrone and sugar pine and reducing the canopy cover around these species that prefer settings of relatively higher solar radiation) and creating canopy gaps for those cultural use species like iris and beargrass that benefit from solar radiation.

Prior to the surveys there was a known site of the S&M bryophyte *Buxbaumia viridis* in a riparian area that corresponds to the Donahue Focal Area, Unit 2403 and the S&M fungus *Phaeocollybia olivacea* in the Ti Bar Focal Area, Unit 2161. Both units are proposed for manual removal of less than 8-inch diameter ladder fuels and limbs, pile burning followed by prescribed burning at five (5) to seven (7) year intervals. In 2015, surveys were conducted for potential S&M plant species. Survey efforts focused on potentially suitable habitat for these species, specifically stands in the mid-mature and older seral stages with the structure and canopy cover that defines the habitat. As a result of the surveys, a new site of *Buxbaumia viridis* and *Cypripedium fasciculatum* were respectively detected in the Patterson Focal Area, Unit 2247, in association with a riparian area and in the Ti Bar Focal Area, Unit 2162. Activities planned for both of these units are the same as the previously known sites—manual removal of fuels followed by prescribed burning.

Surveys were not undertaken for S&M fungi species. The prescriptions associated with the proposed actions in late-successional forests, emphasize manual thinning of ladder fuels and prescribed burning or understory burning. An estimated 80 percent of the treatment is planned to occur in late successional forests). Prescriptions include canopy cover retention of 60 percent (except around culturally significant trees or plant species) and retention of predominant and dominant trees. Standards and guidelines pertaining to protection of CWD and fine organic matter also address habitat components that are critical to fungi (USDA Forest Service 2010). While mechanical treatments may occur in late-successional stands to enhance culturally significant species, the proportion of the project area slated for this type of treatment is very limited (i.e., 61 acres).

Additional information on S&M species can be found in the specialist report covering faunal, plant and fungi species (Bettaso, Yost and Hoover 2017) with more detail on the ecology of the respective species or species group (i.e., fungi) in the BA/BE (Hoover 2017a) for this project, since the species associated with known sites and those newly detected are also Forest Sensitive.

Environmental Consequences

The indicators for evaluating environmental effects of the No Action and Proposed Action and the effects by species are addressed under the *Environmental Consequences* section for Sensitive plant and fungi species above.

The PDFs (i.e., species buffers), in association with the prescriptions and S&Gs, which retain predominant trees and retention areas in mechanical units, aim for low-intensity burning, retain a percentage of CWD and duff/litter on the forest floor, and implement prescribed burning at 5- to 7-year intervals, would provide for persistence at a site relative to S&M species.

Invasive Plant Species

Introduction

The policy that guides the management of invasive species on national forest lands requires that land management activities not foster the introduction and spread of invasive species. Germane to the Proposed Action, the following policies from FSM 2900, Invasive Species Management apply:

- Determine the risk of introducing, establishing, or spreading invasive species associated with any proposed action, as an integral component of project planning and analysis, and where necessary provide for alternatives or mitigation measures to reduce or eliminate that risk prior to project approval, and,
- Ensure that all Forest Service management activities are designed to minimize or eliminate the possibility of establishment or spread of invasive species on the NFS, or to adjacent areas.

The SRNF LRMP includes the following applicable S&Gs (USDA Forest Service 1995):

- Sites for which ground-disturbing activities are planned shall be evaluated for the presence of invasive exotic plant species. (20-16)
- Practices that prevent the introduction or spread of invasive exotic plant species shall be incorporated into planning and analysis for all management activities that have the potential to introduce or spread these species. (20-18)
- Off-site material (i.e., mulch, imported soil) shall be screened for the presence of invasive exotic plant materials. (20-19)
- Sites treated to eradicate invasive exotic plant species shall receive follow-up monitoring. (20-20)

The SRNF also developed Invasive Species BMPs that are to be incorporated as standard operating procedures Forest wide (USDA Forest Service 2014).

The KNF LRMP includes the following standard and guideline related to introducing invasive plants in the context of vegetation management:

- All silvicultural practices shall consider how to best prevent introducing noxious or alien weeds, insects, and disease. Certify, by the County Agricultural Department, all straw, hay, and seeds used in mulching activities as free of noxious weeds (USDA Forest Service 2010). (21-53)

In keeping with the aforementioned FSM direction, and S&Gs, an Invasive Plant Risk Assessment (Hoover 2017b) was developed for this project. Risk is evaluated based upon five indicators: 1) presence of known invasive plant species in the project area, 2) habitat vulnerability, 3) non-project-dependent vectors such as existing roads or trails, adjacent private property, 4) habitat alteration expected as a result of project implementation, and 5) increased vectors as a result of project implementation. This section addresses these factors in relation to the Proposed Action.

Affected Environment

As a result of surveys conducted by MKWC, a partner in this project, six species of invasive plants were mapped. The focal areas with the highest diversity of invasive plants and cover were those in the north of the project area: Ti Bar, Patterson, and Rogers. In contrast, Donahue Focal Area was relatively clear likely due to its distance from State Highway 96 and the Klamath River, both majors vectors for invasive species. Himalayan blackberry was the most widespread species, associated with stretches of road, within riparian areas adjacent to roads and within unit interiors. Blackberry in the northern-most focal areas was almost continuous within the first 1.5 to 2.0 miles on roads accessing the respective areas and along State Highway 96, which dissects the western-most edge of the northern focal area.

Other species, specifically yellow starthistle, Dyer’s woad, Dalmatian toadflax, Scotch broom, butterfly bush and tree-of-heaven, were primarily associated with portions of the focal areas adjacent to State Highway 96 and associated with the Klamath River bars—those portions dominated by invasive plants—and road edges or clearings (e.g., turn-outs, existing landings, disposal sites) along lower sections of Forest Service routes that intersect with State Highway 96. The preponderance and diversity of invasive plants associated with a state highway demonstrates the role vehicles play in dispersal of invasive plants and the suitability of the highway edge setting (i.e., exposed, regularly disturbed) for invasive plant establishment (Christen and Matlack 2006, Der Lippe and Kowarik 2007).

In areas further away from State Highway 96 and Klamath River, on less travelled roads, these other species listed above were only sporadically observed in the focal areas. With the exception of the site with a few small tree-of-heaven stems, all satellite (i.e., discrete, isolated) sites with relatively few plants were manually treated (hand pulled) upon detection in 2015 and 2017. Invasive annual grasses were not targeted for surveys due to the preponderance of forested habitats, however, they do exist in the area in association with the river bar and road edges. Annual grasses are very likely present in natural openings that exist in those mixed conifer-hardwood forest types (e.g., with oak and pine).

Invasive species have in common high dispersal capabilities, relatively long-lived seed banks, high tolerance for disturbance, few herbivores, an ability to reproduce both sexually via seed and asexually (via rhizomes). These attributes provide a competitive advantage that leads to displacement of native plant communities. Himalayan blackberry is distinguished from the other invasive plant species in the focal areas in that it tolerates both shady and exposed settings (Caplan and Yeakley 2006), has the ability to reproduce by cane sprouting that can produce a thicket up to 15 feet in diameter in less than two years (Soll 2004), and the abundant fruits/seeds are readily dispersed by mammals and birds (Hoshovsky 2015). Most problematic was the occurrence of Himalayan blackberry in continuous thickets along the relatively lower sections of Forest Service routes intersecting with State Highway 96. Within this area, Himalayan blackberry was also in forested stands associated with riparian and wetland settings. Its presence in the latter setting reduces the ecological role of wetlands and creeks by acting as a barrier to water sources for large mammals such as Roosevelt elk (a focal species). Habitat for the riparian associated Woodwardia fern, a cultural use species, is also compromised by Himalayan blackberry that out-competes the fern and reduces accessibility for gathering. Likewise for hazel, another cultural use shrub species, where Himalayan blackberry was encroaching into the patch of hazel.

Environmental Consequences

Methodology

Invasive species introduction and spread are a by-product of activities occurring within and outside the jurisdiction of Forest Service, and as such, the geographic scope associated with invasive plant introduction is broad and beyond the scope of this analysis. For this project, due to the relative ease of dispersal, the geographic scope is not a fixed landscape or watershed, but related to the Mid-Klamath watershed where the invasive plant species associated with this project are documented. What the landscape in the project area has in common is the Klamath River, State Highway 96, county or Forest Service roads, and private property. Roadside settings are vectors for the spread of invasive plant species and if invasive plants make their way to the chronically disturbed river bars, the river also serves as a vector of spread. Depending on the extent of clearing and other activities, private property may also provide suitable settings for spread of invasive plants.

Temporally, Forest management activities prior to the mid-1990s did not even address invasive plant species; presence of species and their distribution were not documented. In addition, definitions and risk rankings of invasive plant species is a relatively recent development; therefore, cumulative effects of invasive plant species in the current project would focus on recent past and future activities.

In the context described above and given the array of species, their ecology and their geographic distribution within the focal areas, the activities associated with implementation of this project—the indicators of risk—include:

- Operating equipment in areas with a high cover of invasive species and then using that same equipment where invasive species do not currently exist,
- Use of heavy equipment or staging equipment at sites with invasive plants or where invasive plants are nearby,
- Reducing canopy cover proximal to occurrences of invasive plants,
- Mechanical thinning that removes native vegetation which functions as a barrier to movement of invasives from the road edge down into the unit, and
- Manual fuels treatment (thinning and prescribed burning) or understory burning that removes native shrubs and trees (competitive vegetation) proximal to existing invasive plant sites.

Alternative 1 – No Action

Direct Effects

There are no direct effects of choosing the No Action Alternative.

Indirect Effects

Road use and road maintenance activities, private land activities and development, as well as the potential for high intensity wildfire are ongoing activities that could affect the introduction and spread of invasive plants beyond their current distribution, regardless of implementing the Proposed Action. As described above, roads and their use are vectors of spread (Christen and Matlack 2006) and certain activities on private lands increase risk of introduction and spread. Lastly, given that invasive species are tolerant of disturbance, most of the species shade intolerant (e.g., yellow starthistle, Dyer's woad, Scotch broom) and easily disturbed, high intensity wildfire—a situation the Proposed Action is attempting to ameliorate—would create a setting conducive to the spread and establishment of invasive species beyond their current location. Relative to the growth habit of Himalayan blackberry in particular, removal of woody native species by wildfire, followed by relatively rapid growth of blackberry could result in its spread from road edges down or upslope into the forest interior and serve as a ladder fuel for subsequent wildfires.

Cumulative Effects

Prior to current forest LRMPs that addressed invasive plant species, invasive species could have been introduced on equipment used to build roads, to remove timber, or to stabilize slopes. Private road building into forested landscapes also created vectors for the spread of invasive plants, as did some of the activities on private lands. Cumulatively, without active management and monitoring, invasive plant species would spread both with and without the Proposed Action in association with currently disturbed settings (e.g., road edges, clearings, river bars) but as presented under indirect effects, high intensity wildfire that removes the canopy and understory cover would create an environment conducive to spread of invasive plants, especially Himalayan blackberry, from its current location, into forest interior environments.

Alternative 2 – Proposed Action

Direct Effects

The direct effects pertaining to invasive plant species are primarily associated with introduction and spread of invasive plants associated with equipment used for road maintenance, landing developing and thinning. Project design features for this project that aim to reduce the risk of invasive plant introduction and spread are:

- Equipment cleaning prior to operating in the four respective focal areas,
- Avoid development of landings and staging equipment where there is a risk of contact with invasive plants, and
- Progression of work which prioritizes road maintenance and mechanical treatments (including mastication) first to those units in settings that are relatively "invasive-plant free" such as upper reaches of the focal areas, before operating in the units/setting where invasive plant cover and diversity is high such as along State Highway 96 and on Forest Service routes within one (1) mile of the highway.

Indirect Effects

Indirect effects are those associated with the consequences of mechanical thinning, manual treatments, mastication, and understory burning relative to the spread of invasive plants. For example, staging equipment to be used in a mechanical unit at a turnout that contains patches of Dyer's woad with seed heads could result in the export of plants to another section of road that is currently uninfected. Another example relates to opening of the canopy or removing native shrubs (i.e., related to manual treatments) in settings proximal to invasive plants. As discussed above, with the exception of Himalayan blackberry, the other species are primarily intolerant of shade so exposing the forest floor or reducing cover of competing native plants, increases the risk of invasive plant seed, or canes, spreading beyond its current setting.

The PDFs developed for the Proposed Action would aim to reduce the risk of introduction and spread of invasive plants associated with these actions. Given its widespread distribution, abilities to spread, and tolerance for exposed or shaded settings (including riparian areas), the features below emphasize management of Himalayan blackberry but include management of other invasive plants as well. Project design features include:

- Management of satellite occurrences with relatively few individuals (i.e., manually remove/grub plants until eradicated, before implementing prescribed burning), and manually treat other invasive plants (e.g., yellow starthistle, Dyer's woad) that co-exist with the Himalayan blackberry,
- Management of a satellite occurrence of the invasive tree-of-heaven by manual removal of the root crown,
- If avoidance is not an option, mechanically blade invasive plants present on existing landings away from where equipment would be operating; removed plants would be piled away from operations, subsequently burned, and managed with prescribed fire, as applicable,
- Exclude road and roadside openings occupied by Himalayan blackberry from operations associated with mastication, mechanical treatments, and road maintenance, and
- Where associated with riparian areas or settings of moderate cover, site prep by manual removal (e.g., weed whacking) and piling blackberry where removed, followed by pile burning and prescribed fire, with subsequent re-treatments.
- Option: where invasive plants (yellow starthistle, Dyer's woad) occur as discrete, small occurrences manually treat.
- Option related to riparian areas: where Himalayan blackberry has been contained or cover reduced, consider active revegetation with relatively fast-growing native trees to provide competition and canopy cover (Bennett 2007).

Adaptive management relative to the efficacy of treatment for Himalayan blackberry in particular is a key component of the PDFs. If, through monitoring, it is determined that PDFs are not meeting the objective of eradicating, maintaining or reducing the spread of Himalayan blackberry, actions pertaining to frequency of aboveground treatment or prescribed fire intervals may need to be altered.

Implementation of invasive plant control measures would aim to reduce the risk of introduction and spread in relation to the proposed actions identified above under *Methodology* where invasive plant sites are discrete and of relatively few plants. It should be noted that given the invasive plant distribution and cover associated with units adjacent to State Highway 96 and the river bar—units that are currently dominated by a diversity of invasive plant species—the risk of spread would remain high regardless of the proposed action; therefore, PDFs do not focus on these already compromised areas. Likewise are those lower reaches of Forest Service routes where Himalayan blackberry, and other invasive plant species, occupies the road edges and adjacent slopes. In this setting, the risk of spread would remain high.

Cumulative Effects

As imparted above under the header *Environmental Consequences*, establishing the geographic scope for analysis of cumulative effects is difficult for species that disperse readily and long-distances on vehicles, equipment and via river transport. In general, the scope is associated with the focal areas and the highway and river corridors that run through these areas. In keeping with the temporal context for analysis described above, recent past projects include *OCFR* and the *Roots and Shoots Project*. The foreseeable future activities are associated with implementation of *OCFR*, *Roots and Shoots Project* and the *Aquatic Restoration Project*.

For the recent past projects, invasive plant risk assessments were developed using similar criteria outlined above (e.g., presence of known invasive plant species in the project area, habitat vulnerability). As an example, for the *Roots and Shoots Project*, yellow starthistle, Dyer's woad, spurge species, Dalmatian toadflax and spotted knapweed were documented in the area associated with State Highway 96, Forest Service routes and the river bar. The assessment indicated a moderate risk to high risk for introduction and spread associated with project implementation without PDFs. The features included: a) avoidance of settings with yellow starthistle or timing activities before seed heads develop, b) retention of a native vegetation along the edge of a unit to reduce the risk of Dyer's woad spreading from the road into the unit and c) manual removal of invasive species associated with the river bar, including treatment over multiple seasons. With these features in included part of the decision for the project, the risk of introduction and spread as result of project activities was reduced to a moderate level. Given the nature of invasive plants and a setting such as that associated with the *Roots and Shoots Project* that includes documented invasive plants, a river bar, a highway and roads, a low risk of introduction and spread due to indirect effects (e.g., prescribed burning that stimulates an unknown invasive plant seed bank) is not a feasible determination.

Avoidance of infested sites, equipment cleaning, use of weed-free rock material and erosion control material, and clearing invasive plants from landings prior to use were identified in the risk assessment for OCFR to reduce the risk of introduction and spread of yellow starthistle and Scotch broom. Given that the foreseeable future projects are the current project, continued implementation of the *Roots and Shoots Project* and OCFR, the PDFs for these respective projects would apply. Depending on the proposed actions related to the *Aquatic Restoration Project*, a risk assessment would develop applicable design features in this case.

What has not been undertaken is the monitoring of PDF effectiveness let alone implementation. Critical to this project would be assuring that design features were implemented and adapted as applicable to meet the objectives of containment, by reducing the risk of spread, and eradication, in those incidences where invasive plant sites are discrete and consist of a small number of plants.

Social Environment

Introduction

This section presents the predicted effects of Alternative 2 (Proposed Action) compared to Alternative 1 (No Action) associated with human disturbances (operational noise and smoke), and to recreational and visual resource values. Most homesteads were purchased between 1913 and 1940 (Land Status Atlas). Transportation development built to meet national demands for timber resources abundant on national forests, particularly in 1950s when extraction escalated, improved road access to private land inholdings.

During collaborative events, residents expressed they choose to live in these isolated private land parcels surrounded by forestlands, because they highly value and cherish solitude, quiet, outdoor recreation, the scenic beauty and bounty provided by nature. For them, the ripple effects to family traditions, scenic quality and recreational opportunities from one high severity fire event becomes a moment in time that lasts in the memories for generations… stories not forgotten. Although some activities such as gathering and hunting are necessary activities to supplement food sources, they also represent family-oriented recreation and cultural traditions.

The second part of the social environment at the end of the analysis displays the economic outcomes of the project benefiting local economies.

Affected Environment

Localized environmental conditions are influenced by topographic, slope gradient and aspect, promoting forest vegetative species diversity and complexity in pattern and texture (see *Fire/Fuels* and *Vegetation* sections).

The Ti Bar, Patterson, and Rogers Creek focal area landscape features on the eastern side of the Klamath River are steep slopes, dissected by numerous seasonally running and perennial streams, as illustrated in Figure 3-32. In contrast, the Donahue Focal Area located on the west side of the Klamath River is characterized by more gentle slopes.

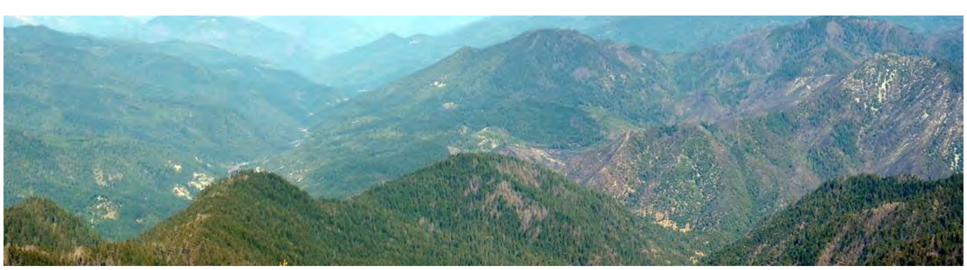

Figure 3-32. Aerial view of steep slopes in the Klamath Mountains.

Scenic integrity (quality) has been altered by historic land management activities on national forest and private lands. The private land inholdings experienced land development for agriculture, hobby farms and residential construction, involving clearing of forest vegetation and road development as displayed in Figure 3-33.

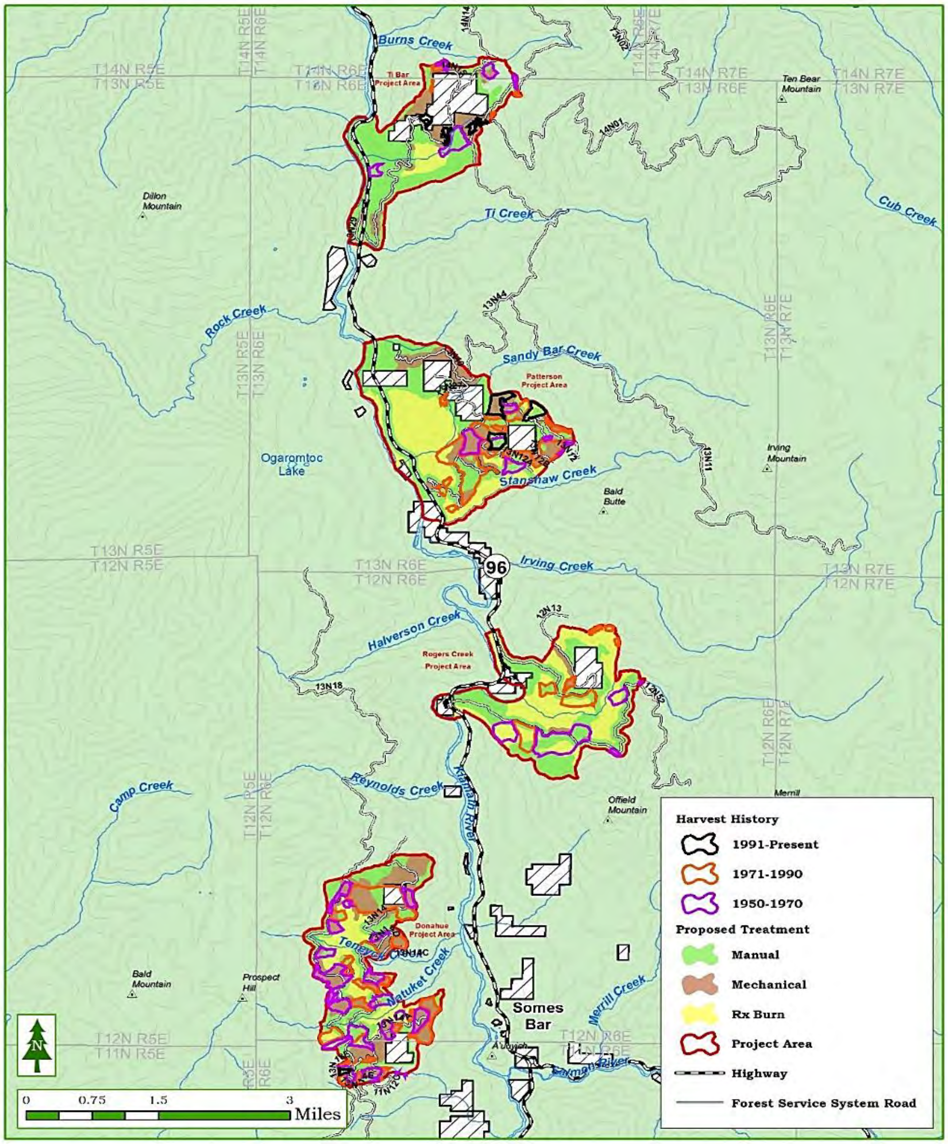

Figure 3-33. Map of historic timber harvesting in the project areas.

On national forest land, even-aged timber harvesting practices were implemented. The intensity occurring in the Donahue Focal Areas was more extensive compared to the other focal areas, due to the more gentle slopes, where operations were most cost effective. The most extensive timber extraction occurred in the 1950s, 60s and 70s. During that time, the transportation network was expanded for access and hauling timber to mill sites; now used by the public as access to national forestlands and inholdings.

The outcome of tree removal, intensive timber harvest practices (i.e., clearcut, seed tree, shelterwood methods), along with road construction drastically altered the scenic quality. On national forest lands, there has been some recovery of the forest clearings with ingrowth of planted trees, natural regeneration and sprouting shrubs. However, resource modifications and utilization practices are still visually evident from open public roads, private land and select distance viewpoints from State Highway 96.

These same historic forest vegetative conditions also inadvertently promote moderate and high-intensity severe fire behavior, as combustible plantations are overstocked with low-lying limbs and continuous surface fuel debris. This potential for combustible forested vegetative and woody debris to fuel flames is a potential threat to scenic stability, which impacts scenic and recreational quality. Refer to *Fire/Fuels* and *Vegetation* sections for more information.

The social recreational setting provides for moderate to high frequency of contact on open public roads and low- to moderate-frequency use away from roads, allowable under Semi-Primitive Motorized and Roaded-Natural Recreation Opportunity Spectrum (ROS) visitor-use opportunities (see *Methodology* section below). There are no national forest system trails (OHV or hiking) or dispersed camping sites within the focal areas. Creeks tend to be shallow, incised and are not favored public swimming sites. Most recreational activities are concentrated along the Klamath River or are associated with the Marble Mountain Wilderness to the east, outside the project area.

The Klamath River, flowing north-south, is designated a Recreational River within the National Wild and Scenic Rivers System in 1981; classified as a designated and recommended recreational river (KNF LRMP 4-156). Three designated segments have been identified for potential reclassification per the 1986 amendment to the Wild and Scenic River Act (WSRA); closest segment is from Ti Bar to the mouth of the Salmon River. The Recreational River designation overlaps portions of the focal areas and all project activities are consistent with the Reactional River standards and guidelines in the KNF LRMP.

Environmental Consequences

Methodology

The methodology applies to assessing the effects linked to 1) human disturbance from operational noise due to the presence of field crews and smoke generated from prescribed burning may periodically disturb neighbors and 2) compliance with federal land management S&Gs for recreation and scenic management, disclosed in the KNF and SRNF LRMPs.

Human Disturbance Indicators

The analysis indicators include noise levels from timber harvesting activities and smoke generated from prescribed burning in proximity to private land.

Noise.

For purposes of this analysis, machinery noise associated with timber harvest and manual tree cutting is targeted, discussed in terms of equivalent sound level, accounting for chainsaws, back-up beepers, yarding engines and tooters, diesel motors, cable yarders, landing construction, temporary road building and grading roads associated with maintenance. The area of influence is one-half mile from open roads.

Noise is often described as unwanted sound. Sound is defined as any pressure variation in air that the ear can detect. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard by the human ear and called *sound*. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second, called Hertz (Hz). The relative loudness or intensity of sound energy is measured in decibels (dB). A decibel is a logarithmic unit of sound energy that represents the smallest variance in sound that the human ear can detect.

Ambient (background) sources of natural noise range from short-term soft sounds, as in the sound of the wind in the trees (30 to 50db), to short-term loud cracks and rumbles, as in the sound of falling rocks (60 to 80db). Environmental noise is usually measured in A-weighted decibels (dBA) and typically fluctuates over time. An "A-weighted" decibel (dBA) is a decibel corrected for the variation in frequency response of the typical human ear at commonly encountered noise levels. Noise exceeding 85 decibels (dBA), regardless of duration, warrant protective devises to protect hearing.

The presence of field crews is recognized for the potential to disrupt the experience of remoteness and isolation. The analysis indicator addressing noise is used as a proxy to reflect disruption to these quiet-dependent experiences.

- ***Spatial parameters.*** The spatial bounds for analyzing indirect and cumulative effects of noise disturbance is defined as within 150 feet of private land.
- ***Temporal parameters.*** The temporal scale for noise disturbances for analyzing direct, indirect and cumulative effects is based upon the 15-year implementation timeframe.

Smoke/Dust.

For purposes of this analysis, altered air quality from prescribed burning is targeted, discussed in terms relative to visibility and smell. Although prescribed burning activities must adhere to the Clean Air Act[33] and all relevant state and federal associated provisions; there is allowance for temporary production of air borne particulates (ash fall-out) during specified weather conditions and dust from use of heavy equipment (log and transport trucks) on native (dirt) roads

- ***Spatial parameters***. The spatial bounds for analyzing indirect smoke effects from prescribed burning in the project area.
- ***Temporal parameters***. The temporal scale for smoke disturbances for analyzing direct, indirect and cumulative effects is based upon the 15-year-implementation timeframe.

Scenic and Recreational Quality Indicators

The KNF LRMP describes land management direction with unique S&Gs to fulfill this vision, based on designated spatially explicit management area (MA) prescriptions. Standards and guidelines are the rules and limits governing actions and the principles specifying the environmental conditions or levels to be achieved and maintained. The land management direction is to achieve landscape objectives for visual quality influencing recreational experience, so actions, "would appear to be primarily shaped by ecological processes, rather than management activities. Openings in the forest canopy created by vegetation management would not be readily evident. Existing clearcut units that are apparent today

[33] Including provisions of the Clean Air Act, California's Title 17.

would blend into the surrounding vegetation in the future, as planted trees mature and visual restoration projects soften sharp contrasts in line, form and color" (KNF LRMP p. 4-15).

Each MA allows for an integrated set of management activities and practices conducted on geographically locatable areas in alignment with the designated ROS, place-based setting prescription and S&Gs. In some cases, management areas can overlap, in which case, the more restrictive standards apply. This analysis of predicted effects to recreational and scenic resource values is founded upon ensuring prescribed ROS classes as defined in the ROS Users Guide (USDA Forest Service 1982) described in Table 3-31 and visual quality objectives (VQOs) are fulfilled, described Table 3-32.

The ROS classes are based on the premise that recreational opportunities exist in a continuum of time, and with a variety of social motivations and place-based settings, ranging from completely undeveloped with Retention VQO prescriptions, to highly developed allowing for Modification VQO prescriptions. For management and conceptual convenience, possible mixes or combinations of activities, settings, and probable experience opportunities have been arranged along a spectrum, or continuum (USDA Forest Service 1982). This continuum is the ROS, which accounts for alterations to visual (scenic) quality.

Table 3-31. Definitions of Roaded-Natural, Rural and Semi-Primitive Motorized ROS classes.

ROS Class	LRMP FEIS Appendix E-1	1982 ROS User's Guide
Roaded-Natural	Characterized by predominantly natural-appearing settings with moderate sights and sounds of human activities and structures.	The area is 1/2 mile or less from roads and trails open to motorized use. Resource modifications and utilization practices are evident but are harmonious with the natural environment. The social setting provides for moderate to high frequency of contact on roads and low to moderate frequency on trails away from roads. Capacity ranges from 10 to 20 RVDs/acre/year. On-site use controls are noticeable, but are harmonious with the natural environment. Typical activities include, but are not limited to hiking, horseback riding, cross-country skiing, snowmobiling, OHV touring, trailer camping, hunting and fishing. The compatible VQOs are Modification, Partial Retention and Retention.
Rural	The sights and sounds of human activity are readily evident while the landscape is often dominated by human-caused geometric patterns.	The natural environment is substantially modified to the point that developments are dominant to the sensitive observer. Structures are readily evident and may range from scattered to small dominant clusters. Pedestrian or other slow moving observers are constantly within view of culturally changed landscapes. The social setting provides for moderate to high visitor contact. Typical activities or facilities include, but are not limited to camping, fishing, information centers, convenience stores and resorts. The compatible VQOs are Modification, Partial retention and Retention.
Semi-Primitive Motorized	Characterized by predominantly natural or natural-appearing landscapes and the presence of motorized vehicles. The size gives a strong feeling of remoteness. The natural setting may have moderately dominant alterations, but would not draw the attention of motorized observers. Structures are rare and isolated.	The area is generally 2,500 acres to 5,000 acres in size, and 1/2 mile from Level 3 or better roads. There is strong evidence of roads and motorized use of roads and trails. Access roads are usually Level 1 or 2 roads. An area designated within ½ mile of primitive roads or trails used by motor vehicles, but not closer than ½ mile from better than primitive roads. Area is characterized by a predominantly natural or natural-appearing environment of moderate-to-large size. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Motorized use is permitted.

Table 3-32. Visual quality objective (VQO) definitions.

VQO Class	LRMP FEIS	Standards and Guidelines
Retention: 1,337 (MA 11)	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 VQO classes.	Manage recreational settings to generally achieve semi-primitive motorized or roaded-natural ROS conditions.
Partial Retention: 3,781 (MA 15)		Manage recreational settings to generally achieve semi-primitive motorized or roaded-natural ROS conditions.

The analysis indicator is consistency with ROS and VQO classification S&Gs. Only ROS classes Semi-Primitive Motorized, Roaded-Natural, and Rural were considered for this analysis and VQO classes Retention and Partial Retention, as the remaining classes are either not relevant to this project area or so limited in extent as not to provide a comparison to Alternative 1 (No Action) to inform the Responsible Official. The scenic integrity VQO is considered within the framework of scenic integrity (quality) and scenic stability (threat to being altered by disturbance).

- ***Spatial parameters***. The spatial bounds for analyzing direct, indirect and cumulative effects for recreation and scenic resources are the project area.
- ***Temporal parameters***. Since the ROS S&Gs are closely tied to visual quality objectives (VQO) for scenery, the same temporal bounds apply. The temporal scale for direct and indirect effects is three years for short-term effects, as defined by the Forest Plan, where projects are required to meet defined VQO thresholds (retention, partial retention, and modification), by meeting VQOs immediately upon completion of the project where ever possible and, at the maximum, within 3 years of project completion per MA 11-6 (LRMP p. 4-116). The temporal scale for cumulative effects accounts for past landscape alterations since 1960 relative to land allocation, along with foreseeable actions on private land inholdings within the four focal areas defining the project area.

Alternative 1 – No Action

Direct Effects

There would be no direct effects for human disturbance from machinery noise, dust and smoke production or to ROS recreational opportunities or scenic VQO Retention and Partial Retention classes from choosing the No Action Alternative, as no mechanical pre-treatment vegetative fuels modification or associated timber harvest/hauling, decking or required temporary access improvements, manual cutting or prescribed fire would be implemented. There would be no modification to the natural environment to further affect scenic integrity along public roads and private land boundary lines. Historic land management and development is visually dominant to the sensitive observer. The focal areas would continue to be characterized by a predominantly natural or natural-appearing environment of moderate-to-large size. The ROS social setting would continue to provide for moderate to high frequency of user contact on roads and low to moderate frequency of backcountry use, away from roads in ROS Roaded-Natural and Semi-Primitive Motorized classes.

Indirect Effects

Under the No Action Alternative, there would be no indirect effects from increased human disturbances resultant of machinery noise, presence of field crews, dust or smoke production. As forest vegetation would not be altered and operations would not be implemented, there would be no increase of human disturbances, and no change to ROS recreational opportunities or scenic integrity linked to VQO Retention and Partial Retention classes.

Scenic stability would continue to be at-risk, as current hazard and risk ratings for wildfire would remain status-quo (see *Fire and Fuels*/*Vegetation* sections). Scenic integrity may be compromised in the event of a landscape-scale wildfire, featuring mixed moderate to high fire severity. Charring and conversion of forested mid- and late-seral stage stands to early seral shrubs and forbs would be evident, most visible immediately after the disturbance. In the long-term, partial recovery of scenic integrity would occur as blackened woody material decomposes and vegetative re-growth occurs (Figure 3-34). Smoke generated from wildfires would likely be of a higher concentration and longer duration (see *Fire and Fuels* section).

Figure 3-34. Post-fire landscape showing charred downed woody material that was once a living forest with scenic integrity.

Loss and/or degradation of natural resources from wildfire would affect other natural resource amenities such as water quality (see *Water Quality* section), wildlife habitats (see *Wildlife* section), and air quality, would act to indirectly compromise recreational and special use activities.

Cumulative Effects

Historic land management and development activities on private and public lands have already altered the VQO scenic integrity and quality of ROS natural resource dependent recreational opportunities for the short and long-term. Although under Alternative 1 (No Action) there would be no machinery noise or smoke from prescribed burning, these past land management actions combined with the low scenic stability have inadvertently set the stage for moderate and high intensity future fire behavior, which could degrade scenic integrity and recreational opportunities associated with Roaded Natural, Rural and Semi-Primitive Motorized ROS classifications in the long term. In the event of a wildfire, recreational use would likely disperse to alternate unburned areas, areas void of smoke, and noise from fire suppression, until vegetative recovery and the air quality and visibility is restored.

Alternative 2 – Proposed Action

Direct Effects

Scenic and Recreational Quality

Proposed mechanical and manual treatments are designed to appear natural by retaining variable forest structure and complex mosaic patterns by maintaining retention patches and creating small gaps, as portrayed in Figure 3-35. The alteration, mimicking healthy forest conditions that would not be visually evident and would remain visually subordinate within the Retention and Partial Retention VQO classes.

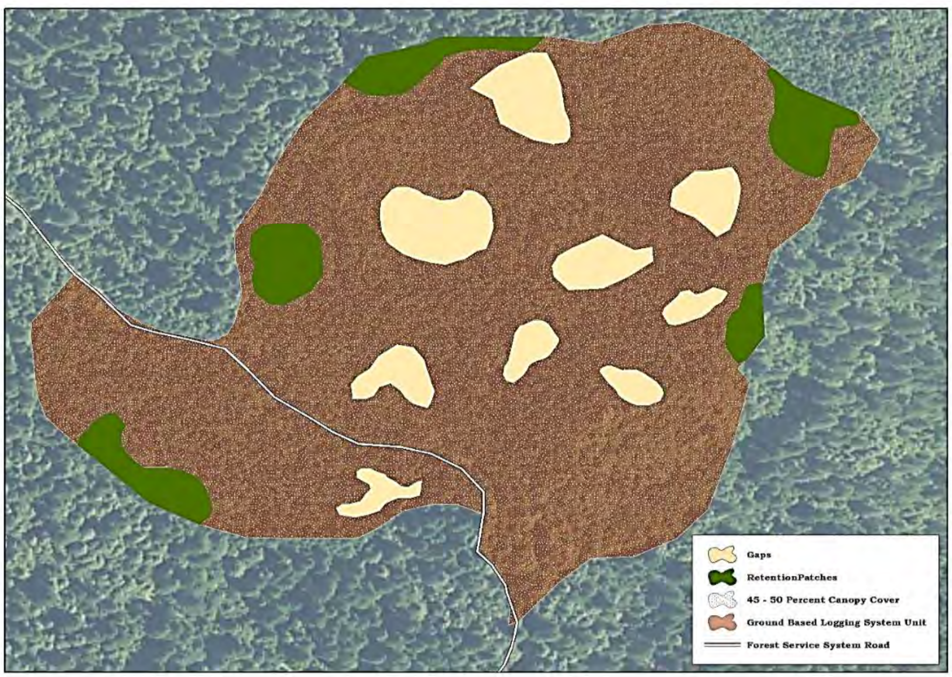

Figure 3-35. Map of example gaps and retention distribution.

The natural setting would experience moderate, dominant alterations from mechanical and manual treatments listed in Table 3-33 and displayed on Figure 3-36, which illustrates where managed areas spatially overlap VQO Partial Retention and Retention classifications. This change to scenic integrity in these areas, along with the presence of field crews during and immediately after prescribed burning, operational slash, reflective tree stumps and smoldering debris would likely draw the attention of motorized observers in the short term.

Table 3-33. Proposed treatment summary.

Integrated Fire Management Treatments	Area and/or Length
Strategic Fire Control Feature Actions	**Feet**
Ridgetop Shaded Fuelbreak	105,524
Handline	145,298
First, Second, Third Treatments	**Acres**
Manual, Prescribed Fire	2,658
Mastication, Manual, Prescribed Fire	187
Mechanical – Cable System, Manual, Prescribed Fire	176
Mechanical – Ground-Based, Manual, Prescribed Fire	1,058
Prescribed Fire	1,491
Total	***5,570***

Although there is concentrated mechanical treatments in the Ti Bar, Patterson and Rogers Creek focal areas around private land, mitigation measures such as not painting trees boles on the side where immediately visible to landowners and coordinating tree marking to accommodate personal preferences within the 500-foot buffer would minimize visual impacts.

The series of viewshed maps (Figure 3-37 through Figure 3-40) display the unique spatial extent where treatments could be seen from select locations on the Klamath River and private property for each focal area. The patterns suggest topographic screening associated with mountain ridges and incised stream channels. From select viewpoints such as in Ti Bar, the viewing distance extends for almost a mile up Kennedy Creek. Similarly, steep slope pitches that rise from the main Klamath River channel are also visible in the forefront.

Indirect Effects

Human Disturbances

Noise.

Operational noise from equipment and presence of field crews may periodically disturb neighbors. “People do not become accustomed to noise” (Brauer 1990). Noises in the rural settings characterized within the focal areas can seem amplified, where there are no barriers to the source, such as segments along Highway 96. However, noise levels are reduced by increasing distance, air density, wind, and obstructions (trees, rock outcrops and natural landscape features). On windy days under the forest canopy or near streams, ambient noise tends to screen noise from machinery and traffic.

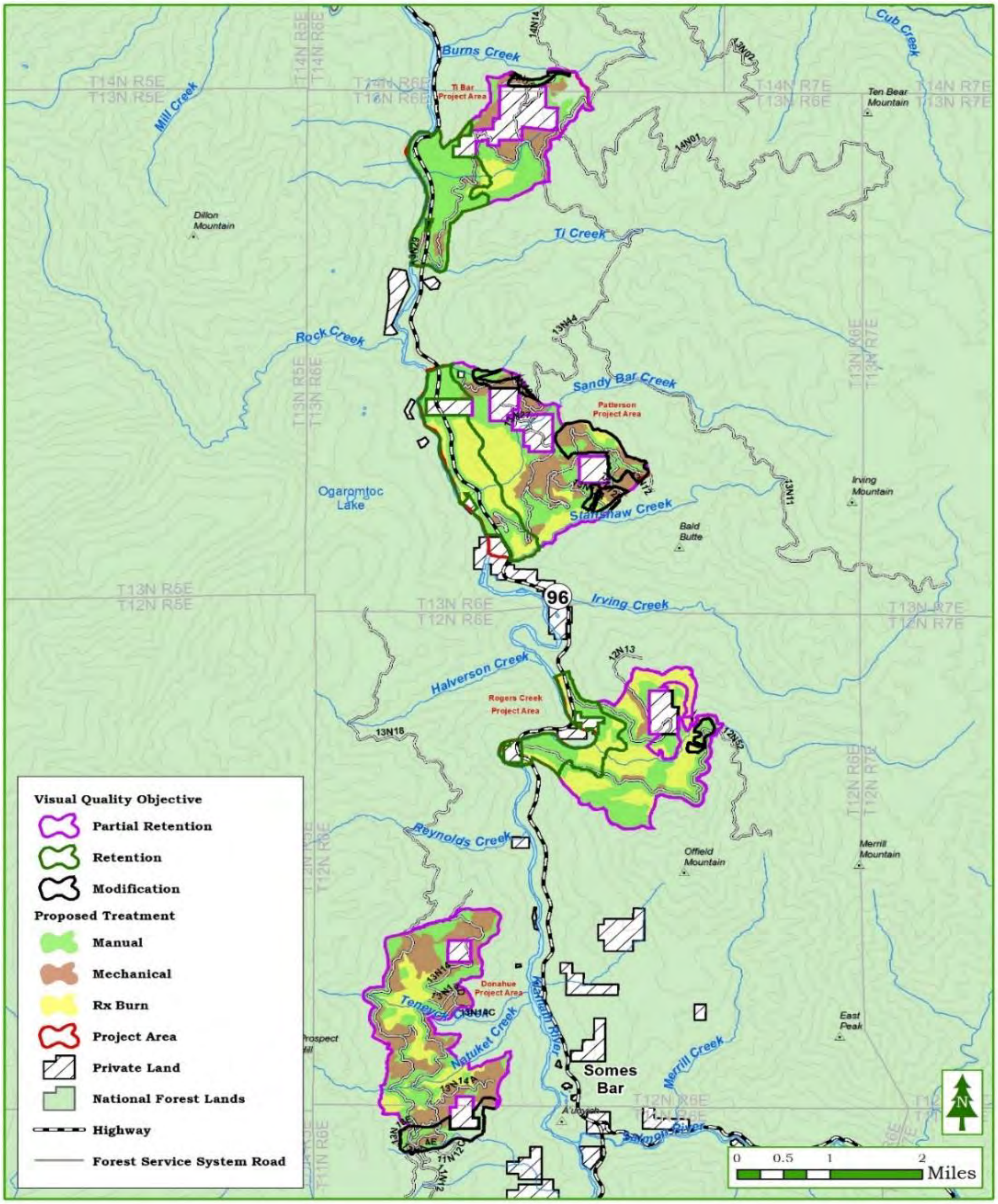

Figure 3-36. Map of visual quality objectives within the project (or focal) areas.

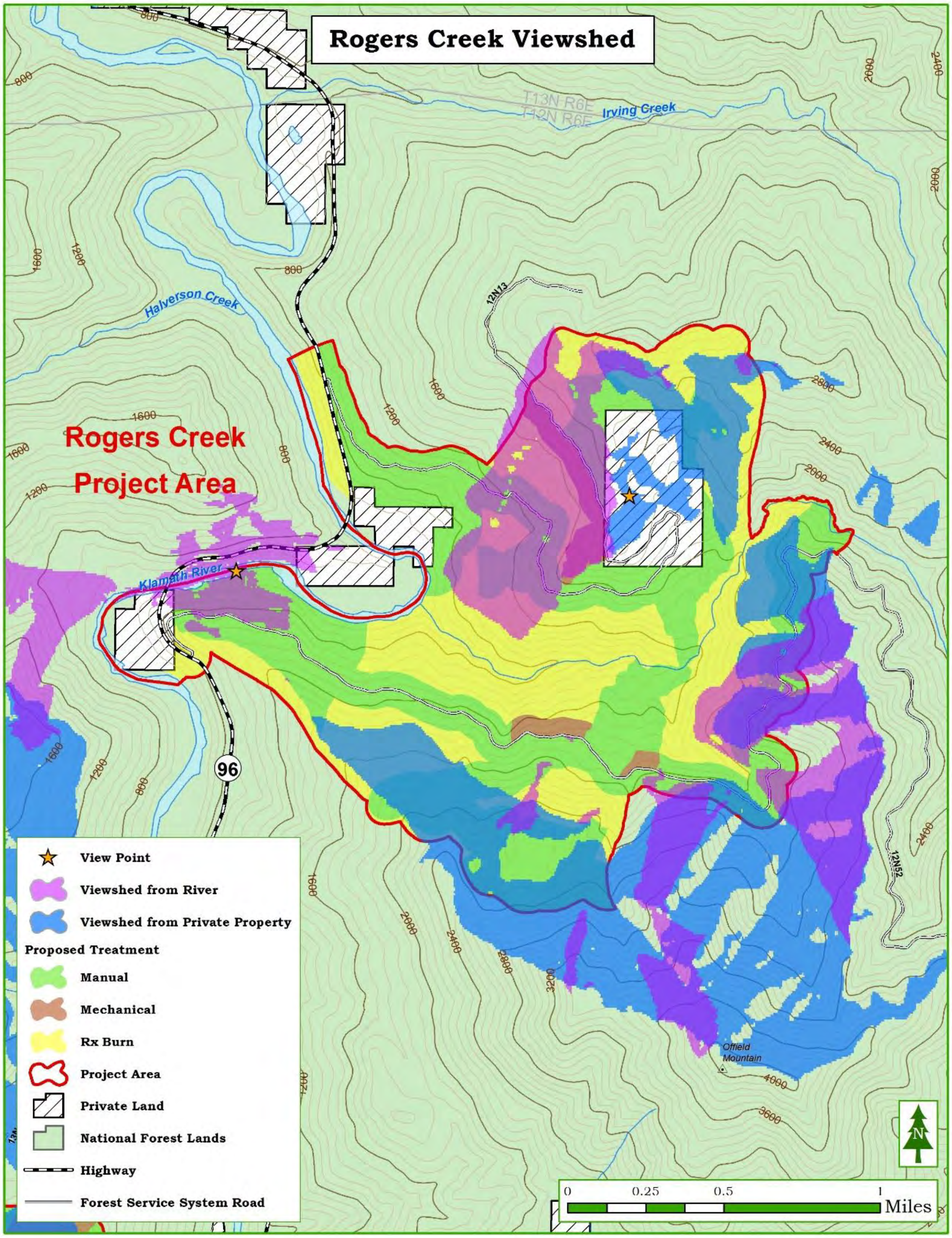

Figure 3-37. Map of the Rogers Creek project area viewshed with proposed treatments.

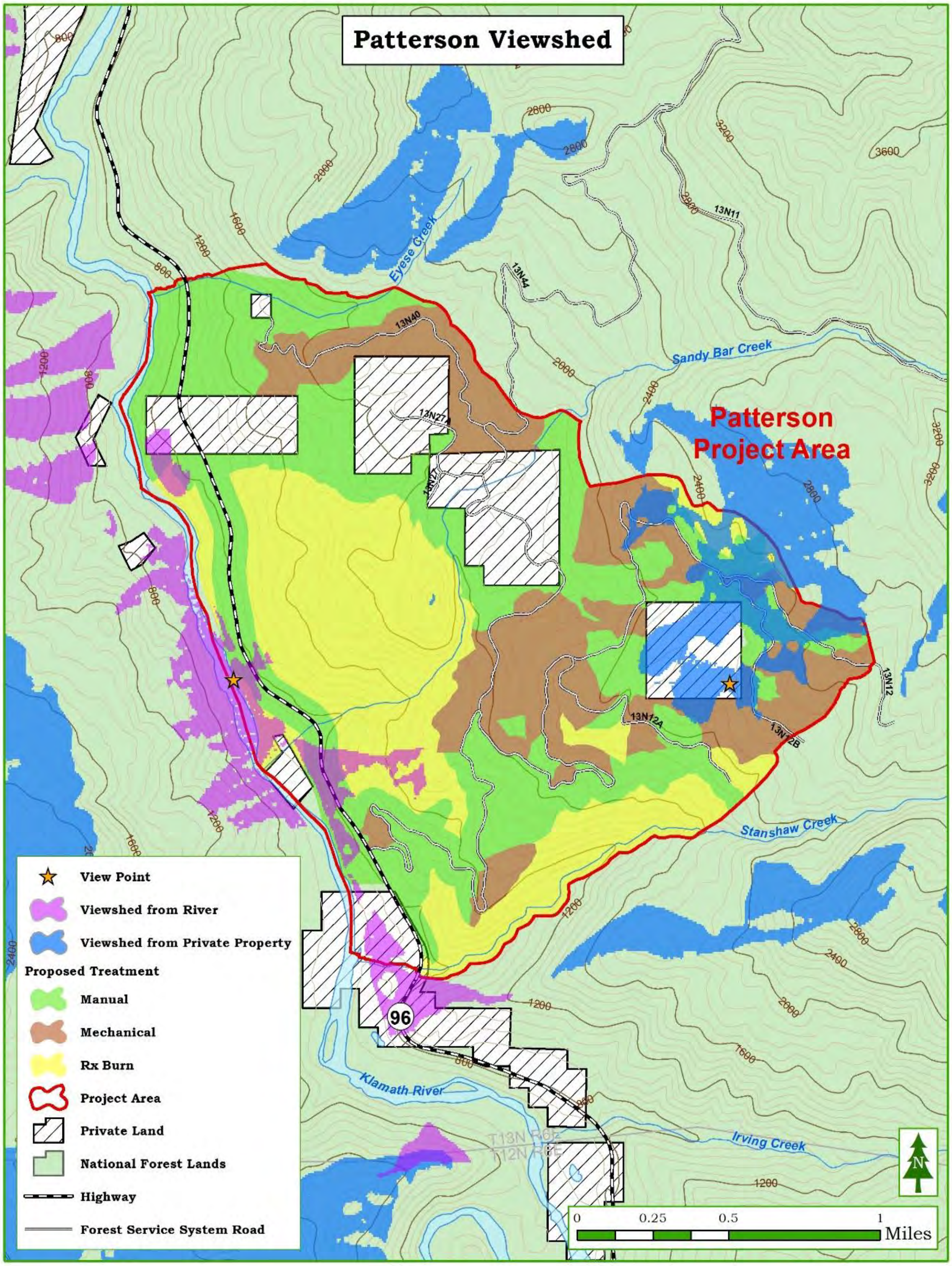

Figure 3-38. Map of the Patterson project area viewshed with proposed treatments.

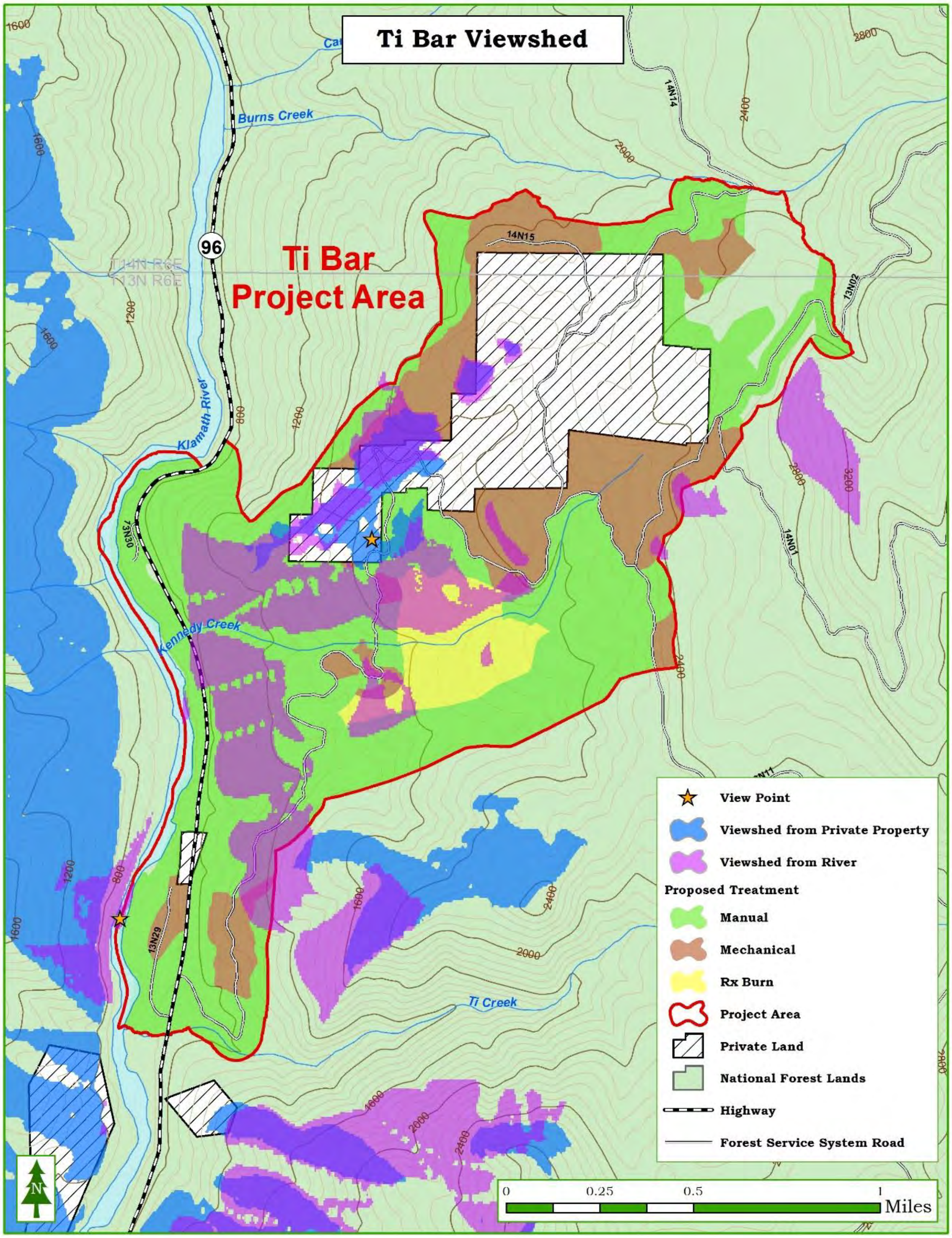

Figure 3-39. Map of the Ti Bar project area viewshed with proposed treatments.

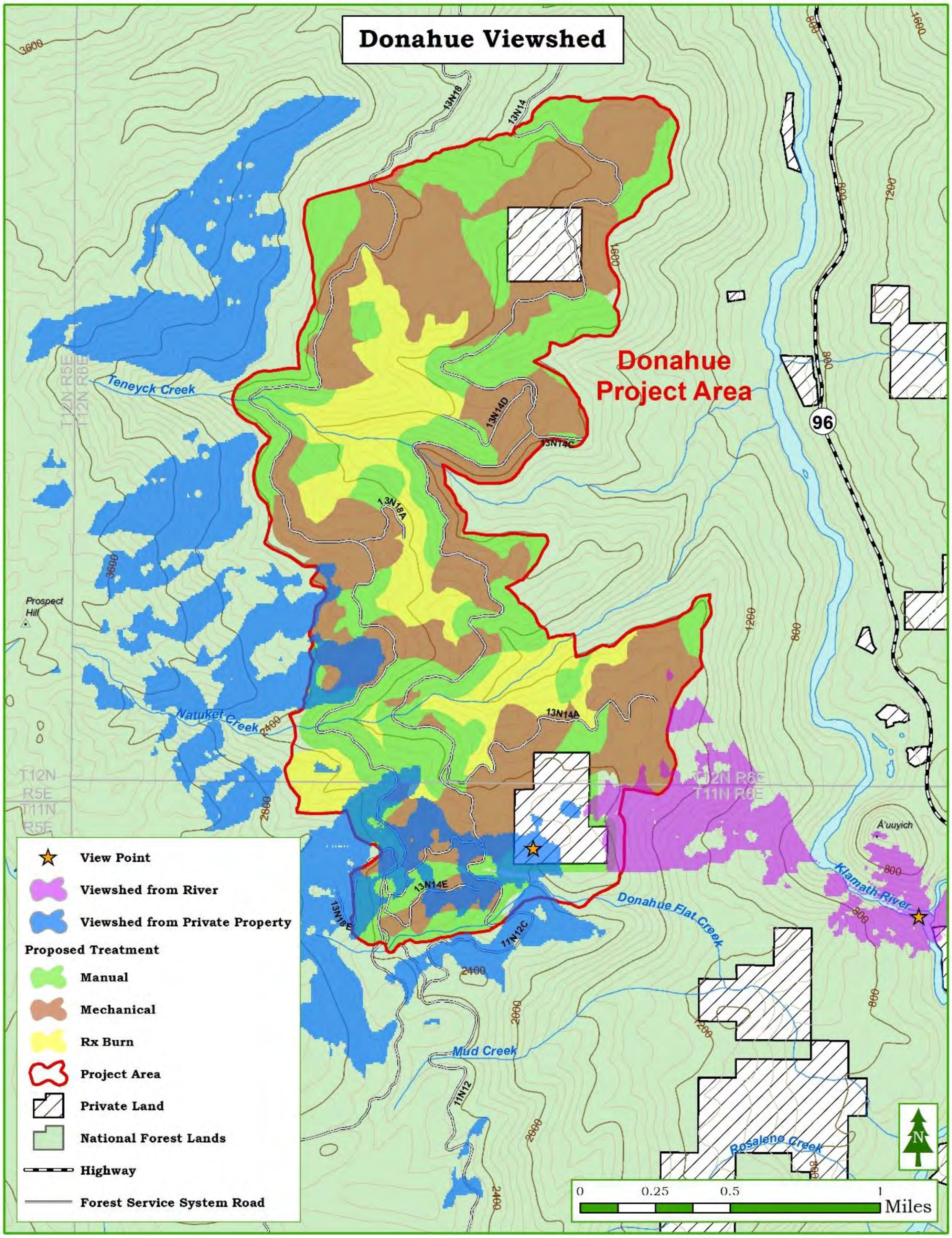

Figure 3-40. Map of the Donahue project area viewshed with proposed treatments.

The extent of noise disturbances from timber harvesting and use of chainsaws would be seasonal, with operations phased along transport or log-truck haul routes. Traditional tractor logging generates sounds from many sources throughout the harvest area, and usually for the duration of the harvest period. However, the sounds from heavy equipment operating on the ground in the forest are often dampened or attenuated by the surrounding trees and soft ground surface. Generally, on even terrain, noise level is reduced by one-half with a doubling of distance between the noise source and the receptor. The Leq measurements reported herein include tree falling, limbing, skidding, stacking, sorting, and loading logs onto log trucks to the mill. The initial phase would involve tree felling (65 dBA) within line of sight noise measurement distance of 150 feet, skidding and stacking logs (65 dBA), and loading (58 to 65 dBA). The dBA would vary depending on the size of logs, if heel boom or loader equipped with log forks is used, and other equipment (typically equipment similar to the Caterpillar D6 or D7 bulldozer or a log skidder) needed for operations.

Cable yarding by itself is a fairly quiet operation; however, communication from the logging area up to the landing is necessary. Loggers do this with pre-designated signals from a device on the belt of the choker setter/hook tender that emits sounds on the yarder called a “talkie tooter”. This enables the person in the woods to give instructions to the yarder operator to slack on the cable, tighten the slack, haul the logs, stop for emergencies, etc. The talkie tooter horn generally emits repeated short blasts (documented blast of 135 to 140 db at the source). These sounds can carry across small ravines and increased distances with wind, generally 1 to 3 kilometers (0.6 to 1.9 miles).

All substantial noise levels resulting from operations would be temporary and infrequent. No permanent increases in ambient noise levels in the project vicinity above existing levels are expected to result from operations. With the exception of Rogers Creek Focal Area, where only manual use of chainsaws are proposed, noise production would be associated with tractor and cable yarding machinery to remove crown and ladder fuels (trees ranging in size) up to the property boundary.

The level of human disturbance depends upon the individual (receptor) sensitivity and life preferences. Although noise production would be temporary, limited to daylight hours and weekdays only, those living within two miles of operations would hear machinery noise during phased entries over 15 years.

Smoke.

Prescribed burning as seen in Figure 3-41 would be implemented seasonally, phased over 15 years. As each entry may be implemented over several seasons, smoke disturbance may impact nearby residents and visitors by lowering visibility and from the burning smell. While these impacts may occur, mitigation elements would address public concerns such including contract language to maintain roadway openings or providing road monitors to address safety concerns. Additionally, burn plan development would also include language on how to reduce smoke emissions, identify sensitive smoke receptors or indicate favorable wind directions for smoke transport.

Figure 3-41. Prescribed burning during and after.

Cumulative Effects

Man-made noise-generating activities within the focal areas including vehicle traffic (access roads), recreation (people, wood cutters and hunters), and activities on inholding residences, combined with tree harvesting (machines), manual (crews and chain saws) and prescribed burning disturbances would occur close enough to the surrounding rural residential interface for homeowners to hear and be bothered by the sound and smoke during implementation, as depicted in Figure 3-42.

Figure 3-42. Rural residential interface with smoke disturbance.

Local Economy

WKRP and this project, not including the Klamath TREX or USFS employees, have already contributed over $1.4 million to the local economy. Portions of these funds have gone to local contractors and the majority has been invested in the local workforce. From 2016 to 2017, the number of full-time-equivalent (FTE) positions increased over 200 percent. In addition to USFS employees, WKRP now contributes to almost 10 FTE jobs that are all living wage. That number is expected to increase at least as much during the implementation of the project. During the initial project period, it is estimated that WKRP, including contractors, would employ almost 20 FTE local living-wage employees each year. When the project moves into maintenance and monitoring, that number may decrease again to 10 FTEs.

The areas being treated through this project have food, medicine and fiber materials that embedded within Karuk cultural, social, spiritual, economic and political systems, and daily life (Lake 2010, Norgaard 2014).While the Karuk people’s connection to the project area is more than economic, there are economic implications for the management. The Karuk Tribe, like other tribes, is disproportionately affected by forest management practices because they are heavily dependent on natural resources for both economic and cultural identity. The absence of food and cultural use species in this overgrown forest undermines the subsistence economy. Multiple social, economic, and health benefits that come to the Karuk community from participation in the process of traditional knowledge generation and its application through management.

Timber Receipts

This project may potentially generate six (6) mmbf (million board feet) of timber as part of the fuels reduction objectives.

Prescribed Fire Training Exchanges

In 2008, The Nature Conservancy Fire Learning Network (FLN) designed a novel program to provide training and learning opportunities for wildland fire professionals while at the same time furthering the long-term objectives of FLN landscapes. These two- to three-week events, known as Prescribed Fire Training Exchanges (TREXs), include daily burning and give trainees a concentrated dose of prescribed fire experience as well as exposure to new people, places and techniques. The FLN now hosts dozens of TREX events across the country each year. The events are deliberately designed to create opportunities for trainees to work with qualified trainers. The host units, meanwhile, get qualified workers to help with large or complex burn events.

The WKRP partners hosted their first TREX event in Orleans for two days in October 2013. Now, the Klamath TREX is an annual two-week training in the use of controlled burning in the Western Klamath Mountains to reduce the future danger of wildfires. With combined funding and resources from tribal, local, and federal partners, the TREX events help bring in more participants to deliver good fire to a larger landscape. Every year, the Klamath TREX advances the training of firefighters from around the region, the nation and even the world to share best practices and knowledge about how to implement controlled burns. This training event blends traditional native burning with western science to restore fire processes directly around communities where it is needed most.

Each year there are approximately 50 training opportunities, with about 100 people participating. Approximately six (6) full-time-equivalent (FTE) jobs are created through the Klamath TREX. This number is expected to increase slightly during implementation of the *Somes Bar Project*. The burning also increases the food and fiber resources for subsistence gatherers—greatly contributing to the local economy. The TREX event builds local capacity, while providing high quality training opportunities for local, state, private and federal fire professionals, students, and managers from around the country and from other countries.

Prescribed burning reduces fuel loading and wildfire risks in order to protect communities, homes and lives. With proper planning, in the right conditions during a safe burn window at strategic locations, prescribed burns are an effective tool. This effort requires close coordination with multiple organizations and residents to be successful, including the Forest Service, Karuk Tribe, MKWC, Cultural Fire Management Council, Nature Conservancy Fire Learning Network, Salmon River Restoration Council, Northern California Prescribed Fire Council, California Fire Safe Council, CAL FIRE, Firestorm, Orleans Volunteer Fire Department, and other partners. Prescribed Fire Training Exchange organizers work with regulatory agencies and partners to coordinate these burns, which would be implemented following strict protocols to ensure safe fuels reduction and capacity building for fire management.

Finding of No Significant Impact

Council on Environmental Quality (CEQ) regulations define a Finding of No Significant Impact (FONSI) as a document by a federal agency briefly presenting the reasons why an action, not otherwise excluded (§1508.4), would not have a significant effect on the human environment and for which an environmental impact statement therefore would not be prepared. It shall include the environmental assessment (EA) or a summary of it and shall note any other environmental documents related to it (§1501.7(a)(5)).[34]

Combining the FONSI with the EA avoids having to summarize the effects analysis in the FONSI, thereby allowing you to cite in the same document the respective pages where the significance factor is discussed in the analysis (40 CFR 1508.13). Although the FONSI has often been combined with a decision notice, it is not in itself a decision document. Rather, consider the FONSI the outcome of the EA process, documenting findings for the Proposed Action and alternatives. In accordance with the project-level objections process, the EA, draft FONSI, and draft decision notice are made available to the public at the start of the objection period. If the selected alternative after resolution of objections is a modification of what was analyzed in the EA, update the FONSI document to reflect the change.

As the Responsible Official, I am responsible for evaluating the effects of the Proposed Action relative to the definition of significance established by the CEQ regulations (40 CFR 1508.13). I have reviewed and considered the EA and documentation included in the project record, and I have determined that the Proposed Action would not have a significant effect on the quality of the human environment. As a result, no environmental impact statement would be prepared. My rationale for this finding is as follows, organized by sub-section of the CEQ definition of significance cited above.

Context

For the Proposed Action, the context of the environmental effects is based on the environmental analysis in this EA. This discussion of the Proposed Action's context provides meaning to the intensity of effects described below to support the rationale for a finding of no significant impact related to each factor.

Intensity

Intensity is a measure of the severity, extent, or quantity of effects, and is based on information from the effects analysis of this EA and the references in the project record. The effects of this Proposed Action have been appropriately and thoroughly considered with an analysis that is responsive to concerns and issues raised by the public. The agency has taken a hard look at the environmental effects using relevant scientific information and knowledge of site-specific conditions gained from field visits. My finding of no significant impact is based on the context of the project and intensity of effects using the ten factors identified in 40 CFR 1508.27(b):

[34] Refer to *CEQ's 40 Most Asked Questions #37-39* (*https://energy.gov/sites/prod/files/G-CEQ-40Questions.pdf*), for more information about the FONSI including expected level of detail, providing to the public for review (default when combined with the EA), and mitigation measures imposed in FONSIs.

1. Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.

The Western Klamath Restoration Partnership (WKRP) aims at transforming the fire exclusion paradigm to one of holistic landscape management practice in alignment with the National Cohesive Wildland Fire Management Strategy (Cohesive Strategy). The *Somes Bar Integrated Fire Management Project* (*Somes Bar Project)* seamlessly integrates, in practice, principles underlying the Cohesive Strategy and Karuk traditions passed down and preserved over generations for millennia.

The Proposed Action would reduce ladder fuels, which in turn increases canopy base heights. Canopy densities would be decreased through thinning activities and to a potentially noticeable extent a reduction in fuel ladders would also occur through the same activities. These, in combination, would help to reduce rates of spread, flame length, fireline intensity, resistance to control and the potential for a ground fire to transition into a crown fire. The reduction in fire behavior indicators would occur over time and multiple entries as the fuel models transitioned following thinning and burning by improving the resiliency of stands to large-scale crown fires (North et al. 2012).

One of the most threatened species is the California black oak (*Quercus Kelloggii*), which is vulnerable to being overtopped and crowded out by Douglas-fir. All the same, the oaks that remain are old and serve as indicators of an ancestral state. One of the biggest deficits on the landscape is the old upland oak woodland (CR). The Proposed Action would directly benefit these traditional ecological knowledge (TEK) species of interest (California black oak, Oregon white oak, golden chinquapin, hazel, large tanoaks, etc.). In plantations, larger hardwoods, both single stemmed and larger stems in clumps, would be favored for retention and conifers thinned out around them to enhance hardwood growth while reducing stand densities. In natural stands, hardwoods over 24-inch dbh are usually the oldest trees in the stand, although they may no longer be dominant or co-dominant in the canopy, these trees were once the dominant or codominant trees in the stands before fire exclusion. Thinning around these remnant trees, many of which are being over topped and shaded out by faster growing Douglas-fir, would enable the remnant trees of interest to receive more light and grow fuller crowns, which would increase their health and resistance to disturbance, as well as enhance accord production in true oaks, tanoaks, and chinquapins.

Small-diameter tree basal mortality is the main negative effect pertaining to incidental torching during prescribed burning. These dead trees may be most visibly evident along roadways and near private property. Fire-killed leaves and needles are a short-term visual indicator of mortality; however, in a one-year period following the entry, these fall to the ground lessening the visual effect. The Proposed Action would implement pre-treatment thinning activities prior to understory burning to limit incidental basal mortality of preferred retention leave trees. This would minimize unintended impacts to soils and visual integrity as well.

The Basin Plan of the North Coast states controllable water quality factors shall not cause further degradation of water quality when it has already been established as degraded, and efforts to restore the impaired beneficial uses of these watersheds must be made. The project design and mitigation measures would act to minimize delivery of management-related sediment and improve the long-term sediment regime for the project area to protect water quality. The watershed analysis indicates stream temperature and dissolved oxygen would not be altered as a result of implementing the Proposed Action. The project design delineates extensive riparian reserve buffers and residual canopy cover at 60 percent in the outer 80 feet of the acres treated mechanically (147 acres) to protect stream temperatures and reduce the risk of sedimentation and turbidity. Current dissolved oxygen concentrations are within the range of natural concentration levels and would not be altered by the proposed activities.

The policy, which guides the management of invasive species on National Forest System (NFS) lands requires that land management activities not foster the introduction and spread of invasive species. Germane to the Proposed Action, the following policies from FSM 2900 (Invasive Species Management) apply. The direct effects of the Proposed Action pertaining to invasive plant species are primarily associated with introduction and spread of invasive plants from equipment used for road maintenance, landing developing and thinning. Project design features (PDFs) for this Proposed Action would reduce the risk of invasive plant introduction and spread via 1) equipment cleaning prior to operating in the four respective focal areas; 2) avoiding development of landings and staging equipment where there is a risk of contact with invasive plants; and 3) employing progression of work which prioritizes road maintenance and mechanical treatments (including mastication) first to those units in settings that are relatively “invasive-plant free” such as upper reaches of the focal areas, before operating in the units/setting where invasive plant cover and diversity is high such as along State Highway 96 and on US Forest Service (Forest Service) routes within one (1) mile of the highway.

Indirect effects of the Proposed Action pertain to the types of actions occurring adjacent to invasive plant occurrences, such as reducing canopy or shrub cover by mechanical thinning or manual fuels treatments, thereby enhancing the growing conditions of relatively shade-intolerant invasive species and reducing competition. These indirect effects could result in invasive species like Himalayan blackberry expanding from the road edge into the forest. Project design features to reduce the risk of indirect effects and thus substantiate the FONSI for this element, include treatment of relatively small and discrete occurrences of invasive species, maintenance of a native vegetation around invasive plant occurrences to reduce down or upslope spread, and in certain riparian area reaches, focal treatment of blackberry by manual removal, piling and burning.

2. Degree to which the Proposed Action affects public health or safety.

Clean Air Act of 1970

The Clean Air Act of 1970 and its amendments provide for the protection and enhancement of the nation’s air resources. The implementation of the Proposed Action would not exceed the federal and state ambient air quality standards to protect public health. Prescribed burning would be implemented seasonally, phased over 15 years. As each entry may be implemented over several seasons, smoke disturbance may impact nearby residents and visitors by lowering visibility and from the burning smell in the short-term. While these impacts are unavoidable, mitigation elements would address public health and safety concerns. The project design incorporates operational provisions to maintain roadway openings, along with requiring road monitors, to ensure safe motorized access to private land inholdings during operations. Additionally, burn plan would be developed identifying specific tactics to reduce smoke emissions, including identifying sensitive smoke receptors and when favorable wind directions would promote smoke dispersal prior to scheduling burn ignition.

Clean Water Act

The protection of water quality and quantity is an important part of the mission of the Forest Service (USDA Forest Service 2015). Management activities on NFS lands must be planned and implemented to protect the hydrologic functions of forest watersheds, including the volume, timing, and quality of streamflow. The alternatives, as proposed, would comply with the Clean Water Act, Porter-Cologne Water Quality Control Act, applicable water quality control plans, and the North Coast Regional Water Quality Control Board waiver of waste discharge requirements. A waiver application will be filed after the Decision Notice is signed.

The Basin Plan contains water quality objectives, implementation plans for meeting those objectives, and other policies of the State Water Quality Control Board and the Federal Government, which are applicable to timber and fuel treatment projects. The water quality standards in the Basin Plan that most closely apply to this Proposed Action are sediment, turbidity, temperature and dissolved oxygen.

The standard for sediment states that sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses. The standard for turbidity states, "turbidity shall not be increased more than 20 percent above naturally occurring background levels". Relative to water temperature, the Basin Plan states that water temperature of receiving water bodies shall not be altered and at no time shall the temperature of any cold water be increased by more than 5°F. Similarly, dissolved oxygen concentrations shall not fall below 6.0 mg/l.

Stream temperature and dissolved oxygen would not be altered as a result of the Proposed Action. Extensive riparian reserve buffers and residual canopy cover at 60 percent in the outer 80 feet of mechanically treated units (147 acres total) would protect stream temperatures. Current dissolved oxygen concentrations are in the range of natural concentrations and would not be altered. Effort was made to reduce the risk of sedimentation and turbidity relative to the Proposed Action. The Basin Plan states that controllable water quality factors shall not cause further degradation of water quality when it has already been established as degraded, and efforts to restore the impaired beneficial uses of these watersheds must be made. The water quality analysis of this Proposed Action has focused on minimizing delivery of management-related sediment and improving the long-term sediment regime for the project area.

Because the Proposed Action is spread across three 6th-field watersheds, and at most encompasses roughly 13 percent of the Reynolds-Klamath River watershed, it is very unlikely that enough vegetation would be removed to cause detectable changes in peak flows in the analysis area. For rain-dominated zones (below 2,500 feet in elevation in the project area), changes in peak flow can only be detected where 29 percent of the area is harvested (Grant et al. 2008). For areas where rain-on-snow events can occur (above 2,500 feet in elevation in the project area), the detection level for peak flow increases is 19 percent, including harvested acres and the area in roads. The magnitude of observed changes in peak flows from management activities diminished with increased watershed area (ibid).

Wildland-urban interface

The reduction in fire hazards would enhance public safety for those living within the WUI, as the Proposed Action is designed to allowing for efficient wildfire containment and control. Between 2006 and 2011, about 600 assessments were completed by the Forest Service on wildfires that burned into areas where hazardous fuels reduction treatments had previously been conducted (Stein et al. 2013). These assessments evaluated the effects of prescribed fire as well as mechanical and chemical treatments on fire behavior and fire suppression actions. The data indicate that 90 percent of treatments reported in the database have helped to reduce wildfire intensity, allowing better control by firefighters. In most of these cases, as fires moved from untreated locations to areas treated by thinning, mowing, or prescribed burning, the fire behavior changed from active crown fires (burning an entire upper story of the forest) to passive crown fires (where only a single tree or small group of trees burned), or from passive crown fires to surface fires (burning only dry grass, shrubs, pine needles, and other flammable materials on the ground) (DellaSala and others 2004, Stein et al. 2013).

3. Unique characteristics of the geographic area such as the proximity to historical or cultural resources, parklands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

Katimiin Cultural Management Area

The Katimiin Cultural Management Area (CMA) lies within Rogers Creek and Donahue focal areas, encompassing 2,306 acres within the project area. A memorandum of understanding (MOU; Karuk Tribe, SRNF and KNF 2017) provided a platform for both parties to collaboratively develop the *Somes Bar Project* to achieve mutually beneficial goals and objectives for land management, recognizing the indescribable importance to the Karuk people. The Proposed Action fulfills the intent of the MOU to work together to mutually coordinate planning and implementation efforts as partners, in and adjacent to the Katimiin CMA in a manner consistent with Karuk customs, culture and federal land management direction.

Wetlands and Floodplains

No floodplains associated with Executive Order 11988 or wetlands per Executive Order 11990 exist within the project area. Therefore, the Proposed Action would constitute a “no effect” undertaking, as none exist or would be affected.

Parklands and Prime Farmlands

There are no parklands or prime farmlands within or immediately adjacent to the project area. The Forest Service would notify and coordinate with a local grape grower to coordinate the timing of prescribed burning to mitigate smoke tainting of commercial grape products.

Wild and Scenic Rivers

The Klamath River lies adjacent to the focal areas, flowing north-south, designated a Recreational River within the National Wild and Scenic Rivers System in 1981; classified as a designated and recommended Recreational River (KNF LRMP 4-156). Three designated segments have been identified for potential reclassification per the 1986 amendment to the Wild and Scenic River Act (WSRA). The closest segment is from Ti Bar to the mouth of the Salmon River. Portions of the designation overlap the focal areas near the Klamath River. All Proposed Action activities are consistent with the KNF standards and guidelines (S&Gs) for Recreational River management. Most recreational activities are concentrated along the Klamath River or are associated with the Marble Mountain Wilderness to the east, outside the project area.

Norther Spotted Owl Critical Habitat

The California Coast Range (Klamath West) is considered a “fire prone” area because of its frequent fire return intervals and existing vegetation condition that likely elevates the potential of fire (USDI Fish and Wildlife Service 2012). Within fire-prone areas, resource agencies planning vegetation management in critical habitat for the northern spotted owl (NSO) are encouraged to ameliorate current threats of on-going habitat loss from uncharacteristic fires and vegetation change that are largely related to past fire exclusion (USDI Fish and Wildlife Service 2012). The *Somes Bar Project* is designed collaboratively aimed at maintaining and enhancing the characteristics of older forest and providing large habitat blocks and associated interior forest conditions. Range this means providing mosaics of interior habitats and edges to provide for the diversity of prey for NSO.

Special Habitat KNF Management Area 5

This management area consists of special provisions for peregrine falcon, bald eagle and late successional reserves (LSR). The Klamath National Forest Land and Resource Management Plan (KNF LRMP) includes a provision for the Special Habitat Management Area around peregrine falcon eyries. The Proposed Action proposes fuels reduction treatment that occurs within the Special Habitat area. However, no known peregrine falcon eyries are located within 0.5 miles of the focal areas. Therefore, the proposed treatment is consistent with the management of this area and will not be analyzed further for this project.

Bald eagles were also delisted under the Endangered Species Act (ESA) but the eagle is included in the Forest Service Sensitive species list. Forest plan provisions for the Special Habitat Management Area around bald eagle nests would be followed. Effects of the Proposed Action on bald eagles are disclosed under discussions of Forest Service Sensitive species.

Approximately 48 acres of the Proposed Action is proposed for treatment within LSRs, specifically in LSR Ten Bear RC349. The KNF Forest-Wide LSR Assessment (LSRA 1999) determined that this area of the LSR was deficient in late-successional habitat. Portions of the LSR prior to its designation were harvested, therefore, extensive stands of dense plantations exist that not only create a fuels hazard, they also do not provide suitable habitat for late-successional species such as the NSO. Plantations and young natural stands are even-aged and lack the horizontal and vertical diversity components associated with late-mature stands. Young stands have the potential to achieve rapid diameter and height growth with thinning treatments. Silvicultural prescriptions can be applied to younger stands in order to accelerate their development toward late seral conditions. These treatments could increase the amount of late seral vegetation sooner than would occur naturally. The LSRA indicated the proposed area needs extensive fuels treatments to protect the LSR as well as extensive habitat restoration. Planned treatments outside but adjacent to the Ten Bear LSR would reduce fuel loading risk and provide additional protection to late-seral stands.

4. Degree to which the effects on the quality of the human environment are likely to be highly controversial.

The Conservation Congress comments indicate there is “Hysteria around issue of wildfire and most is myth, and logging reduces large wildfires”. A study done by fire ecologists at the Missoula Fire Lab was quoted, stating, "Even extensive fuel treatments may not reduce the amount of area burned over the long-term and furthermore, reduction of area burned may actually be an undesirable outcome. A new study soon to be published found that reviewed 1,500 wildfires between 1984 and 2014 found that actively managed forests had the highest level of fire severity. While those forests in protected areas burned, on average, had the lowest level of fire severity. In other words, the best way to reduce severe fires is to protect the land as wilderness, not *manage* it”.

Because modern human alteration of many ecosystems has been so profound, reference states must often be derived from historical information from before the onset of anthropogenic change. Maintaining managed ecosystems within the bounds of the “historical range of variation” for key ecosystem patterns or processes has traditionally been seen as the best hope for preserving species and landscapes and ensuring long-term ecological sustainability (Egan and Howell 2001, Landres et al. 1999).

5. Degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.

The Proposed Action applies low-intensity mechanical, manual and prescribed burning treatment methods. The treatment prescriptions and mitigation measures incorporated have been applied on numerous projects across the SRNF with predictable effects and outcomes.

Executive Order 12898, Environmental Justice

This federal order requires an assessment of whether there would be disproportionate effects to minority or low-income populations. Although there are minorities and low-income populations living in the North Coast California area, they would benefit from the proposal.

Environmental Justice means that, to the greatest extent practicable and permitted by law, all populations are provided the opportunity to comment before decisions are rendered on, are allowed to share in the benefits of, are not excluded from, and are not affected in a disproportionately high and adverse manner, by government programs and activities affecting human health or the environment. There would be no discernable differences between the Proposed Action and No Action alternatives regarding effects on minorities or the Civil Rights of any American Citizen.

The Proposed Action does not have a disproportionately high and adverse human health effects, high or adverse environmental effects, substantial environmental hazard, or affects to differential patterns of consumption of natural resources. Extensive scoping did not reveal any issues or concerns associated with the principles of Environmental Justice. No mitigation measures to offset or ameliorate adverse effects to these populations have been identified.

Relationships between Local, Short-Term Uses of the Human Environment and Maintenance or Enhancement of Long-Term Productivity

Short-term uses are expected to change the human environment during mechanical, manual, prescribed burning and logging/hauling operations. Long-term effects should not appreciably change the human environment after final entry fuel reduction operations have concluded, as proposal treatment prescriptions are low-intensity, and planned for phased entries to minimize disturbance to nearby neighbors and natural resources.

The availability of natural resources contributes to the quality of life for many county residents. Many community members rely on natural resources for substance food gathering and jobs. These communities are directly influenced by forest-management job opportunities and supply of natural resources from forest ecosystems. Implementation of the Proposed Action would cause no unavoidable or other indirect social/economic adverse effects.

The Klamath Prescribed Fire Training Exchange (TREX) is an annual two-week training in the use of controlled burning in the Western Klamath Mountains to reduce the future danger of wildfires. The TREX event builds local capacity, while providing high quality training opportunities for local, state, private and federal fire professionals, students, and managers from around the country and from other countries. With combined funding and resources from tribal, local, and federal partners, the TREX events help bring in more participants to deliver good fire to a larger landscape. Every year, the Klamath TREX advances the training of firefighters from around the region, the nation and even the world to share best practices and knowledge about how to implement controlled burns. This training event blends traditional native burning with western science to restore fire processes directly around communities where it is needed most.

Each year there are approximately 50 training opportunities, with about 100 people participating. Approximately six (6) full-time-equivalent (FTE) jobs are created through the Klamath TREX annually. The implementation of the *Somes Bar Project* over a 15-year period would potentially increase paid training job opportunities equivalent up to 20 full-time positions. The burning activities would promote production of food and fiber resources for subsistence gatherers contributing to the local economy.

6. Degree to which the action may establish precedent for future actions with significant effects or represents a decision in principle about a future consideration.

Irreversible or Irretrievable Commitments of Resources

Irreversible commitment of resources refers to a loss of non-renewable resources, such as mineral extraction, heritage (cultural) resources, or to those factors, which are renewable only over long time spans, such as soil productivity. Under the No Action Alternative, there would be no irreversible or irretrievable commitment of resources.

Irretrievable commitment applies to losses that are temporary, such as use of renewable natural resources. The production lost would be irretrievable, but the action would not be irreversible. Vegetation removed as commodity byproducts under the Proposed Action, is considered an irretrievable impact. Forest conditions would return, as tree growth over one or more decades would feature increased canopy closure and development of healthy, sustainable stand densities resilient to natural processes serving TEK focal and indicator species, ESA wildlife habitat, and human and cultural values.

Adverse Environmental Effects that cannot be Avoided

The Proposed Action involves adverse environmental effects to soil resources that cannot be wholly avoided or mitigated. There would be measurable negative effects in specific areas (temporary roads, landings, some skid trails); however, these are not expected to be long term or extensive enough to be significant at unit-scale. The aerial extent of these impacts is expected to comply with applicable standards (less than 15 percent area), and thus impacts are not considered to constitute a "substantial and permanent impairment" of soil productivity with respect to National Forest Management Act of 1976 (NFMA) and Forest Service Region 5 Soil Quality Standards (R5 SQS). Project design features are developed in site-specific fashion and are intended to ensure compliance with the various elements of soil management direction. Physical soil impacts would be limited in aerial extent, and thus are considered acceptable for this Proposed Action, in accordance with soil management direction.

Implementation of the Proposed Action would cause no other known unavoidable or other indirect adverse effects, other than the effects already stated.

Energy Requirements of Alternatives

Under the Proposed Action, various amounts of fossil fuels, and human labor would be expended. Fossil fuel energy would not be retrievable. None of them are in short supply and their use would not have an adverse effect upon continued availability of these resources.

7. Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

When considering past, present, and foreseeable future actions (e.g., mechanical and manual cutting, prescribed burning, etc.), both the No Action Alternative and the Proposed Action have the potential to increase the amount of ground-disturbing activities and prescribed fire across the landscape. Past and present projects that are in and around the current project footprint include the *Roots and Shoots Cultural Burn* (*Roots and Shoots*), *Orleans Community Fuels Reduction* (OCFR), and *Katimiin Thin* projects. The only known future project is the *Six Rivers Aquatic Restoration Project* (*Aquatic Restoration Project*), which is under development.

Cultural Resources

Mitigation measures have been or would be implemented to keep ground-disturbing activities out of cultural resource site boundaries. Fuels reduction pre-treatments have been or would be implemented to minimize fire effects on archaeological sites and traditional cultural properties during prescribed burns. As such, the potential cumulative effects on cultural resources and TCPs are not considered adverse. In fact, on-going and future collaborative-based ecological restoration projects would benefit the cultural resources across the larger landscape.

Fire and Fuels

In consideration of additional projects within the project area boundaries, as well as those just outside of the project boundaries, this project is a direct compliment to other efforts. There is a recognition that fire danger exists well beyond the project boundaries (as well as on private inholdings) and providing for a connectivity of fuels reduction treatments aims to address that issue. Working across jurisdictional boundaries achieves the greater goal of the WKRP as well as aiming to achieve goals within the Cohesive Strategy.

By initially developing strategic fire control features of private property thinning, ridgeline fuelbreak construction and careful assessment of high fuel loading condition, we should be able to return fire successfully to the project areas. Once first-entry treatments of fire have occurred, second and third entry treatments may occur at larger scales due to previous reductions in fuel loading and decreased tree densities as well as the multiple established control line placement.

Soils

The Proposed Action involves adverse environmental effects to soil resources that cannot be wholly avoided or mitigated. There would be measurable negative effects in specific areas (new temporary roads, landings, some skid trails); however, these are not expected to be long term or extensive enough to be significant at unit-scale. The aerial extent of these impacts is expected to comply with applicable standards (less than 15 percent area), and thus impacts are not considered to constitute a “substantial and permanent impairment” of soil productivity with respect to NFMA and R5 SQS. Project design features are developed in site-specific fashion and are intended to ensure compliance with the various elements of soil management direction. Physical soil impacts would be limited in aerial extent, and thus are considered acceptable for this Proposed Action, in accordance with soil management direction.

Invasive Plants

For recent past projects, invasive plant risk assessments were developed using similar criteria outlined above (e.g., presence of known invasive plant species in the project area, habitat vulnerability). As an example, for the *Roots and Shoots Project*, yellow starthistle, Dyer’s woad, spurge species, Dalmatian toadflax and spotted knapweed were documented in the area associated with State Highway 96, Forest Service routes and the river bar. The Proposed Action would result in a moderate risk for introduction and spread associated with Proposed Action implementation with design features. These features include: a) avoidance of settings with yellow starthistle or timing activities before seed heads develop, b) retention of a native vegetation along the edge of a unit to reduce the risk of Dyer’s woad spreading from the road into the unit and c) manual removal of invasive species associated with the river bar, including treatment over multiple seasons.

Avoidance of infested sites, equipment cleaning, use of weed-free rock material and erosion control material, and clearing invasive plants from landings prior to use were identified in the risk assessment for *OCFR* to reduce the risk of introduction and spread of yellow starthistle and Scotch broom. Given that the foreseeable future projects are the current project, continued implementation of the *Roots and Shoots* and *OCFR* projects, the PDFs for these respective projects would apply. Depending on the proposed actions related to the *Aquatic Restoration Project*, a risk assessment would develop applicable design features in this case.

8. Degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.

The primary intent of the *Somes Bar Project* is to benefit cultural resources. Fuels reduction treatments and the reintroduction of cultural burning would in fact improve the state of certain sites, objects, features or properties. It is important to consider traditional principles, practices, use factors, and associated wildlife habitats that link the action to the spiritual, living environment, and human responsibility through respect and reciprocity, especially concerning food, fiber, medicinal and regalia species. The proposed activities in the *Somes Bar Project* include prescribed burning, hand thinning with chainsaws, mastication, and several types of ground-disturbing activities, such as ground and cable-based tree harvesting. These activities have the potential to affect cultural resources, including historic properties, archaeological sites, traditional cultural properties (TCPs), sacred sites, and traditional use areas. However, with the application of PDFs and standard protection measures, it is anticipated that none of the proposed activities would adversely affect cultural resources. The cultural resource surveys have been designed in such a way as to assess current conditions in the area of potential effect (APE) to design management prescriptions that would lead towards a desired future condition more considerate of perpetuation of living Karuk culture.

In taking the approach of TEK integration and in considering that we are preserving a living culture while enabling expansion of fire adapted community concepts. The management practices achieved in the currently proposed *Somes Bar Project* would lead to the introduction of fire, and would start the process of landscape recovery from years of neglect, fire exclusion, road building, use of chemical/biological agents and logging practices. The reintroduction of management by fire may have indirect beneficial effects over a much wider area than the direct APE covered by this analysis. Since the Proposed Action takes a holistic landscape approach and employs five focal species that together cover the main landscape components, it is appropriate to realize that we may have indirect beneficial effects in the context of the entire WKRP planning area and beyond. These actions have the potential to enhance the focal species and integrate other TEK considerations across that whole area as well as in building relationships with additional tribal groups. Indirect effects beyond the scope of the WKRP effort are also underway as many people at regional, national, and international scales are expressing interest in the processes and considerations being established and undertaken in this demonstration project. A key indirect effect of this Proposed Action is the potential for enabling the restoration of important ceremonial burning practices on Offield Mountain. By treating large areas around residential structures, and building social license for increasing the scope and scale of fire use, ceremonial burning can be restored, as well as managed wildfire decisions enabled on adjacent landscapes. The *Somes Bar Project* has been implemented in accordance with the requirements of National Environmental Policy Act (NEPA) and National Historic Preservation Act (NHPA) §106. The implementation of this Proposed Action would avoid and improve cultural resources in TCPs.

9. Degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

The Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.) requires any action authorized by a federal agency to not jeopardize the continued existence of a threatened or endangered species, or result in the destruction or adverse modification of the critical habitat of such species. Section 7 of the ESA, as amended, requires the responsible federal agency to consult with the US Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) concerning endangered and threatened species under their jurisdiction as follows:

Wildlife

The draft wildlife BA for the *Somes Bar Project* (Bettaso and Yost 2017/2018) contains a detailed analysis of effects and determinations on the following ESA listed species. No gray wolf den or rendezvous sites are known to occur within the project area. No critical habitat has been designated for the gray wolf. The nearest known den or rendezvous site is located greater than 70 miles from the project area. Therefore it was determined the Proposed Action would have “no effect” on this species. Surveys were conducted for the marbled murrelet with no detections. In addition, the project is not located within marbled murrelet critical habitat. Therefore, the Proposed Action would have “no effect” on marbled murrelet or its critical habitat.

During discussions with the Level 1 team, draft data presented to the USFWS has resulted in a tentative agreement on the determination of “may affect, not likely to adversely affect” NSO and its critical habitat due to the removal of six (6) acres of low- to moderate-quality nesting/roosting habitat and removal of 12 acres of foraging habitat during construction of temporary roads and new landings. Temporary roads and landings would remove scattered pockets of nesting, roosting and foraging habitat typically less than 0.25 acres in size of suitable NSO habitat. No commercial treatment would occur within 70-plus-acre nest groves or high-quality nesting/roosting habitat. All current NSO habitat function would be maintained in the remaining treated areas and ample alternative (non-treated) habitat exists in all areas. In the long term, this Proposed Action is expected to have beneficial effects through restoration and protection of higher quality habitats. The Proposed Action is consistent with the 2011 NSO Recovery Plan. Limited operating periods (LOPs) would be imposed to prevent noise and smoke disturbance during the peak breeding season.

The *Somes Bar Project* “may affect but is not likely to adversely affect” Critical Habitat for the northern spotted owl due to removal and modification of primary constituent elements, although current functionality of the primary constituent elements would be maintained in the proposed treatment units. Temporary roads and landings would remove scattered pockets of nesting, roosting and foraging habitat. In the long term, this Proposed Action is expected to have a beneficial effect on Critical Habitat through restoration and protection of higher quality habitats. The Proposed Action is consistent with the 2012 NSO Critical Habitat Rule.

Botany

There are no occurrences of the federally listed endangered species within the project area. Hence, there would be no effects (direct or indirect) from the Proposed Action to this species. Under §7 of the ESA, consultation with the USFWS is not required for no effect determinations.

Fisheries

A draft Fish BA/BE (biological evaluation) for the *Somes Bar Project* (Cyr 2017) contains a detailed analysis of effects and determinations on the following ESA-listed species, Essential Fish Habitat, and Sensitive species. The Fish BA/BE analysis resulted in a Level 1 agreement on the determination of “may affect, not likely to adversely affect” coho salmon and its critical habitat due to a negligible potential for sediment to reach occupied habitat through a combination of all actions. More importantly, the Fish BA/BE documenting the proposed action, would result in key recovery actions being implemented on 5,570 acres of the Mid-Klamath population of coho salmon to reduce the risk of high-severity fire.

10. Whether the action threatens a violation of federal, state, or local law or requirements imposed for the protection of the environment.

Aquatic Conservation Strategy

The *Somes Bar Project* was developed in alignment with the Aquatic Conservation Strategy (ACS) reflected in the Record of Decision (ROD), and S&Gs of the Northwest Forest Plan (NWFP; USDA and USDI 1994) as incorporated into the Six Rivers National Forest (SRNF) LRMP (USDA Forest Service 1995) and the KNF LRMP (USDA Forest Service 2010). The ACS outlines specific objectives regarding the forest goals in the management of aquatic and riparian resources (KNF 4-25and SRNF IV-107). Project NEPA decisions must be consistent with the wording regarding ACS consistency, including consistency with the nine ACS objectives, as ACS consistency is described in the 1994 NWFP ROD on page B-10 and in the May 22, 2007 Memorandum.

Project implementation does not prevent attainment of ACS objectives at the HUC 6th and larger scales in the short-term, and promotes attainment of ACS objectives in the long-term. Fuel treatments are in accord with recommendations in the *Ishi Pishi Ecosystem Analysis* (1998). Cumulative watershed effects (CWE) would remain below threshold for adverse watershed effects. Minimal disturbances are not expected to adversely affect anadromous fish and habitat because PDFs would contain effects to the project site and the effects are negligible in the action area. The Proposed Action would maintain and help restore many of the Indicators of the HUC 6 subwatersheds in the short term and are expected to improve aquatic habitats and watershed conditions for fish populations in the Kennedy-Ti Creek and Irving-Reynolds Creek composite subwatersheds, and in the lower mid-Klamath River in the long term.

Forest Service Sensitive Wildlife Species

Analysis of Proposed Action impacts to Forest Service Sensitive species is required by FSM 2670 through the preparation of a BE. All Forest Service Sensitive wildlife species known or thought to occur in the project area (based on habitat and range), were evaluated for this Proposed Action. It was determined that the Proposed Action would have no impact on certain Forest Service Sensitive species, based on either the lack of habitat, lack of detections during surveys, or the fact that habitat would not be impacted. In addition, surveys and limited operating periods (LOPs) could be used as a mitigation to reduce the risk that the Proposed Action would impair a species reproduction.

Species that would not be affected by this Proposed Action include greater sandhill crane, great gray owl, Siskiyou Mountains salamander, cascade frog, northern red-legged frog, Tehama chaparral snail and mardon skipper.

The *Somes Bar Project* may impact individuals, but is not likely to result in a trend towards federal listing for the following Forest Service sensitive species and/or habitat: bald eagle, northern goshawk, fisher, marten, wolverine, pallid bat, Townsend's big-eared bat, fringed myotis, willow flycatcher, western bumblebee, foothill yellow-legged frog, southern torrent salamander, and western pond turtle. The BE prepared for this Proposed Action contains the affected environment for each species, description of indicators to base effects on as well as the assumptions upon which the analysis was done

Forest Service Sensitive Botanical Species

Sensitive species are those for which there is a concern for viability of the species based upon population trends or loss of habitat that would reduce the species existing distribution (USDA Forest Service 2005, FSM 2670.5). The Proposed Action was designed to not lead toward a loss of viability or a trend toward federal listing in compliance with KNF and SRNF forests plans direction; disclosed in the BE (Hoover 2017a). For *Thermopsis robusta*, implementation of the Proposed Action with the PDFs is not expected to have any negative direct or indirect effects to this species. For the other species considered, prescriptions that provide for retention of mature forest and their structure (i.e., partial canopy, coarse woody debris (CWD), predominant trees, forest floor vegetation mosaics) coupled with PDFs associated with recent past, present and future projects are intended to reduce the possibility of direct effects to Sensitive species and mitigate significant indirect effects. In light of the inherent uncertainties about some Sensitive species, such as the extent of the underground network of fungal mycelia of *Phaeocollybia olivaceae*, the distribution of *Sulcaria badia* in the forest canopy, and the dormancy and dispersal of *Cypripedium fasciculatum*, the Proposed Action may affect individuals of a given sub-population but is not likely to result in a trend toward Federal listing or loss of viability for these species.

Forest Service Sensitive Aquatic Species

A BE was prepared for the Forest Service aquatic sensitive species that are located in the analysis area (see Region 5 list by Forest dated July 2015; Cyr 2018). The analysis resulted in a "may impact individuals but would not lead to a trend towards federal listing" for Upper Klamath Trinity River Chinook salmon, Klamath Mountain Province steelhead trout, as well as, Pacific and Klamath River lampreys. The slight risk of an insignificant amount of sediment reaching these species habitat is far outweighed by reducing the risk of high severity wildfire and the potential impacts that would bring. The Proposed Action would have no effect on western brook lamprey, California floater, pristine springsnail, and chace juga, as they are not located within the project boundaries.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (PL 104-267), requires federal agencies to consult with NOAA Fisheries on all actions and proposed actions authorized, funded or undertaken by the agency that may adversely affect essential fish habitat (EFH). All EFH assessments must include 1) a description of the Proposed Action; 2) an analysis of the effects, including cumulative effects of the Proposed Action on EFH, the managed species and associated species, including life history stages potentially affected; 3) the federal agency's views regarding the effects of the action on the EFH; and 4) proposed mitigation, where applicable (50 CFR 600.920(g)(2)). The information prepared under a BA for formal or informal consultation under the ESA (50 CFR 402.12) may serve as the EFH assessment curtailing the need for separate analysis. The effects to EFH related to the Proposed Action were analyzed using habitat data derived from available historical fish species inventories and habitat assessments on record at the Orleans/Ukonom RD. The Proposed Action would have no effect on Chinook or coho salmon EFH.

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Chapter 4. Consultation and Coordination

The Forest Service consulted the individuals, federal, state and local agencies, tribal governments and non-Forest Service individuals during the development of this environmental assessment. *Appendix A* contains additional information on the collaborative efforts in the project development.

Environmental Assessment Team Members and Contributors

Interdisciplinary Team Members	Affiliation
Merv George Jr.	Forest Supervisor, Six Rivers National Forest
Nolan C Colegrove Sr.	Project Leader, District Ranger, Six Rivers National Forest
Carol Spinos	Environmental Planner, Six Rivers National Forest
Corrine Black	Interdisciplinary Team Leader, Hydrologist, Six Rivers National Forest
Jill Beckmann	GIS Specialist/Data Steward, Karuk Tribe
Roberto Beltran	Supervisory Forester, Six Rivers National Forest
James Bettaso	Wildlife Biologist, Six Rivers National Forest
Natalie Cabrera	Geologist/Hydrologist, Six Rivers National Forest
LeRoy Cyr	Fisheries Biologist, Six Rivers National Forest
Jennifer Dyer	Heritage Program Manager, Six Rivers National Forest
Lisa Hoover	Forest Botanist, Six Rivers National Forest
Kenny Sauve	GIS Technician II , Karuk Tribe
Andrew Spain	Fuels Planner, Six Rivers National Forest
Bill Tripp	Deputy Director Eco-Cultural Revitalization, Karuk Tribe
Alex Watts-Tobin	Tribal Heritage Protection Officer, Karuk Tribe
Kurt Werner	Engineering Technician, Six Rivers National Forest
Bryan Yost	Forest Wildlife Biologist, Six Rivers National Forest
Dave Young	Soils Scientist, R5 Regional Office

Contributors	Affiliation
Kimberly Baker	Klamath Forest Alliance, Environmental Protection Information Center
Brandy Clark	Archaeologist – Pathways Intern, Six Rivers National Forest
Max Creasy	Ecologist (Retired), Klamath National Forest
Earl Crosby	Watershed Restoration Coordinator, Karuk Tribe
Brenda Devlin	Wildlife Biologist, Six Rivers National Forest
Eamon Engber	Interagency Fire Ecology, Redwood National Park and Six Rivers National Forest
Karuna Greenburg	Salmon River Restoration Council
Scott Haggerty	Soils Scientist (Retired), Six Rivers National Forest
Will Harling	Director, Mid Klamath Watershed Council
Leaf Hillman	Director, Department of Natural Resources, Karuk Tribe
Lisa Hillman	Department of Natural Resources, Karuk Tribe
John Hunter	US Fish and Wildlife, Arcata Field Office
Jeff Jones	Forest Silviculturist, Six Rivers National Forest
Karen Kenfield	Fisheries Level 1 Consultation and Editor, Six Rivers National Forest

Frank Lake	Research Ecologist, PSW Research Station
Kristen Lark	Forester, Six Rivers National Forest
Luna Latimer	Director, Mid Klamath Watershed Council
Fred Levitan	Geologist, Six Rivers National Forest
Bridget Litten	Public Affairs Officer and Editor, Six Rivers National Forest
Cassandra Marszal	Wildlife Biologist, Six Rivers National Forest
Cathy Meinart	Happy Camp Fire Safe Council, Happy Camp, CA
Jeni Peterson	GIS, Six Rivers National Forest
Vicki Prescott	Cultural Specialist, Karuk Tribe
Carol Sharp	Happy Camp Fire Safe Council, Happy Camp, CA
Zack Taylor	Fuels Technician, Six Rivers National Forest
Brendan Twieg	Forester, Mid Klamath Watershed Council
Leslie Wolff	National Marine Fisheries Service, Arcata Field Office

Federal and State Agencies Consulted

- USDI Fish and Wildlife Service
- USDOC National Marine Fisheries Service
- California Regional Water Quality Control Board
- State Historic Preservation Office

Tribal Governments

- Karuk Tribe

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Appendix A. Collaboration

The Western Klamath Restoration Partnership (WKRP) and the project arose because members of the community, including the Karuk Tribe, Mid Klamath Watershed Council (MKWC), US Forest Service (USFS or Forest Service), area fire safe councils, environmental groups and other community-based stakeholders, came together (Table A-1 and Table A-2) from a desire to reintroduce prescribed fire in the Klamath Mountains. Ultimately, the goal of this coordinated effort is to utilize an *all hands, all lands* approach to ecological restoration that includes landowners and a diverse group of partners to modify prescribed fire and wildfire behavior at the larger landscape-scale.

Table A-1. Western Klamath Restoration Partnership (WKRP) meetings.

Date	Location	Summary
2/25/2016	Somes Bar Work Station	Community Meeting with Landowners and Public
07/7/2016	Orleans	Community Meeting with Landowners and Public
12/17/2012	Happy Camp	Middle Klamath Restoration Partnership activities since 2007. Initially began as the Instream working group with the intention of creating a common vision for Coho salmon restoration and decision was made to branch off into Upslope and Instream working groups.
2/19/2013	Happy Camp	Upslope Working Group Meeting. General ideas on collaborative opportunities, possibilities, and resources available for a dedicated upslope multi-party collaboration. Ideas taken from the Instream working group on developing a candidate action table for restoration priorities and vetting it through various organizations. US Fire Learning Network (FLN) was interested in facilitating and providing guidance.
5/30/2013	Happy Camp	Public Workshop #1: Vision and Scope of the entire project. FLN present for facilitating and guiding. What will the project boundary encompass? Group work on project vision statements and outlining describing values. Defining next steps and agreeing to a workshop every 1.5 to 2 months. Develop working groups to address the scope and vision.
7/29/2013	Orleans	Public Workshop #2. Draft vision statement proposed received comments. Review work done by the scoping working group thus far. Review of the project targets.
1/29/2014	Happy Camp	Public Workshop #3. Group identified key ecological attributes of the targets and assessed their current viability; identified and marked on maps the threats related to each target; and developed a series of situation diagrams, exploring linkages among identified targets of: Fire-Adapted Communities; Restored Fire Regimes; Resilient Biodiverse Forests, Plants, and Animals; Sustainable Local Economies; Cultural and Community Vitality, and Key Attributes associated with these as well as threats and opportunities. Group discussed and became familiar with the Open Standards Process; applied identified targets and threats to community related areas within the general landscape; began to work on strategies; and continued to build shared knowledge among stakeholders participating in the network.
2/24/2014 – 2/26/2014	Orleans	Public Workshop #4: Prioritization model presented (previously from KFES and CWPP) to identify areas where efforts should be concentrated. Discussion of which layers to include for GIS.
3/17/2014 – 3/19/2014	Happy Camp	Public Workshop #5: Continued development of the treatment prioritization model (overlay) and its relationships to what exists. Scenario building in the three geographic areas that center in community areas. Find zones of agreement and understanding the commonalities and differences behind the scenarios. Development of overlays based on need for different communities and real world issues that affect these areas. Developed case studies based on geographic areas and associated needs, priorities, and challenges and resources associated with each of these case studies. Finalized the last two results chains. Set goals and objectives related to each target and results chain. Referring to the strategies, developed an action plan to accomplish the goals and objectives. Developed a monitoring plan related to the action plan to create the adaptive management loop.
4/28/2014 – 4/30/2014	Orleans	Public Workshop #6. Finalize the last two results chains; set goals and objectives related to each target and results chain; referring to the strategies, develop an action plan to accomplish the goals and objectives; develop a monitoring plan related to the action plan; and stakeholder mini-assessment.

Date	Location	Summary
5/20/2014 – 5/21/2014	Happy Camp	Public Workshop #7. Refine the project lifecycle. Updates on the pilot project proposals.
11/3/2014 – 11/5/2014	Happy Camp	Public Workshop #8: Plan for the upcoming year, including funding. Coordinate activities in order to maximize use of funding and accomplish funding deliverables. Visit burn areas for insights into fire effects and possible landscape treatment options. Discuss post-fire treatment prescriptions, level of WKRP engagement on proposed projects, and zones of agreement. Introduce Fire Adapted Communities Self-Assessment Tool provided by the Fire Adapted Communities Learning Network. Discuss research and monitoring needs, relative to university scholarships and PSW involvement.
2/17/2015 – 2/19/2015	Orleans	Public Workshop #9: Field review of Donahue Flat area potential treatments, presentations on prescription development and treatment options.
5/19/2015 – 5/21/2015	Orleans	Public Workshop #10: Shared learning about differing perspectives on treatment options in the Somes Bar pilot project area. Discover zones of agreement in practice that can inform prescription development in the Somes Bar pilot project area. Collaboratively develop Purpose and Need statements. Use field trip exercises and indoor work regarding potential treatment prescriptions, including some that involve desired future conditions and dynamics in natural stands. Continue to build durable relationships by discovering zones of agreement in practice. Continue to build muscle for complex problem solving, while maintaining fundamental regard for one another.
7/21/2015 – 7/23/2015	Orleans	Public Workshop #11: Get landscape perspective of Rodgers Creek treatment focus area. Build consensus and shared understanding of the prescription development process, and how this is applied to stand delineation and marking through group marking exercises. Review Purpose and Need for the Somes Bar Pilot Project. Discuss integration of Instream Working Group and instream restoration into WKRP.
10/27/2015 – 10/29/2015	Happy Camp	Public Workshop #12: WKRP as a whole continues to stay informed, synergistic and coordinated. Happy Camp subgroup receives input from whole group on the emerging focal area project. WKRP strategies are further developed, per the Open Standards. WKRP and scientists from PSW and USFWS exchange information, strengthen their working relationships.
3/1/2016 – 3/2/2016	Orleans	Public Workshop #13: Field trip to the Simms Gulch burn area. Participants continue to share learning and build skills in collaborative problem solving. The Orleans/Somes Bar subgroup received helpful feedback on the Purpose and Need statement for its pilot project. Participants find a path for working with diverse treatment philosophies, such as treatment options associated with linear treatments in the Orleans/Somes Bar project. WKRP strategies are reviewed and participant input on next steps is gathered.
5/11/2016 – 5/12/2016	Sawyers Bar	Public Workshop #14: Update the large group on subgroup and working group progress and important announcements, and reflect on WKRP's work to date. Through a field learning exchange, build a common understanding of the Eddy LSR Project as an example of a collaboratively designed project that aligns with the shared values of WKRP. See first-hand how written prescriptions translate into on-the-ground treatments. Dig deeper into a "project lifecycle" and, especially, into the available mechanisms for implementation of projects. We will address specific project related questions through a discussion with practitioners experienced in various mechanisms. Familiarize the large group with the Yellow Jacket Ridge Project, and see how the project represents the group's shared values.
8/23/2016 – 8/24/2016	Happy Camp	Public Workshop #15: Understand what is happening in each of the geographic subgroups of WKRP (Orleans/Somes Bar (OSB), Salmon River and Happy Camp/Seiad). Understand the objectives of the 2016 Prescribed Fire Training Exchange (TREX) and how they relate to the WKRP vision. Understand the next steps for the research and monitoring in the WKRP planning area. Agree to how we should move forward with WKRP-wide objectives and actions (based on strategies).
2/15/2017 – 2/16/2017	Orleans	Public Workshop #16: Understand what is happening in each of the geographic subgroups of WKRP (Orleans/Somes Bar, Salmon River and Happy Camp/Seiad). Review the characteristics of a WKRP Project. Agree on next steps for out-year planning throughout the 1.2 million acre WKRP planning area (mapping exercise). Participate in working sessions of the Communication and Engagement, and Research and Monitoring working groups. Understand WKRP decision process and components. Review *Somes Bar Integrated Fire Management Project* (*Somes Bar Project*) planning material including maps. Provide feedback on proposed actions in WKRP pilot project areas.
6/6/2017 – 06/7/2017	Happy Camp	Understand what is happening in each of the geographic subgroups of WKRP: Orleans/ Somes Bar, Salmon River and Happy Camp/Seiad. Understand biomass energy production and how it might be used in each of the WKRP geographic areas. Understand and develop strategies to incorporate managed wildfire into strategic areas within the WKRP project area.

Table A-2. Western Klamath Restoration Partnership (WKRP) meeting participants.

Name and Affiliation	Name and Affiliation
Jamie Allen, Northern California Resource Center (NCRC)	Arielle Halpern, UC Berkeley
Russell 'Buster' Atteberry, Karuk Tribal Chairman	Will Harling, MKWC
Nancy Bailey, MKWC	George Harper, Happy Camp FSC and USFS (retired)
Kimberly Baker, Klamath Forest Alliance/Environmental Protection Information Center (EPIC)	Damien Hawley, AmeriCorps Watershed Steward
	Chris Hays, USFS KNF
Kara Baylog, Shasta Resource Conservation District (RCD)	Mike Hentz, MKWC
George Bearnhart, Happy Camp Fire Safe Council (FSC) and USFS (retired)	Leaf Hillman, Karuk Tribe
	Lisa Hillman, Karuk Tribe
Mike Beasley, USFS (retired)	Lisa Hoover, USFS SRNF
Wind Beaver, Community Member	Mary Huffman, FLN
Jill Beckman, Karuk Tribe	Gary Hughes, EPIC
Roberto Beltran, USFS SRNF	John Hunter, USFWS Arcata
Jamie Bettaso, USFS SRNF	Clint Isbell, USFS KNF
Corrine Black, USFS SRNF	David Jaramillo, WRTC
Dan Blessing, USFS KNF	George Jennings, NCRC
Greg Bloomfeld, USFS KNF	David Johnson, USFWS Yreka
Lisa Blousfeld, USFS KNF	Vince Keeler, USFS KNF
Greg Bousfield, USFS KNF	Tyrone Kelley, USFS SRNF
Leslie Burkhardt, USFS (retired)	Alyson Kral, USFS SRNF
Ramona Butz, USFS SRNF	Frank Lake, USFS PSW
Heather Campbell, MKWC	Kristen Lark, USFS SRNF
Nolan Colegrove, USFS SRNF	Luna Latimer, MKWC
Mark Cookson, US Fish and Wildlife Service (USFWS) Yreka	Fred Levitan, USFS SRNF
Rick Costalas, Siskiyou County	Katie Lighthall, Cohesive Strategy Coordinator
Max Creasy, Community Member and USFS (retired)	Bridget Litten, USFS SRNF
Earl Crosby, Karuk Tribe	Jeff Marszal, USFS KNF
Leroy Cyr, USFS SRNF	Andy McBroom, USFS SRNF
Michelle Medley-Daniels, The Watershed Center (WRTC)	Dean McBroom, Community Member
Lynn Decker, TNC/Fire Learning Network (FLN)	John McRae, USFS SRNF
Brenda Devlin, USFS SRNF	David Medford, Karuk Tribe
James Donahay, Natural Resources Conservation Service (NRCS)	Cathy Meinert, Community Member
Guy Duffner, FLN	Bobbi Miller, USFS KNF
Alan Dyar, Retired Principal/HCCSD/HCCC	Mike Minton, USFS SRNF
Jennifer Dyer, USFS SRNF	John Morris, USFWS Yreka
Eamon Engber, Redwood National and State Parks	Tom Mutz, USFS KNF
Bill Estes, Humboldt County Coordination Committee/HCFPD	Lance Noxon, USFS KNF
Imil Ferrara, HSU Grad Student	Kevin Osborne, USFS KNF
Tom Fielden, Karuk Tribe	Ed Prather, Seiad FSC
Don Flickinger, National Marine Fisheries Service	Ron Reed, Karuk Tribe
Merv George Jr., USFS SRNF	Erin Rentz, USFS KNF
Jaclyn Goodwin, Karuk Tribe	Rachel Rhinehart, Karuk Tribe
Patty Grantham, USFS KNF	Zach Rodriguez, USFS KNF
Karuna Greenberg, Salmon River Restoration Council	Amanda Rudolph, MKWC
Jon Grunbaum, USFS KNF and Happy Camp FSC	Daniel Sarna, UC Berkeley
Scott Hagerty, USFS (retired)	Kenny Sauve, Karuk Tribe

Name and Affiliation
Ben Saxon, Karuk Tribe
Josh Saxon, Salmon River Restoration Council and Karuk Tribe
Mark Severy, Schatz Energy Research Center
Carol Sharp, Happy Camp FSC
Robin Shuckle-Shea, Small Business Coach
Carl Skinner, USFS (retired)
Andrew Spain, USFS SRNF
Carol Spinos, USFS SRNF
Stormy Staats, Klamath Salmon Media Collaborative
Jessica Stauffer, Contract Wildlife Biologist
Peter Stine, USFS PSW
Brian Taylor

Name and Affiliation
Zack Taylor, USFS SRNF
Malcolm Terrence, Community Member and Journalist
Sue Terrence, Community Member
Bill Tripp, Karuk Tribe
Mike Turek, USFS (retired)
Terry Walter, USFS KNF
Matt Watson, USFS KNF
Alex Watts-Tobin, Karuk Tribe
Tim Wilhite, US Environmental Protection Agency (EPA) Yreka
Leslie Wolff, National Marine Fisheries Service
Andy, Schatz Energy Research Center
Peter, Schatz Energy Research Center

Appendix B. Response to Comments

Table B-1. Project scoping comments received during February 21 through March 23, 2017 scoping period.

Resource	Issue	Rule	Analysis	Conclusion	Comment
Gary Strouss, Landowner in Ti Bar, oral comment, See meeting notes; 3/1/2017.					
Lands	Water tank and water pickup on private land in Ti-Bar, within unit 2108. PVC 2″ water-pipe running above the road (#/), through the culvert, underground from there to the house.	40 CFR §1500.2(d). Policy. Encourage and facilitate public involvement in decision, which affect the quality of the human environment. 40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their National Environmental Policy Act (NEPA) procedures.	These private land infrastructure features have been recorded and mapped during the analysis process to verify locations. Structures would be flagged so they are visible to field crews and equipment operators, required to protect them by either avoiding use of heavy machinery, buffering during prescribed burning, and handpiles placed so radiant heat is dispersed; contained by manually constructed control lines.	US Forest Service (USFS) would protect private property via application of project design features and mitigation measures.	1
Maria Strouss, Landowner in Ti Bar, oral comment, 3/1/2017. See meeting notes.					
Public Involvement / Lands	Requests adequate notification prior to implementation near private property.	40 CFR §1500.2(d). Policy. Encourage and facilitate public involvement in decision, which affect the quality of the human environment. 40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	The USFS would call, send email, or letter to adjacent landowners two weeks prior to commencing each operational, phased treatment entry. Notifications would be posted at existing community bulletin boards, mailed or emailed to the public and consulting agencies.	USFS is responsive to landowner request for notification of operations near private property.	2
	Proper identification of private land boundaries.		The USFS field verified property land lines and improved boundary markers in 2016, recognizing select USFS ownership boundary delineations recorded in the agency's GIS corporate database required verification and some field markers (red paint) have faded since being surveyed. Spot flagging would be placed along boundaries where markers and/or tree paint are no longer visible prior to operations.	USFS has properly field verified and would identify (flag) private land boundaries within the four focal areas to avoid inadvertent trespass during implementation.	

Resource	Issue	Rule	Analysis	Conclusion	Comment
Julie Hoopes and Susan Luidblom, Landowners in Donahue Flat, written comment, 3/1/2017					
Transportation	Wants chip seal on Donahue flat road to reduce dust.	40 CFR §1500.2(d). Policy. Encourage and facilitate public involvement in decision, which affect the quality of the human environment. 40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	A USFS representative would contact the landowner to address dust abatement options. Notification would occur prior to short-term log haul operations.	The USFS considered the landowners request to chip seal road segment on Donahue Flat Road. The USFS determination is the application of spraying the road surface with water during hauling would be sufficient to abate excessive dust and frequent grading would mitigate rutting and erosion from motorized uses, whereby expensive road improvement surfacing is unwarranted.	3
Visuals	Wants Douglas-fir removed to re-open view from home.	40 CFR §1500.2(d). Policy. Encourage and facilitate public involvement in decision, which affect the quality of the human environment. 40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	The USFS would contact the landowner prior to tree marking identification and invite resident to coordinate with field crews on-site when tree marking occurs and where removal of such Douglas-fir trees meets the marking prescription described in the EA.	USFS would be responsive to the landowners request via on-site coordination during tree marking identification.	4
Fuels	Manually remove tan oak root balls.	40 CFR §1500.2(d). Policy. Encourage and facilitate public involvement in decision, which affect the quality of the human environment.	The USFS would contact the landowner to discuss their requests for removing tan oak root balls and pruning branches. They may accommodate selective application along the boundary line and be responsive to landowner participation in implementation within the 500-foot defensible space interface.	The USFS is responsive to the landowner's request for site-specific treatments.	5
	Limb branches to tan oak <4″ as far as you can reach.	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	The Western Klamath Restoration Partnership (WKRP) designed the treatments to thin re-sprouting tanoak clumps and limbing of low-lying branches where needed to reduce ladder fuel concentrations.	The proposed action would treat low-lying limbs.	
Lands	Nantucket Creek to Donahue Flat has overland water line; if we build a fire line around the water line, elk will use it as a trail and break the water line.	40 CFR §1500.2(d). Policy. Encourage and facilitate public involvement in decision, which affect the quality of the human environment. 40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	The USFS would contact the landowner to discuss ways to best protect overland waterline damage from elk known to dwell in this area. Firelines could be relocated as an option.	The USFS is responsive to the landowner's request to ensure protection of overland private property.	6

Resource	Issue	Rule	Analysis	Conclusion	Comment
Planning	Move to Teneyke as part of next project.	40 CFR §1500.2(d). Policy. Encourage and facilitate public involvement in decision, which affect the quality of the human environment. 40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	WKRP recognizes the community's interest to begin considering the location and size of the next project and planning strategy for fulfilling federal and state procedural mandates. The recommendation would be considered.	WKRP is responsive to public input of where to plan the next project.	7
Transportation	Make sure the road stays open (sidewinder to Dillion).	40 CFR §1500.2(d). Policy. Encourage and facilitate public involvement in decision, which affect the quality of the human environment. 40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	WKRP would coordinate with the landowner to ensure public road access from sidewinder to Dillion during operations.	The USFS would provide motorized access to private land inholdings during logging operations.	8
Public Information	FS needs to do a better job in notifying landowners prior to burning.	See comment #2.	See comment #2.	See comment #2.	9
Dean Hepp, Orleans Resident, oral comments 3/1/2017. See meeting notes.					
	Support for project, covers a lot of ground. Northern side of rogers creek, if gets burned, then outside of unit could be burned.	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures. 40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	WKRP appreciates the support of local residents, as it will require an "all-lands" approach to achieve defensible space for those living in the wildland-urban interface (WUI). Also see comment #40.	Scoping comment indicates support for WKRP's proposed treatments.	10

Resource	Issue	Rule	Analysis	Conclusion	Comment
Sue Terrence, Salmon River resident, oral comments/question, 3/1/2017. See meeting notes.					
Implementation	Will the collaborative be part of the implementation? Will the collaborative have a say on who gets awarded the contracts?	40 CFR §1501.2(d). Apply NEPA early in the process. Provide for cases where actions are planned by private applicants or other non-federal entities before federal involvement so that: (1) Policies or designated staff are available to advise potential applicants of studies or other information foreseeably required for later federal action. (2) The federal agency consults early with appropriate state and local agencies and Indian tribes and with interested private persons and organizations when its own involvement is reasonably foreseeable. (3) The federal agency commences its NEPA process at the earliest possible time.	WKRP initiated and participated in the interdisciplinary team (IDT) to develop the S*omes Bar Integrated Fire Management Project* (*Somes Bar Project*) and fulfill procedural and documentation requirement per the NEPA. The USFS is responsive to residents expressing interest to participate in implementing and/or monitoring of the *Somes Bar Project*. Ultimately, the authority of who is awarded contracts resides with the USFS, as the agency with delegated administrative authority. The USFS is considering a variety of administrative procedures for implementation including; stewardship agreements, stewardship contracts, timber sale and service contracts, participating and cost-share agreements and Interagency agreements. Residents would have an opportunity to provide recommendations of who should be awarded contracts for the Forest Service to consider. The 30-day comment period on the forthcoming draft environmental assessment (EA) will be provided as an opportunity to again bring forward this question.	Community members will be consulted to develop an implementation strategy and local labor interests and capacity. The district ranger shared the USFS position at the public meeting during the Scoping period.	11
Deja Malone-Persha, Somes Bar resident, oral comments, 3/1/2017					
Fuels	Can see how this project will make things safer for these properties in the long run.	40 CFR §1500.2(d). Policy. Encourage and facilitate public involvement in decision, which affect the quality of the human environment. 40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	WKRP appreciates the support of local residents, as it will require an “all-lands” approach to achieve defensible space for those living in the WUI. Also, see comment #40.	Scoping comment indicates support for WKRP’s proposed treatments.	12
Marshall Hansen, Orleans resident, oral comments via landline, 3/3/2017					
Fuels	Are you aware of the storm damage in the project area? Looks like a war zone, trees down everywhere.	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	The USFS has inventoried the storm damage and recognized the increased fuel loading. Much of the excessive fuels adjacent to roads in and around the project area was removed during emergency wildfire suppression actions in the summer and fall of 2017.	The USFS has inventoried and plans to treat fuel concentrations throughout the project area to address resident concerns.	13

Resource	Issue	Rule	Analysis	Conclusion	Comment
NEPA	Didn't receive the scoping letter until after the public meeting.	§1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures; (b) Provide public notice of NEPA-related hearings, public meetings, and the availability of environmental documents so as to inform those persons and agencies who may be interested or affected; (1) In all cases the agency shall mail notice to those who have requested it on an individual action.	The USFS identified an inadvertent error in the mailing list (he is a part-time resident in Orleans; apparently the Orleans Post Office forwarded the direct mailing to his McKinleyville address). The USFS called the resident and will send future notices by email to Mr. Hansen, as requested. The USFS shared that he would receive future notifications for the upcoming 30-day review and comment period on the draft DEA and 45-day objection period on the final EA and draft decision notice.	The USFS identified an inadvertent mailing error and would send notification by email in the future, as Mr. Hansen's preferred method of contact. His email address has been included in the project's mailing list.	14
Fuels	Is in favor of thinning the forest.	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	WKRP appreciates the support of local residents, as it will require an "all-lands" approach to achieve defensible space for those living in the WUI. Also, see comment #40.	Scoping comment indicates support for WKRP's proposed treatments.	15
Economics	Expressed general support for the project. Have we received any funding?	40 CFR §1502.23. Cost-benefit analysis. For the purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed.	The USFS called Mr. Hansen to share an update on the WKRP funding secured to date, including the NFWF grant recently received.	Scoping comment indicates support for WKRP's proposed treatments. The Forest Service responded to Mr. Hansen question regarding funding status.	16
Bruce Hayes, Sierra Pacific Industries					
Implementation	Focus on mechanical units first.	40 CFR §1502.23. Cost-benefit analysis. For the purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed.	WKRP designed the *Somes Bar Project* so there is a progression of work. In many cases, the roadside fuelbreak units planned for mechanical removal of ladder fuels is the highest priority to implement, as pre-treatment is critical to allow for the safe application of prescribed fire within burn plan specifications.	In many cases, the progression of work designed for the proposed action would focus on mechanical units first.	17
Economics	Where are the funds coming from for non-commercial work?	40 CFR §1502.23. Cost-benefit analysis. For the purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed.	WKRP would apply contracting and agreement authorities to use revenue from commercial sale of forest byproducts to fund non-commercial work. WKRP would also seek other federal and state grant funding opportunities.	WKRP would seek multiple funding sources to complete non-commercial work.	18
Fuels	Will private lands owners be compensated if control burns go onto private land and FS be held responsible?	40 CFR §1505.3 Implementing the decision. Agencies may provide for monitoring to assure that their decisions are carried out and should do so in important cases.	The landowner can file a tort claim as the process for being compensated for unintentional damages.	Private lands owners would be compensated if control burns go onto private land and the USFS is held responsible.	19

Resource	Issue	Rule	Analysis	Conclusion	Comment
Robert Rohde, Orleans resident					
Planning	EA conducted for only one of the four focal areas. Ti Bar location is a good place to start.	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	In 2013, the WKRP convened workshops and utilized an Open Standards Process for Conservation planning for the entire Middle Klamath sub-basin. The focal areas were selected because they protect some of the most at-risk private lands in the Orleans and Somes Bar communities, while pre-treating flammable vegetation so unplanned wildfires can become a restorative management tool for resource benefits on the west side of the Marble Mountain Wilderness.	WKRP considered the recommendation to start implementation in the Ti Bar focal area. The decision was to proceed with a progression of work strategy throughout all four focal areas.	20
Cultural	Does not support work so close to the Tribes Center of the World.	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	This project has been conceptualized and planned in close consultation and coordination with the Karuk Tribe as well as in collaboration with the WKRP of which the Tribe is a co-lead.	The Tribe is supportive of implementing the currently identified project footprint to improve landscape condition so more burning in a manner consistent with Karuk customs and culture can safely occur.	21
John Stoa, Somes Bar grape grower and winemaker					
Air Quality	Concerned about smoke tainting commercial grape products (and the economic consequences of tainted grapes). Requests no burning in August or September. Impacts can occur from the first week of September to early October, although some harvests do extend into November.	40 CFR §1501.2 (a). Apply NEPA early in the process. Comply with the mandate of section 102(2)(A) to “utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision-making which may have an impact on man’s environment,” as specified by §1507.2.	The USFS would notify and coordinate with Mr. Stoa on the timing prescribed burning to mitigate smoke tainting of commercial grape products.	The USFS would coordinate prescribed burning operations near the Somes Bar grape vineyard to address landowner concern.	22

Resource	Issue	Rule	Analysis	Conclusion	Comment
F. Kanawha-Dedali Lake, Orleans Resident					
Cultural	Supports project cultural/Rx burning and emphasis on the WUI as long as it's aligned with National Cohesive Strategy.	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	The WKRP aims at transforming the fire exclusion paradigm to one of holistic landscape management practice in alignment with the National Cohesive Wildland Fire Management Strategy. The *Somes Bar Project* seamlessly integrates, in practice, principles underlying the Cohesive Strategy and Karuk traditions passed down and preserved over generations for millennia. The focal areas were selected because they protect some of the most at-risk private lands in the Orleans/Somes Bar WUI, and would bring the community closer to being able to use unplanned wildfires for resource benefits on the west side of the Marble Mountain Wilderness. Within the Katimiin Cultural Management Area, Karuk ceremonial burning practices are intended to be restored and part of what this project does is begin to put the land into a condition that will enable these ceremonial burning activities to occur once again, consistent with Forest Plan direction.	Scoping comment indicates support for WKRP's proposed treatments.	23
Cultural	Prioritize treatments in WUI by working with WKRP partners.	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	See comment #18.	The *Somes Bar Project* prioritizes treatments in WUI, developed by the WKRP partners.	24
Cultural	Prioritize treatments that promotes resiliency and diversity of forest plants/animals.	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	The proposed fuel treatments are designed to enhance cultural and ecological resources and reinstate traditional tribal practices dependent on the use of fire as a land management tool, and to preserve plant and animal species that depend on habitats maintained by frequent fires.	The *Somes Bar Project* prioritizes treatments that promote resiliency and diversity of forest plants/animals.	25

Resource	Issue	Rule	Analysis	Conclusion	Comment
Cultural	Promote access by reducing surface and ladder fuels for gathering and improved wildlife habitat. Integrate TEK.	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	The *Somes Bar Project* was designed in concert with the Katimiin Memorandum of Understanding between the Karuk Tribe, Six Rivers and Klamath national forests (SRNF and KNF), which establishes a working partnership between those entities with respect to management activities and opportunities within and adjacent to the Katimiin Cultural Management Area. The project puts into practice some of the principles from the Karuk Tribe's draft Eco-Cultural Resources Management Plan (ECRMP), which is an over-arching planning document that aims at establishing a unified approach to managing the human, cultural/natural resources, and interests of the Karuk Tribe. The project would establish up to 250,000 linear feet of ridgetop Strategic Fire Control Features (SFCF) and implement 5,500 acres of landscape-scale integrated vegetative, fuels reduction and restorative prescribed burning alongside roads and in interior forests, phased over 15 years.	The *Somes Bar Project* promotes access by reducing surface and ladder fuels for gathering and improved wildlife habitat, integrating traditional ecological knowledge (TEK) principles and practices.	26
Cultural	Develop and promote collaborative opportunities for broader inclusion of partners for implementation.	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	See comment #11.	See comment #11.	27
WKRP collaborative					
NEPA	Thank you for your commitment to the collaborative development of this project.	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	The WKRP is dedicated to shared-learning by doing. The *Somes Bar Project* exemplifies participatory planning wherein all contributors share responsibilities for each other's safety and well-being, and for preserving the nation's natural resources as our cultural legacy imparted to future generations.	Scoping comment indicates support for forest leadership's commitment to the collaborative development of this project.	28

Resource	Issue	Rule	Analysis	Conclusion	Comment
NEPA	Continue with research and monitoring aspects of the project to broaden the public's understanding of project goals and objectives.	40 CFR §1505.3 Implementing the decision. Agencies may provide for monitoring to assure that their decisions are carried out and should do so in important cases. Mitigation (§1505.2(c)) and other conditions established in the environmental assessment, or during its review and committed as part of the decision shall be implemented by the lead agency or other appropriate consenting agency or partners.	The WKRP is dedicated to shared-learning by doing. The *Somes Bar Project* multiparty monitoring (MPM) strategy would be the primary learning mechanism as a Partnership, and as a community, about and from the project. The goal is to further refine the strategy during the planning process.	WKRP is fully dedicated to continued research and monitoring aspects of the *Somes Bar Project* to broaden the public's understanding of project goals and objectives.	29
NEPA	Fully analyze the 'no action' alternative.	40 CFR §1502.14 Alternatives including the proposed action. This section is the heart of the environmental impact statement. In this section, agencies shall: (d) Include the alternative of no action.	The No Action Alternative would be analyzed in detail and disclosed in the draft EA.	The USFS would develop and analyze the no action alternative in detail and discuss the effects in the draft EA per the Council of Environmental Quality (CEQ) regulations.	30

Resource	Issue	Rule	Analysis	Conclusion	Comment
The Conservation Congress					
Wildlife	Consider NSO as driving force in project development.	40 CFR §1508.8. Effects. Effects include ecological, aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative.	The overall *Somes Bar Project* purpose, as stated, is to "Demonstrate the reintroduction of fire as a step towards restoring and maintaining resilient ecosystems, communities, and economies in the interest of revitalizing balanced human relationships with our dynamic landscape". The proposed action of the project is to conduct fuels reduction treatments in order to restore fire within the focal areas. WKRP designed the proposal addressing the NSO as a regulated species, with Pacific fisher as a potential surrogate, which is a regalia species directly ties to TEK principles. The planning approach was from a broad landscape scale considering species/habitat function and interactions, including recognizing the Pacific fisher in fact closely matches the habitat characteristics critical to the spotted owl food web. In Karuk culture, it is the Pacific fisher that represents NSO habitats in the environment. Though owls are known as messengers of sickness and death, it is the great horned and screech owls that are told to carry these specific messages. These two species are known to have specific names in the Karuk language. The NSO is not known to have a specific name, but has been found in practice to be one of the first species to decline when the habitat dynamics deteriorate.	Five TEK focal species were selected according to the guidelines for the initiation of the Somes Bar IFMP and inform the planning efforts of the greater WKRP collaborative. The focal species represent different components of the landscape. Although WKRP considered the NSO as one of the five focal species, it was not emphasized over the other four focal species as a driving force for developing the proposed treatments. The USFS has been working with the Level 1 team with the goal of receiving a letter of concurrence from US Fish and Wildlife Service (USFWS) for the project determination "May effect not likely to adversely affect" NSO and it's critical habitat prior to project implementation.	31
Wildlife	No further habitat reduction in any AC deficient NR or F.	40 CFR §1508.8. Effects. Effects include ecological, aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative.	During project design, deficit NSO cores received additional design features to avoid indirect take of an NSO activity center (ACs). Specific design features: • No commercial treatment within a NSO nest grove or high quality nesting and roosting habitat (N/R). • Treatment of NRF habitat within deficit cores will include an 18″ dbh limit of commercial material cut. In N/R habitat, 60% canopy cover will maintain habitat suitability. In foraging habitat, 40% canopy cover will maintain habitat suitability post-treatment. • Temporary roads and landings were dropped from consideration during project design if the site removed or downgraded suitable NSO habitat within deficit cores.	Maintaining habitat within deficit NSO ACs was a forest priority and was considered during project design. Any actions that removed or downgraded habitat within deficit cores were dropped from consideration to prevent "indirect" or direct take of an NSO site. The forest's Level 1 team worked extensively with the USFWS to develop a project that did not reduce habitat for NSO at deficit sites.	32

Resource	Issue	Rule	Analysis	Conclusion	Comment
Wildlife	Why are 12 ACs not occupied? Are Barred owls present? Continue with NSO surveys.	40 CFR §1508.8. Effects. Effects include ecological, aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. 40 CFR §1502.24 Methodology and scientific accuracy. Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements.	NSO surveys have been conducted and barred owl presence has been documented. NSO surveys are ongoing and will continue during project activities. The analysis area contains NSO activity centers that have been active at some point since the early 1990s. Many of these ACs have not been active for many years and in most cases, the reason for no activity is unknown. The Forest is analyzing all possible NSO ACs based on information from Forest and California Department of Fish and Wildlife databases. The Somes Bar Integrated Fire Management Project will protect all high quality habitats (not just old-growth), and all spotted owl territories (not just high priority sites) and is designed to restore, maintain, and accelerate important habitat characteristic for the spotted owl. "Maintaining or restoring these forests should allow time to determine both the competitive effects of barred owls on spotted owls and the effectiveness of barred owl removal measures" (II-67 of the 2011 Recovery Plan).	The BE/BA Reports (Bettaso / Yost 2017) and/or field forms documenting survey results can be provided upon request. NSO surveys will continue during project implementation.	33
NEPA / Wildlife	Include in the EA a map showing NSO ACs, units proposed for mechanical treatment and survey call points.	40 CFR §1502.24 Methodology and scientific accuracy. Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements. They shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement.	The map of NSO ACs will be included in the EA. Units proposed for mechanical treatment will be discussed in detail in the BA. NSO call points are maintained in the *Somes Bar Project* record.	Requested information would be posted on the USFS website. The BE/BA Reports (Bettaso/Yost 2017) and/or field forms documenting survey results will be provided.	34

Resource	Issue	Rule	Analysis	Conclusion	Comment
Wildlife	What condition is the LSR in that is partially in the project area and what its primary purpose as defined in the NWFP?	40 CFR §1502.24 Methodology and scientific accuracy. Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements. They shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement.	The Klamath National Forest Forest-Wide Late Successional Reserve (LSR) Assessment (LSRA 1999) determined that this LSR was deficient in late-successional habitat. Portions of the LSR prior to its designation were harvested, therefore, extensive stands of dense plantations exist that not only create a fuels hazard, they also do not provide suitable habitat for late-successional species such as the northern spotted owl (NSO). Plantations and young natural stands are even-aged and lack the horizontal and vertical diversity components associated with late-mature stands. The *Somes Bar Project* proposes to treat 49.4 acres of LSR. Of this, 37.5 acres is manual prescribed fuels. The remaining 11.9 acres is mechanical treatment consisting of 60% canopy closure and removing trees less than 20″.	The desired condition for the LSR and the 2011 Revised NSO Recovery Plan is for late-successional habitat to be resistant to large-scale disturbance. Connectivity for late-successional species to be maintained across the analysis area. Management activities do no not create dispersal barriers to late-successional species. The proposed action will drive the *Somes Bar Project* towards the goals of the 2011 Revised NSO Recovery Plan and the KNF LSRA assessment.	35
NEPA / Wildlife	40-60% residual canopy cover is the bare minimum. Burning can reduce this even more should it get out of control.	40 CFR §1502.24 Methodology and scientific accuracy. Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements. They shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement.	The proposed action treatment design for minimum canopy closure includes adjustments in tree marking (mechanical) canopy closure, as well as follow up manual treatments to further reduce fuel loading and the potential for any incidental torching of tree crowns during prescribed burning operations.	WKRP considered the potential for canopy loss from incidental torching during burning operations so minimum residual canopy closure would not fall below retention objectives at the completion of all phased treatments; including consideration for prescribed fire maintenance operations.	36
NEPA / Wildlife	Recommends 18″ dbh cutting limit in natural stands and cable units.	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	Treatment of NRF habitat within deficit cores will include an 18″ dbh limit of commercial material cut. In N/R habitat, 60% canopy cover will maintain habitat suitability. In foraging habitat, 40% canopy cover will maintain habitat suitability post-treatment.	WKRP considered retaining all trees over 18″ diameter; however, preliminary review indicates fuels, TEK and ecological objectives would be compromised at a landscape-scale with the use of this prescription.	37

Resource	Issue	Rule	Analysis	Conclusion	Comment
NEPA	"Less desirable conifer species" for what? Needs further explanation.	40 CFR §1501.2 (a). Apply NEPA early in the process. Comply with the mandate of section 102(2)(A) to "utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision-making which may have an impact on man's environment," as specified by Sec. 1507.2.	Karuk stories commonly tell of the relationship of people today to the *Ikxareyavs*, and on the role of Coyote in establishing that transition. Coyote is a trickster figure and helper of mankind. This story tells of how Coyote stole fire. In this story, several key themes emerge. The story represents the transition from the time of Spirit People to the time of people, and it defines their relationship to the world. This transition is marked by the howling of dogs. Three things happen simultaneously: the appearance of fire by the river, the transformation of the Spirit People, and the emergence of mankind. They are linked. Fire is crucial to who people are, and what they do. It enables them to live. It is a central component of that duty of care for the whole world, which is inherited form their common ancestry as Spirit People. Five focal species have been selected according to these guidelines for the initiation of the *Somes Bar Project* and inform the planning efforts of the greater WKRP collaborative. The fisher is not just associated with the conifer forests, but also with the upland oak stands, which are traditionally more open and contain bunch grasses. The fisher plays a very central role in ceremony and culture: this is the species that is carried through the World Renewal Ceremonies by way of holding the arrows used to pierce the earth and wake up the world. The favored form of traditional gathering foods are acorns from tanoaks; black oaks are used also. For this reason, retention of oaks would be prioritized over Douglas-fir, removed when its crown is overtopping or shading the crown of the oak.	WKRP designed the proposed action to enhance survival and health of oak species, requiring the removal of select conifer species.	38
Wildlife	Post BE/BA and FWS consultation on website.	40 CFR §1502.24 Methodology and scientific accuracy. Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements.	The USFS posts the BE/BA and FWS consultation communication on website as a standard practices along with the final EA and draft decision notice (DN).	Requested information would be posted on the USFS website.	39

Resource	Issue	Rule	Analysis	Conclusion	Comment
Botany / Wildlife	Provide survey data for sensitive species and findings. Doubts survey efforts are sufficient due to project size.	40 CFR §1502.24 Methodology and scientific accuracy. Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements. They shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement.	Botany: Most of the project area was considered unsuitable for Sensitive species. With range and habitat of Sensitive species in mind, the project area was stratified emphasizing units with mature forest types, specifically those typed as mid-mature (without harvest), late-mature (without and with harvest), old-growth (without and with harvest). The one exception to the mature forest affiliation is the early successional species, *Thermopsis robusta* is associated with clearings and road edges—settings of periodic disturbance. Road proximity surveys were conducted independently for this species by Mid Klamath Watershed Council. As a result of both the pre-field analysis and field reconnaissance (to validate spatial information), approximately 1,650 of the 5,570 unit acres (30%) were surveyed from June to August 2015 for vascular and non-vascular Sensitive species. Units or portions thereof not subject to survey were plantations (seral stage classified as pole-harvest, early mature with harvest) and those characterized by shrub-dominated communities, or vegetation sub-series lacking habitat components for the potential Sensitive species. Surveys resulted in new detections of *Cypripedium fasciculatum* (1), *Sulcaria badia* (3), *Buxbaumia viridis* (1 new/1 known) and *Thermopsis robusta* (3-4). The surveys follow standards established in Forest Service Manual direction (FSM 2672.42: USDA Forest Service 1991) and complies with National Forest Management Act (NFMA), NEPA, and 1994 and 1995 Land and Resource Management Plan (Forest Plan) for the KNF and SRNF. Based on the effects of the proposed activities, this direction helps in the determination whether these activities will lead the Forest Service Sensitive species in a trend towards Federal listing (FSM 2672.41).	Botany: An estimated 70% of the project area was not considered suitable habitat for those Sensitive species with the potential to occur in the area based upon range and habitat requirements. It is recognized that survey traverses of a given unit with habitat elements suitable for Sensitive species may inadvertently bypass or overlook a setting of suitable habitat, (i.e., the “body” of Buxbaumia viridis is <0.5″ tall and grows on advanced decay class logs) but good faith efforts by qualified individuals, following standard survey were employed. Specialist report (Hoover 2017) and/or field forms documenting survey results can be provided upon request. Survey results will be provided upon request.). The wildlife BE is the project record for this analysis and provides the details for each species determination.	40
Fisheries	Show locations of cable units relative to water resources. Will impact to fish, water or soil occur?	40 CFR §1508.8. Effects. Effects include ecological, aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative.	Effects to fish, water, and soil are analyzed in Chapter 3.	Chapter 3 analyzes the effects of cable units on fish, water and soil. Cable units occur in the outer 80 feet of riparian reserves (total of 22 acres spread over 27 units) and therefore are not located near water sources and would not impact water resources.	41

Resource	Issue	Rule	Analysis	Conclusion	Comment
NEPA	Map of towns in project area and disclose distance to treatment units.		The project is entirely located with WUI designated in the KNF and SRNF Land and Resource Management Plans. The location of treatment units relative to private property is disclosed in the EA.	Proposed action treatment maps in the EA display treatment units, access roads, and private property boundaries.	42
NEPA	Timeframe too long, with climate change there are unknown effects in the future. Requires an EIS.	40 CFR §1502.24 Methodology and scientific accuracy. Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements. They shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement.	Supplemental Information Reports (SIRs) are an agency's internal tool used to determine whether changed circumstances, or changes in the proposed action that arise after the agency decision require supplementation of an EA. If there are substantial physical changes to the environment within the WKRP project areas or TEK field-based studies, western scientific papers, or trend data indicates substantial misassumptions used to modeling climatic parameters or analysis areas used to determine environmental effects area disclosed in the Somes Bar Project EA, an SIR would be appropriate to evaluate whether supplementation is necessary. For California, scientist Malcolm North recently predicted the rise of mega-fires across the state as fuel loading and climate change combine to overwhelm the most technologically advanced firefighting force in history. The potential for changing climatic conditions is discussed in Chapter 3.	Changed circumstances and new information arise with the passage of time. CEQ's 40 Questions (46 FR 18026, at 18036, Q&A #32) state, "As a rule of thumb, if the proposal has not yet been implemented, or if the EA concerns an ongoing program, EA that are more than 5 years old should be carefully reexamined to determine if the criteria in Section 1502.9 compel preparation of an EA supplement." *See also* Forest Service Handbook 1909.15 § 18.03 ("Review the environmental documentation of actions that are awaiting implementation and those of ongoing programs or projects at least every 3 to 5 years to determine if the environmental analysis and documentation should be corrected, supplemented, or revised."). An SIR is the proper tool to accomplish the reexamination described in CEQ's 40.	43
Fisheries	Mechanical entry in RR violates the Forest Plan. How will ACS be attained?	40 CFR §1501.1 Purpose. (a) Integrating the NEPA process into early planning to insure appropriate consideration of NEPA's policies and to eliminate delay.	Riparian reserve standard and guidelines in the Klamath and the SRNF LRMPs. The Klamath NF LRMP S&G MA-7 allows for heavy equipment into RR for riparian restoration. Silvicultural and fuels treatments are permitted in riparian reserves to restore riparian vegetation (MA-10 and MA-62).	Baseline conditions of riparian reserves include areas that had been previously harvested prior to riparian reserve designation and much of these plantations are now dense thickets dominated by Douglas-fir species. Past timber harvest practices and wildfire suppression creates a need to treat these areas. Proposed treatments are designed to promote ACS objectives.	44

Resource	Issue	Rule	Analysis	Conclusion	Comment
NEPA / Fuels	Hysteria around issue of wildfire and most is myth.	40 CFR §1502.24 Methodology and scientific accuracy. Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements. They shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement. 40 CFR §1500.1 Purpose (a). The NEPA is our basic national charter for protection of the environment.	In the Happy Camp Complex fires of 2014, as in the fires of 2008, several areas were noticed that burned at sufficient temperatures to kill all the plants and to prevent any significant regeneration. This danger is especially acute because of the overall lack of fire across the WKRP planning area. Few areas have seen five fires in the last century, and most of the project area has seen none at all (Harling and Tripp 2014). The pattern has been set for infrequent, uncharacteristically high-intensity fires, instead of the traditional practice of introducing frequent, designed, and regular fires at low intensity. By not taking action on the project landscapes, the continued lack of fire would drive stands further and further from their historic conditions.	WKRP applied professional integrity, including scientific and TEK integrity, to develop the proposed action and predict the effects disclosed in the draft EA.	45
Vegetation / Cultural	Myths: restoration of forest is needed to recreate historical conditions.	40 CFR §1502.24 Methodology and scientific accuracy. Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements. They shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement.	The proposed action treatments provide for the reintroduction of prescribed fire. The accomplishment of this goal would in turn revitalize TEK, practice, and belief systems. The reintroduction of fire as a cultural environmental management practice promises to mitigate if not remediate the era of wildland fire exclusion and past management or clearcut logging practices, as well as to promote the cultural use species traditionally utilized across the landscape. One of the most threatened species is the California black oak (*Quercus Kelloggii*), which is vulnerable to being overtopped and crowded out by Douglas-fir. All the same, the Oaks that remain are old and serve as indicators of an ancestral state. One of the biggest deficits on the landscape is the old upland oak woodland. The development of the TEK data collection forms has helped summarize most of the characteristics of these remnant stands. Because modern human alteration of many ecosystems has been so profound, reference states must often be derived from historical information from before the onset of anthropogenic change. Maintaining managed ecosystems within the bounds of the “historical range of variation” for key ecosystem patterns or processes has traditionally been seen as the best hope for preserving species and landscapes and ensuring long-term ecological sustainability (Egan and Howell 2001, Landres et al. 1999).	WKRP applied TEK and western science as driving forces in designing restoration treatments. Archaeological and cultural resources surveys document evidence of human management throughout the project area.	46

Resource	Issue	Rule	Analysis	Conclusion	Comment
Fuels	Myth: Logging reduces large wildfires	40 CFR §1502.24 Methodology and scientific accuracy. Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements. They shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement.	The reintroduction of fire as a cultural environmental management practice promises in the long-term to mitigate if not remediate the era of wildland fire exclusion, as well as to promote the cultural use species traditionally utilized across the landscape. The *Somes Bar Project* is not designed to reduce large wildfires.	The proposed treatments are designed to allow the reintroduction of prescribed fire, while achieving desired prescribed fire effects. The accomplishment of this goal would in turn revitalize TEK practice, and belief systems. WKRP applied professional integrity, including TEK and scientific integrity, to develop the proposed action.	47
Fuels	Myth: Thinning will protect homes.	40 CFR §1508.8. Effects. Effects include ecological, aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. 40 CFR §1502.24 Methodology and scientific accuracy. Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements. They shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement.	Between 2006 and 2011, about 600 assessments were completed by the Forest Service on wildfires that burned into areas where hazardous fuels reduction treatments had previously been conducted (Stein et al. 2013). These assessments evaluated the effects of prescribed fire as well as mechanical and chemical treatments on fire behavior and fire suppression actions. The data indicate that 90 percent of treatments reported in the database have helped to reduce wildfire intensity, allowing better control by firefighters. In most of these cases, as fires moved from untreated locations to areas treated by thinning, mowing, or prescribed burning, the fire behavior changed from active crown fires (burning an entire upper story of the forest) to passive crown fires (where only a single tree or small group of trees burned), or from passive crown fires to surface fires (burning only dry grass, shrubs, pine needles, and other flammable materials on the ground (DellaSala and others 2004, Stein et al. 2013).	WKRP designed the *Somes Bar Project* to strategically establish roadside and ridgeline fuelbreaks, private land 500 ft. defensible space buffers, and reduce fuels across the landscape to alter forest components; all designed so fire managers would be able to provide a measure of protection to communities and establish anchor points where prescribed fire could be safely employed.	48

Resource	Issue	Rule	Analysis	Conclusion	Comment
NEPA	Only include plantations up to 60 years old. Drop mature stands and cable units from project.	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	There are approximately 1,481 acres of plantations in *Somes Bar Project* area.	The purpose of the *Somes Bar Project* is to demonstrate how fire restores and maintains resilient ecosystems, communities, and economies to revitalize balanced human relationships with our dynamic landscape. The project would also reinstate the use of TEK fire integrated with emergent restorative fire practices at the landscape scale. WKRP considered this alternative. Preliminary analysis indicates an estimated 25% of the landbase within the four focal area would be treated. Large segments alongside roads, ridgelines and private property would not be treated. As this alternative would not be responsive to landscape scale restoration and defensible space treatment objectives or purpose and need, this alternative was eliminated from detailed study. The need for manipulating fuel patterns and lowering the amount of flammable surface fuels represents an incremental step on the journey to address the fire deficit, that otherwise would be deferred to set the stage for a more hazardous future.	49
Vegetation / Fuels	Myth: Beetle outbreaks increase the chances of wildfire.	40 CFR §1502.24 Methodology and scientific accuracy. Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements. They shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement.	Thinning from below increases the residual size of trees left in a stand (Agee and Skinner 2005; Smith et al. 1997). In general, larger trees have thick bark, and are therefore more fire resilient than smaller trees. Thinning, no matter whether from below or throughout the diameter classes (with the exception of predominant and dominant trees), increases spacing and reduces stand densities, resulting in less inter tree competition, which increases individual tree vigor, resulting in stands that are more resilient to insects, disease, wildland fire, and drought (Agee and Skinner 2005; Fettig et al. 2007; Hessburg et al. 2016; van Mantgem et al. 2009; Vernon 2017). With currently high stand densities throughout the project area comes increased susceptibility to damage and mortality resulting from such stressors as insects, disease, fire, and drought (Agee and Skinner 2005; Condeso and Meentemeyer 2007; Fettig et al. 2007; Vernon 2017). Many trees are currently experiencing high levels of competition for soil moisture, nutrients, and available light.	The WKRP recognizes beetle outbreaks can cause tree mortality and can contribute flammable woody fuels. However, the limited extent of insect mortality within the four focal areas is currently not sufficient to significantly alter fire behavior.	50

Resource	Issue	Rule	Analysis	Conclusion	Comment
Fuels	Another study done by fire ecologists at the Missoula Fire Lab concluded: "Even extensive fuel treatments may not reduce the amount of area burned over the long-term and furthermore, reduction of area burned may actually be an undesirable outcome. A new study soon to be published found that reviewed 1,500 wildfires between 1984 and 2014 found that actively managed forests had the highest level of fire severity. While those forests in protected areas burned, on average, had the lowest level of fire severity. In other words, the best way to reduce severe fires is to protect the land as wilderness, not "manage" it.	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures. 40 CFR §1502.24 Methodology and scientific accuracy. Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements. They shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement.	WKRP designed the *Somes Bar Project* to demonstrate how prescribed fire restores and maintains resilient ecosystems, communities, and economies to revitalize balanced human relationships with our dynamic landscape. The project would also reinstate the use of TEK fire integrated with emergent restorative fire practices at the landscape scale thereby: Reestablishing frequent fire cycles, behavior and patterns stimulating resilient, spatially heterogeneous forest and riparian habitats and self-sustaining populations of culturally important Karuk focal species and traditions. Promote shared values, encourage widespread personal ownership and local technical skills leading to healthy communities and economies, capable of well-coordinated land stewardship regardless of ownership or administrative boundaries.	WKRP applied professional integrity, including scientific integrity, to develop the proposed action. The planning approach incorporates TEK prescribed fire principles and practices rather than optimizing fire suppression. The Karuk skillfully used fire as caretakers of the land, as an instrument in cooperation with nature to expertly cultivate cultural use plants, invigorate forage for elk, deer and other wildlife, emit smoke to suppress insect infestations and promote periods of inversion cooling for anadromous fisheries reliant on cold water. Over 80% of the plants utilized by Karuk people depend on restorative fire for germination, as well as the use quality and quantity of the plant materials (Anderson 2006).	51
Bruce Robison					
NEPA / Vegetation	Drop words "existing condition" when describing reducing canopy closure.	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	The draft EA would clarify that reducing canopy closure is an effect of proposed treatments.	The USFS would respond by not using "existing condition" when describing reducing canopy closure in the draft EA.	52
NEPA	Doug-fir should not be considered "less desirable".	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	See comment #38.	See comment #38.	53

Resource	Issue	Rule	Analysis	Conclusion	Comment
Vegetation / Fuels	Thin immature tanoaks, leave mature oaks.	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	During the development of treatment prescriptions, WKRP recognized the need to thin immature tanoaks, as these ladder fuels would prevent safe application of prescribed fire within burn plan intensity specifications. Mature fire resistant oaks would be retained for ecological and TEK objectives.	WKRP designed the proposed treatments to retain mature oaks and thin immature tanoak, in alignment with the commenter's request.	54
NEPA / Logging Systems	Feller buncher equipment for harvesting gives excellent results.	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	Logging systems are differentiated in terms of ground based or cable based systems.	Harvesting methods may be performed by a variety of equipment conducive to the size of material to be extracted and surrounding terrain.	55
Hydrology	Equipment in the outer RR is used on S-T forest. Goes straight in, no turns, very little ground disturbance.	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	Mechanical equipment would be permitted under the proposed action in the outer RR buffer at designated location marked on the ground, with provisions to minimize ground disturbance. All units proposed for entry in outer portions of riparian reserves were validated on the ground by qualified soils scientist, geologists, hydrologists and fisheries biologist.	WKRP designed the proposed treatments to allow for machinery within outer portions of RR buffer in some units, with restrictions for turning, which can cause gouging of soils, in alignment with the commenter's request.	56

Resource	Issue	Rule	Analysis	Conclusion	Comment
Max Creasy, Public Meeting 3/1/2017					
Fuels	1st entry burn plans need to be developed separately for low severity as well as mixed severity prescriptions (habitat types, location, fuel loading). Specific to Ti-Bar Units 2136 and 2144.	40 CFR §1506.6 Public involvement. Agencies shall: (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.	Units 2136 and 2144 lie within the more active portions of the Ti Bar earthflow. 2136 is a Manual Treatment with Rx Burn Unit with prescriptions planned as 4b, 4d, and 5c. Unit 2144 is a prescribed fire Only Treatment Unit with prescriptions planned as 4d, and 5a. 4d is the manual construction of handline. 4b is Manual Treatment in non-plantations and has the goal of reducing ladder fuels by cutting trees and shrubs up to 6′ diameter leaving a maximum residual spacing of 20 to 24′, and hand pile burning to reduce fuels prior to the burning prescription of 5c. The 4b treatment allows for focus on stand conditions to plan cutting strategy in order to encourage growth of larger trees and create openings for shade intolerant species. This manual treatment can provide some control of future understory burning intensities. Unit 2136 was changed from a fire only treatment to include manual actions in order to prepare the landscape based on these comments. Unit 2144 is surrounded by additional treatment units, which should provide buffers in order to moderate fire effects within Unit 2144. One of the main goals for fuels reduction activities, in order to achieve fire management goals, is to conduct appropriate fuels activities to prepare strategic features, which will support the restoration of fire on the landscape through the application of prescribed fire. Part of this process is to identify sensitive areas which may need special attention or specific burn plan elements to be developed (such as moist burning conditions to ensure lower level fire severity effects, alternating firing patterns, or other burn prep actions needed). While wildfire hazard modeling using the program FlamMap does show potential elevated fire behavior across a large majority of the project areas, patches of Unit 2144 are depicting surface fire only. Additionally, LiDAR tree-density modeling shows more specifically where a portion of higher density trees exist within Unit 2144 and this information can also be used during the planning for implementation activities.	Burn plans would be developed to meet the proposed action objectives.	57

Resource	Issue	Rule	Analysis	Conclusion	Comment
Dean Prat, Senior Engineering Geologist, Regional Water Board, 3/24/2017 comment letter.					
Hydrology	Project must be designed and implemented to meet the water quality standards in Basin Plan and comply with TMDL allocations.	40 CFR §130.6 Water quality management plans. 40 CFR §1501.1 Purpose. (a) Integrating the NEPA process into early planning to insure appropriate consideration of NEPA's policies and to eliminate delay; (b) Emphasizing cooperative consultation among agencies before the environmental impact statement is prepared rather than submission of adversary comments on a completed document.	Effort was made to reduce the risk of sedimentation and turbidity relative to the proposed action. The Basin Plan states that controllable water quality factors shall not cause further degradation of water quality when it has already been established as degraded, and efforts to restore the impaired beneficial uses of these watersheds must be made. The hydrology analysis of the *Somes Bar Project* has focused on minimizing delivery of management-related sediment. A cumulative watershed effects analysis reveals that water quality and beneficial uses would not be adversely impacted and the project is unlikely to result in added detrimental cumulative watershed effects The addition to cumulative effects would leave the watersheds below the threshold of concern.	WKRP designed and would implement the *Somes Bar Project* in compliance with the water quality standards in Basin Plan and comply with TMDL allocations.	58
Hydrology	Notice of Intent and Waiver application shall be filed with the Regional Water Board at least 30 days prior to implementation.	Regional Board waiver (Order No. R1-2015-0021). A waiver application will be filed under Order No. R1-2015-0021 once the decision document is signed.	Upon signature of the DN, the Waiver Notice of Intent (NOI) and application will be send to the Regional Water Board at least 30 days prior to implementation.	The USFS would fulfill waiver application procedures in a timely manner.	59
Hydrology	Waiver application requires USFS to propose treatments of all existing legacy sites within the project area as part of the proposed project where no Watershed Restoration Action Plans in the project area are on file.	Regional Board waiver (Order No. R1-2015-0021). A waiver application will be filed under Order No. R1-2015-0021 once the decision document is signed.	Restoration actions would occur at existing legacy sediment source sites, scheduled for treatment in compliance with the Clean Water Act as a condition of the North Coast Regional Water Quality Control Board waiver of waste discharge requirements (Order No. R1-2015-0021). No legacy sites occur adjacent to anadromous salmonid habitat or resident trout habitat. There are 6 segments, totally 1.1 miles of legacy roads found in the *Somes Bar Project* area. Restoration activities would include: Excavated road fill would be stored on-site and in stable locations. Construct waterbars drainage features to prevent water from concentrating on the roadbed. Cover disturbed ground with native material gathered on sites (tree boughs). Install earthen log barrier at locations to effectively block motor-vehicle access. All ground disturbing work would occur during the dry season, have appropriate erosion control plans developed and Best Management Practices (BMPs) incorporated into project plans.	WKRP designed the proposed action to include restoration of legacy sites within the *Somes Bar Project* area.	60

Resource	Issue	Rule	Analysis	Conclusion	Comment
Hydrology	USFS shall include specific on the ground prescriptions designed to meet the USFS Best Management Practices and include in all associated implementation mechanisms.	40 CFR §1502.24 Methodology and scientific accuracy. Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements. They shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement.	Proximity of ground disturbance to streams is an important factor controlling sediment delivery (Rashin et al. 2006). A study on the effectiveness of BMPs in the state of Washington found that of 212 erosion features within 10 meters (approximately 30 feet) of a stream, 67 percent of the features delivered sediment to the stream. Of 193 erosion features greater than 30 feet from a stream, 95 percent did not deliver sediment to the stream (ibid).	WKRP has developed the proposed action, including specific on the ground prescriptions designed to meet the USFS BMPs, which would be applied and monitored during implementation.	61
Hydrology	Measures to mitigate water quality impacts should be included in the design of the project.	Regional Board waiver (Order No. R1-2015-0021). A waiver application will be filed under Order No. R1-2015-0021 once the decision document is signed. 40 CFR §1502.24 Methodology and scientific accuracy. Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements.	See comment #61. Erosion Prevention and Control. Contract/Agreement provisions would state that operations shall be conducted reasonably to minimize soil erosion. Equipment shall not be operated when ground conditions are such that excessive damage will result. Operator shall adjust the kinds and intensity of erosion control work done to ground and weather conditions and the need for controlling runoff. Erosion control work shall be kept current immediately preceding expected seasonal periods of precipitation or runoff. Pre-operation meetings with all parties of the implementation mechanism are conducted to inform the legal obligations and to approve annual operating plan.	WKRP designed and included mitigation measures during the development of the proposed treatments to lower impacts of increased sedimentation predicted to occur during and shortly after implementation. The USFS informs the contractors of waiver (BMP) obligations as standard operating practice.	62

Resource	Issue	Rule	Analysis	Conclusion	Comment
Fisheries / Hydrology	USFS shall manage and maintain designated riparian zones to ensure retention of adequate vegetative cover that results in natural shade conditions as described in the Forest Plan.	Forest Service - Bureau of Land Management Aquatic Conservation Strategy guidance memo (May 22, 2007). This memo states that in order to make the finding that a project or management action "meets" or "does not prevent attainment" of the Aquatic Conservation Strategy objectives, the analysis must include a description of the existing condition, a description of the range of natural variability of the important physical and biological components of a given watershed, and how the proposed project or management action maintains the existing condition or moves it within the range of natural variability" (1994 ROD, Attachment B, p. B-10). Federal Clean Water Act, and the California Porter-Cologne Water Quality Act, as addressed in the Water Quality Control Plan for the North Coast Region. This Plan contains water quality standards that include water quality objectives and protection of applicable beneficial uses.	Commercial thinning of stands in the outer portion of riparian reserves would be beneficial because the objectives are to increase the average diameter of the stand, and accelerate the development of the shade intolerant species. Benefits include reducing the potential for untreated riparian reserves to contribute to the growth of large fires, as well as reducing potential for effects from moderate to severe burning on soil structure and erosion. As the climate in this area is similar to the climate in western Oregon, the effect that the *Somes Bar Project* would have on stream shade was estimated using the model described in the "Northwest Forest Plan Temperature TMDL Implementation Strategies" (USDA and USDI 2010) commonly used to calculate widths providing adequate shade for riparian buffers in western Oregon. The model provides the process for calculating the width of the riparian area adjacent to perennial stream channels that provides stream shade for the period of greatest solar loading (between 1000 and 1400 hours), known as the primary shade zone. It also provides the process for calculating the width of the riparian area that provides shade in the morning and afternoon (0600 to 1000 hours; 1400 to 1800 hours), considered to be the secondary shade zone. In over-dense riparian areas, optimum shade can be provided by the primary shade zone alone, and the secondary shade zone may contribute little to shade since trees in the primary shade zone are already blocking the sun's solar radiation (USDA and USDI 2005).	WKRP designed the *Somes Bar Project* to ensure retention of adequate vegetative cover that results in natural shade conditions, in compliance with legal direction including the LRMP.	63

Appendix C. Somes Bar Integrated Fire Management Project Prescriptions

Mechanical Thinning

Prescription #1a

Douglas-fir Plantations: Target residual canopy cover (CC) of 50% (prior to burning).

1. Choose retention patches – minimum of 5 to 10 percent of unit in 0.25- to 1.0-acre sections.
    - Number of patches determined by the size of the unit and size of retention patches chosen.
    - Inner riparian reserves and other areas where work is restricted can count as retention patches.
    - Preferably choose areas where there is evidence of woodrat nests
        - If woodrat nests are found, also choose a 0.25-acre area adjacent to this area in which to cut some tanoak sprouts (to encourage resprouting/create future woodrat habitat).
    - Preferably, choose areas where there is evidence of tanoak mushrooms and/or less-encroached mature tanoak.
    - Preferably, choose patches of taller trees with closed canopy (use height as reference to find these patches) and/or uneven complex structure, including understory cover.
    - Lastly, choose relatively cool sites compared to rest of stand.
2. Choose location of openings—no less than 10 percent, up to 20 percent of the unit, not adjacent to system roads. For road or cable-based harvest systems, due to operational limitations, no openings will be identified. It is expected that cable corridors would function as openings.
    - Size:
        - Elk habitat and warmer sites – 0.5- to 1-acre openings
        - Non-elk habitat and cooler sites – 0.25- to 0.5-acre openings
    - First calculate how many openings need to be identified:
        - Acres of landings + (# of openings x size) = 10 to 20 percent of unit acres
        - Inventory landings – count interior landings towards opening target
    - Prioritize openings in areas infected with black stain root disease. Create an opening of at least 35 feet radius away from infected trees. This is equivalent to a minimum opening size of 0.1 acres around each black stain infection – increase this distance to meet minimum opening size of at least 0.25 acres.

- Use Canopy Height Model to identify existing openings that may be enhanced
- Use traditional ecological knowledge (TEK) data and on-site observation to choose areas with TEK species that benefit from increased light. For example, beargrass, iris, adjacent to/south of manzanita, adjacent to/south of oaks.
- Avoid areas where large trees exist, rather choose areas with low site quality or where less desirable tree species are concentrated.
- Preferably, choose areas with moderate-high insolation.
- May 'feather' south edge of openings to allow more light into openings.

3. Mark remaining stand using variable density retention methods.
    - Calculate max canopy reduction of the area to be treated, based on size of selected retention patches, openings and target canopy cover retention.
    - Calculate maximum Canopy Cover (CC) reduction in thinning area:
        - $(\text{retention patch acres} \times \text{existing CC of retention areas}) + (\text{openings acres} \times 0\%\ \text{CC}) + [\text{thinning area acres} \times (\text{existing thinning area CC} - \text{maximum CC redution in thinning area})] = \text{unit size in acres} \times \text{target retention CC})$.
        - Example: A 20-acre unit with target CC retention of 45 percent (prior to burning), 2 acres retention with 90 percent CC, 3 acres in openings, and current thinning area CC of 90 percent:
            - $(2 \times 0.9) + (3 \times 0) + [15 \times (0.9 - \text{maximum CC redution in thinning area})] = (20 \times 0.45)$
            - $\text{Maximum CC redution in thinning area} = 0.42$
            - Therefore, CC in the thinning area can be reduced by an average of 42 percent.
    - Retain *all* predominant and dominant trees in the treatment area.
    - First, use lightest (most canopy retention) prescription to mark trees along roadways and around weeds (see botany PDFs) ~quantify canopy cover or basal area (BA).
    - Second, use heaviest (most open) prescription along ridges and adjacent to retention patches.
    - Third, mark the remaining stand.
        - Preferentially retain individuals with heterogeneity in species and structural complexity (large trees, vigorous lateral growth, defects).
        - Preferentially retain largest trees on the unit.

- Remove all Douglas-fir trees within *20 feet* of trees of shade-intolerant species which have achieved a somewhat fire-resistant diameter at breast height (dbh) size (approximately greater than 8-inch dbh) of the following species:
  - Black oak, white oak, sugar pine, ponderosa pine, dogwood, Pacific yew, madrone (greater than 12 inches).
- Thin re-sprouting tan oak clumps when stem dbh is greater than 4 inches, leaving the largest 25 to 50 percent of stems.

4. General guidelines/restrictions:
   - In suitable habitat where nesting, roosting or foraging habitat is in deficit, limit harvesting of trees to less than 18-inch dbh.

Prescription #1b

Pine Plantations: Target residual canopy cover (CC) of 55% (prior to burning).

1. Follow steps 1 through 4 as described above in 1a.
2. Treatments in plantations with a substantial pine tree component would be thinned to 80 to 100 residual BA per acre dependent on the size and age of the stand to minimize the potential for increasing unwanted bark beetle populations.

Prescription #2

Mechanical prescription for areas with no history of regeneration harvest (may have been previously thinned). Minimum residual canopy cover of 40 to 60 percent.

1. Release of Trees of Interest
   - Selection of *Trees of Interest*:
     - Release mature trees (approximately greater than 18-inch diameter – may choose smaller individuals of true oaks) of the following species, provided here in general priority order:
       - Black oak, white oak, sugar pine, madrone (especially large individuals), ponderosa pine, chinquapin, tanoak (especially large individuals).
     - Retain *all* predominant and dominant trees on the unit.
     - Mark all Douglas-fir within the drip line of the *Trees of Interest* for removal. Consider girdling instead of removal where damage to residual trees is excessive and unavoidable.

        - Continue to mark additional Douglas-fir for removal around the *Tree of Interest*, starting with the most marginal/least dominate and suppressed individuals, until shade on the crown area of the *Tree of Interest* has been reduced by 50 percent relative to the current level of crown area shading from surrounding trees.
    - This is not anticipated to be an issue, but if a large number of *Trees of Interest* are present in the unit, ensure that the release of *Trees of Interest* does not result in over-reduction of canopy cover compared with the target CC.
2. Choose retention patches – minimum of 5 to 10 percent of unit in 0.25- to 1.0-acre sections.
    - Number of patches determined by the size of the unit and size of retention patches chosen.
    - Inner riparian reserves, unstable areas, high quality northern spotted owl (NSO) nesting/ roosting habitat, and other areas where work is restricted can count as retention patches.
    - Preferably, choose areas where there is evidence of woodrat nests.
    - Preferably, choose areas where there is evidence of tanoak mushrooms and/or open grown mature tanoak.
    - Preferably, choose patches of tallest trees with closed canopy (use to 10 percent TAO by height as reference to find these patches).
    - Lastly, choose relatively cool sites compared to rest of stand
3. Choose location of openings – no less than 10 percent, up to 20 percent of the unit.
    - For road or cable-based harvest systems, due to operational limitations, no openings will be identified and marked in road-based or cable system units. It is expected that cable corridors could function as openings.
    - Retain all predominant and dominant trees.
    - After completing items 1-3, considering further thinning of Douglas-fir if CC targets can accommodate additional thinning, or if thinning can be done to suppressed trees only such that it does not further reduce residual overstory CC.
    - Size:
        - Elk habitat and warmer sites – 0.5- to 1-acre openings.
        - NSO foraging and/or nesting/roosting habitat – 0.25- to 0.5-acre openings.
    - First, calculate how many openings need to be identified.
        - Acres of landings + (# of openings x size) = 10 to 20 percent of unit acres.
        - Inventory landings – count interior landings towards opening target.
    - Use Canopy Height Model (CHM) to identify existing openings that may be enhanced.
    - Use TEK data and on-site observation to choose areas with TEK species that benefit from increased light.

    - Beargrass, iris, adjacent to/south of manzanita, adjacent to/south of oaks.
- Avoid areas where large trees exist – preferentially choose areas with low site quality and/or undesirable trees.
- Preferably, choose areas with moderate-high insolation.
- May ‘feather’ south edge of openings to allow more light into openings.

4. Thin approximately 50 percent of suppressed and intermediate Douglas-fir ladder fuel trees across the unit. Intermediate and suppressed trees are best characterized as smaller diameter trees greater than 10-inch dbh that do not contribute to the overstory canopy cover (while maintaining some structural diversity).
    - Focus thinning on areas that can benefit most from low thin to reduce the likelihood of passive crown fire.
    - Thin re-sprouting tan oak clumps when stem dbh is greater than 4 inches, leaving the largest 25 to 50 percent of stems.
    - Calculate possible further reduction of CC:
        - $(\text{retention patch acres} \times \text{existing CC of retention areas}) + (\text{opening acres} \times 0\%\ \text{CC}) + [\text{thinning area acres} \times (\text{estimated residual CC after release of Trees of Interest} - \text{possible further reduction of CC})] = (\text{unit size acres} \times \text{target retention CC})$
        - Example: A 20-acre unit with target CC retention of 65 percent (prior to burning), 4 acres of retention patches with 90 percent CC, and 2 acres in openings. Residual CC in thin area after release of *Trees of Interest* is 75 percent:
            - $(4 \times 0.9) + (2 \times 0) + [14 \times (0.75 - \text{possible further reduction of CC})] = (20 \times 0.65)$
            - $\text{possible further reduction of CC} = 0.08$
            - Therefore, some additional low thinning can be done of intermediate and suppressed Douglas-fir, as long as it does not further reduce the residual canopy cover by 8 percent on average throughout the unit.
5. General guidelines/restrictions:
    - In suitable habitat where foraging habitat is in deficit, limit harvesting of trees to less than 18-inch dbh.

Mastication

Prescription #3

Mastication in plantations in preparation for burning.

1. Overall objectives are to:
    - Break up vertical and horizontal continuity of fuels, while retaining “more desirable” species.
    - Improve access for collection of forest materials (such as nuts or berries) and create travel corridors for wildlife species.
    - Improve access and safety for hand crews and other personnel implementing manual fuels reduction and prescribed burning.
2. Masticate the access road(s) first.
    - Access treatment unit by identified existing temporary or system road. Using the width of the access road as a measurement, masticate small diameter trees and shrubs (generally under 4-inch dbh) within and along the previously disturbed area to an average width of 20 feet (generally between 15 and 30 feet) to a depth no greater than 18 inches.
    - On a 15-foot-wide masticated road, approximately 1,740 feet equals 1 acre of treatment; 30-foot-wide masticated road, approximately 871 feet equals 1 acre of treatment. *So on an average width of 20 feet for a treatment path, approximately 1,300 feet may be masticated per 1 acre.* (Note: this assumes masticating 60 percent of the unit).
    - Where feasible, avoid damaging and/or masticating larger trees whenever possible.
3. Choose retention patches – minimum of 5 to 10 percent of unit in 0.25- to 1.0-acre sections.
    - Number of patches determined by the size of the unit and size of retention patches chosen.
    - Inner riparian reserves and other areas where work is restricted can count as retention patches.
    - Preferably, choose areas where there is evidence of woodrat nests.
        - If woodrat nests are found, also choose a 0.25-acre area adjacent to this area in which to cut some tanoak sprouts (to encourage resprouting/create future woodrat habitat)
    - Preferably, choose areas with desirable species, such as sugar pine, ponderosa and Jeffrey pine, Pacific yew, and true oaks.
    - Preferably, choose areas where there is evidence of tanoak mushrooms and/or less-encroached mature tanoak.
    - Lastly, choose relatively cool sites compared to rest of stand.

4. If treatment unit borders private property, identify property boundary markers and restrict mastication activities near property boundaries.
5. Treatment within units should be limited to approximately 30 to 40 percent of total unit size in order to safely conduct follow-up burning and not increase fuels to a potentially unacceptable level. For example, in a 3-acre unit, about 1 acre should be masticated to help facilitate burning operations (this equates to between 1,960 to 2,615 feet in length of 20-foot-wide masticated paths in the unit).
    - Once inside the treatment unit, identify opportunities to create unevenly spaced rows depending on terrain and size/species of material to masticate. If unit allows for connection of mastication access roads, then connect access points when feasible.
6. Manual actions (cutting, hand piling and hand pile burning) should be considered following mastication in order to address fuels concerns prior to understory burning (see *Prescription 4c*).
7. Follow up prescribed burning would be delayed for approximately 2 to 5 years to allow for decomposition of masticated material. Hand piles of material may be created in some masticated areas prior to broadcast burning where fuel loading is noticeably higher than acceptable levels (these areas will be site specific based on nearby strategic control features).

Manual Prescriptions – Burning Preparation

Prescription #4a

Manual Treatment in Plantations (minimum residual canopy cover of 40 to 60 percent prior to burning).

1. The goal of treatment is to reduce ladder fuels by breaking up fuel continuity (both horizontal and vertical) of high concentrations. High priority treatment areas are those associated with strategic control features (private property, roads and ridges) and in areas identified as having unacceptably high fuel loading which would lead to negative prescribed fire effects.
2. Thin small diameter trees and shrubs (up to 6-inch dbh) and reduce ladder fuels.
    - Maximum residual spacing of trees should be roughly 16 to 25 feet.
    - Enhance diversity of species by thinning around true oaks, incense cedar, madrone, pacific yew, sugar pine and ponderosa pine when feasible in order to provide protection from negative fire effects.
    - Reduce tanoak/hardwood clumps but retain largest 25 to 50 percent of live stems over 4-inch dbh per clump.
    - Thin more heavily in areas where trees show thinning crowns.
    - Use TEK data and other on-site indicators to further prioritize areas for varying levels of thinning in order to enhance resources and create heterogeneous conditions.

- ***Feather treatment adjacent to access/egress routes and private property.***
    - In close proximity to the access/egress route (within 150 feet), thin and pile (or lop and scatter) all material up to the allowable size limit.
    - Within the outer buffer (150 to 300 feet from the road), retain wildlife cover by leaving approximately 30 percent of the total area untreated.
    - Retention buffers may also occur near private boundaries if identified as needed by wildlife personnel.

3. Hand piles
    - On slopes up to 65 percent, hand piles in dimensions smaller than 5 feet by 5 feet should be created away from the dripline of predominant trees.
    - Slash generated from the thinning may be hand piled or jackpot piled in dimensions larger than 5 feet by 5 feet to create openings but this action will be very site specific.
    - Consider leaving piles unburned when adjacent to perennial or intermittent stream channels.
4. Create or enhance openings roughly 0.25 to 0.33 acres in size when opportunities exist (*reference specifications for prescriptions above*).
5. When feasible, maintain areas of structural diversity (roughly 5 to 10 percent of the unit) as retention patches similar to prescriptions listed above.

Prescription #4b

Manual Treatment in Non-Plantations (minimum residual canopy cover of 60 percent).

1. The goal of treatment is to reduce ladder fuels by breaking up fuel continuity (both horizontal and vertical) of high concentrations. High priority treatment areas are those associated with strategic control features (private property, roads and ridges) and in areas identified as having unacceptably high fuel loading which would lead to negative prescribed fire effects.
2. Thin small diameter trees and shrubs (4 to 6 inches depending on NSO habitat) and reduce density of intermediate and suppressed trees.
    - Maximum residual spacing of trees should be roughly 20 to 24 feet.
    - Enhance diversity of species by thinning around true oaks, madrone, Pacific yew, sugar pine and ponderosa pine when feasible in order to provide protection from negative fire effects.
    - Reduce tanoak/hardwood clumps but retain largest 25 to 50 percent of live stems over 4-inch dbh per clump.
        - Use TEK data and other on-site indicators to further prioritize areas for varying levels of thinning in order to enhance resources and create heterogeneous conditions.

- Thin more heavily in areas where trees show thinning crowns.
- Feather treatment adjacent to access/egress routes and private property.
  - In close proximity to the access/egress route (within 150 feet), thin and pile (or lop and scatter) all material up to the allowable size limit.
  - Within the outer buffer (150 to 300 feet from the road), retain wildlife cover by leaving approximately 30 percent of the total area untreated.
  - Retention buffers may also occur near private boundaries if identified as needed by wildlife personnel or private landowners.

3. Hand piles
   - On slopes up to 65 percent, hand piles in dimensions smaller than 5 feet by 5 feet should be created away from the dripline of predominant trees.
   - Slash generated from the thinning may be hand piled or jackpot piled to create openings.
   - Consider leaving piles unburned when adjacent to perennial or intermittent stream channels.
4. Create or enhance openings roughly 0.25 to 0.33 acre in size when opportunities exist (*reference specifications for prescriptions above*). Consider girdling to achieve desired opening where necessary.
5. When feasible, maintain areas of structural diversity (roughly 5 to 10 percent of the unit) as retention patches similar to prescriptions listed above.

Prescription #4c

Manual Treatment in Mechanically Thinned (or Masticated) Units.

1. **As a follow-up action to a mechanical thinning and/or mastication**, these areas need to be treated to reduce activity fuels and ladder fuels by breaking up fuel continuity (both horizontal and vertical). High priority treatment areas are those associated with strategic control features (private property, roads and ridges) or in areas identified as having unacceptably high fuel loading which could lead to negative prescribed fire effects. This would be a site-specific identified condition following mechanical thinning activities.
2. Thin small diameter trees and shrubs (4 to 6 inch depending on NSO habitat).
   - Enhance variability of species by thinning around true oaks, incense cedar, madrone, pacific yew, sugar pine and ponderosa pine when feasible.
   - Reduce tanoak/hardwood clumps but retain largest 25 to 50 percent of live stems over 4-inch dbh.

3. Slash generated from the thinning would generally hand piled, jackpot or lopped and scattered depending on fuel loading conditions.
    - On slopes up to 65 percent, hand piles in dimensions smaller than 5 feet by 5 feet should be created away from the dripline of predominant trees.
    - Consider leaving piles unburned when adjacent to perennial or intermittent stream channels.

Prescription #4d

Manual construction of handline

1. Locations of primary and secondary handline have been pre-identified in order to conduct prescribed burning operations. These proposed handlines are located on strategic ridges, private property boundaries, as well as areas identified to treat mechanical activity fuels or to support prescribed burning.
    - The standard definition of a handline is an average 2-foot-wide scrape down to bare mineral soil supported by a “brush cut” where ALL brush material and small trees (up to 6 inches) are cut to an average width of 6 feet. In some cases, a wider brushing cut may be needed to address a heavy fuel loading.
    - Larger size trees (such as snags) adjacent to handline locations would ONLY be felled if they pose a safety risk to firefighters.
    - Handlines will be constructed with cup trenches in areas greater than 45 percent slope (and where handlines are below a unit) where necessary to mitigate potential rollout of material.
    - Some handlines may be rehabilitated after use, while those located in strategic locations would be maintained on the landscape to aid in future prescribed and wildfire activities.
2. Ridges identified as *shaded fuelbreaks* would have a standard handline (as described above) accompanied by a 100-foot-wide cut of small diameter (generally under 6 inch) material which may be hand piled or lopped and scattered.
3. In addition to main handlines for the units, small “check lines” may be temporarily installed within units or in riparian reserves, in order to mitigate negative fire effects or to temporarily halt the progression of the prescribed fire. These lines would be rehabilitated after use and would not remain on the landscape for an extended period.

Understory Burning

General Guidelines:

- Overall, burn intensity design aims for low to moderate fire effects (average 4-foot flame lengths anticipated) with isolated pockets of potentially higher fire effects.

- Some of the project area (particularly strategic areas as described in manual treatment descriptions) may undergo thinning and hand pile burning or thinning with lop and scatter prior to reintroducing managed fire, in order to reduce fuels and build resiliency in an area prior to prescribe burning.
- In some instances, understory burning may be an initial action, following some handline installation, where values at risk and fuel loading conditions are minimal.
- Timing and sequencing of prescribed fire entries should consider TEK habitat elements present within the burn unit as well as biophysical settings (such as slope and aspect).
- Once understory burning has occurred on a unit, a cyclical application of fire (burning frequency) will be planned occur according to an appropriate sequence. Burning frequencies will depend on conditions such as, but not limited to, existing fuel loading, elevation, aspect, TEK resources, habitat types, and unit location.
- Many understory burn units were developed on the landscape scale, taking advantage of natural control features, and may encompass different types of treatment units and fuel loading. Therefore, fire effects in these units will be moderated as changes in fuel loading, topography, and other conditions are observed on the ground.
- Ignition would not occur within riparian reserves, but prescribe fire would be allowed to back or creep within the area. If fuel loading is determined to be heavy, temporary handlines may be installed, away from stream banks when necessary, to minimize unintended fire effects.

Prescription #5a

Prescribed Fire Treatments in untreated plantations or non-plantations.

- The application of prescribed fire here would be considered a “first-entry” activity and could have potentially high levels of fire effects. These treatment units generally exist interior to strategic features which would undergo some amount of preparation (thinning, hand pile burning) prior to a larger application usage of fire, however some areas may just not have associated features and need to be assessed carefully.
- Burn bosses need to have a strong consideration of environmental conditions present during the application of prescribed fire. Lower percentile burning conditions (moister, cooler weather) could be more favorable to achieve desired fire effects initially.

Prescription #5b

Prescribed Fire Treatments in mechanically treated areas plantations or non-plantations.

- In areas with no history of regeneration harvest, delay broadcast burn by 2 growing seasons after mechanical treatment is complete, in order to allow previously encroached *Trees of Interest* (or trees retained in the units) to adjust to new light conditions, increase vigor, and improve bark thickness.
- Consider moderating fire patterns around fuel concentrations to minimize mortality to remaining stand.

Prescription #5c

Prescribed Fire Treatments in manually treated plantations or non-plantations.

- Burning considerations here should be based on TEK factors as well as treatment unit position.

Prescription #5d

Prescribed Fire Treatments in mastication treated plantations.

- Depending on unit location, high consideration should be given to potential fire effects, given the associated environmental conditions present in the units.
    - In general, prescribed burning activities should be delayed by approximately 2 to 5 years in order to allow for decomposition of masticated material.
    - Where feasible, consider creating and burning handpiles in some heavily treated areas prior to understory burning.
    - Burn bosses should consider lower percentile burning conditions for initial understory burn applications following mastication activities.
    - Second entry understory burning may consider a higher percentile burning condition to achieve objectives, but those conditions should be assessed following the first entry.

Unit Attributes for Prescription Application

Table C-1. Mechanical Harvest Units (Prescriptions 1a, 1b and 2).

Unit #	Proposed Action	Management History	Year Planted	Acres
2101	Mech - ground-based	Plantation	1967	9.7
2105	Mech - ground-based	Plantation	1967	7.4
2110	Mech - ground-based	Plantation	1978	5.7
2111	Mech - ground-based	Plantation	<Null>	8.1
2112	Mech - ground-based	Plantation	1975	16.5
2113	Mech - ground-based	Previously Thinned	<Null>	13.3
2114	Mech - ground-based	Previously Thinned	<Null>	16.4
2116	Mech - ground-based	Previously Thinned	<Null>	19.6
2117	Mech - ground-based	Plantation	1977	12.4
2119	Mech - ground-based	Previously Thinned	<Null>	3.2
2120	Mech - road-based	No Previous Harvest	<Null>	6.1
2124	Mech - cable	Previously Thinned	<Null>	4.0
2127	Mech - ground-based	Previously Thinned	<Null>	35.2
2128	Mech - ground-based	Plantation	1987	2.5
2131	Mech - ground-based	Plantation	1960	8.0
2132	Mech - ground-based	Previously Thinned	<Null>	11.2
2142	Mech - ground-based	Previously Thinned	<Null>	9.0
2145	Mech - ground-based	No Previous Harvest	<Null>	19.9
2148	Mech - ground-based	Previously Thinned	<Null>	5.0
2151	Mech - ground-based	Plantation	1999	1.2
2157	Mech - road-based	Previously Thinned	<Null>	0.5
2158	Mech - road-based	Previously Thinned	<Null>	2.8
2200	Mech - ground-based	Plantation	1964	5.8
2203	Mech - ground-based	Plantation	1985	13.4
2217	Mech - ground-based	Plantation	1976	24.2
2218	Mech - ground-based	Previously Thinned	<Null>	10.0
2221	Mech - ground-based	Plantation	1983	10.1
2224	Mech - ground-based	No Previous Harvest	<Null>	2.9
2225	Mech - ground-based	No Previous Harvest	<Null>	7.3
2226	Mech - ground-based	Plantation	1969	3.7
2227	Mech - ground-based	Plantation	1983	33.3
2228	Mech - road-based	Previously Thinned	<Null>	7.7
2230	Mech - ground-based	Plantation	1979	16.4
2231	Mech - road-based	Previously Thinned	<Null>	1.4
2235	Mech - ground-based	Plantation	1980	9.5
2237	Mech - ground-based	Plantation	1965	17.2
2242	Mech - ground-based	Plantation	1984	25.8
2248	Mech - ground-based	Previously Thinned	<Null>	29.4
2249	Mech - ground-based	Previously Thinned	<Null>	78.4
2260	Mech - ground-based	Previously Thinned	<Null>	5.6
2264	Mech - ground-based	Plantation	1975	25.8
2265	Mech - ground-based	Plantation	1965	39.6
2266	Mech - ground-based	Previously Thinned	<Null>	6.8
2272	Mech - ground-based	Previously Thinned	<Null>	2.9

Unit #	Proposed Action	Management History	Year Planted	Acres
2273	Mech - ground-based	No Previous Harvest	<Null>	3.4
2320	Mech - cable	Plantation	1977	3.8
2321	Mech - cable	No Previous Harvest	<Null>	9.5
2328	Mech - ground-based	Plantation	1986	11.7
2336	Mech - cable	No Previous Harvest	<Null>	16.8
2400	Mech - ground-based	Previously Thinned	<Null>	34.3
2401	Mech - road-based	No Previous Harvest	<Null>	1.8
2402	Mech - ground-based	Plantation	1980	7.2
2404	Mech - ground-based	Plantation	1962	4.3
2405	Mech - ground-based	Plantation	1980	4.4
2407	Mech - ground-based	Plantation	1964	26.0
2409	Mech - ground-based	Plantation	1967	9.0
2411	Mech - ground-based	Plantation	1969	23.5
2412	Mech - ground-based	Plantation	1969	18.9
2414	Mech - road-based	Plantation	1969	6.6
2419	Mech - ground-based	Plantation	1968	7.8
2421	Mech - ground-based	Plantation	1967	19.1
2422	Mech - ground-based	Previously Thinned	<Null>	5.4
2423	Mech - road-based	Previously Thinned	<Null>	6.1
2425	Mech - cable	Plantation	1983	17.0
2426	Mech - road-based	No Previous Harvest	<Null>	5.6
2431	Mech - road-based	No Previous Harvest	<Null>	16.2
2433	Mech - ground-based	Plantation	1975	8.0
2434	Mech - road-based	No Previous Harvest	<Null>	5.4
2452	Mech - ground-based	Previously Thinned	<Null>	6.1
2453	Mech - ground-based	Previously Thinned	<Null>	6.9
2454	Mech - ground-based	Previously Thinned	<Null>	30.7
2456	Mech - ground-based	Plantation	1968	8.7
2460	Mech - cable	Plantation	1967	20.4
2461	Mech - ground-based	Plantation	1969	44.1
2462	Mech - cable	No Previous Harvest	<Null>	25.5
2463	Mech - ground-based	Plantation	1966	11.2
2465	Mech - road-based	Plantation	1969	10.2
2466	Mech - ground-based	Plantation	1983	7.5
2467	Mech - ground-based	Plantation	1987	11.4
2470	Mech - ground-based	Plantation	1969	10.2
2474	Mech - ground-based	No Previous Harvest	<Null>	28.7
2475	Mech - ground-based	Plantation	1962	17.2
2480	Mech - ground-based	Plantation	1968	17.5
2481	Mech - ground-based	Plantation	1965	25.9
2492	Mech - ground-based	Plantation	1987	4.3
2493	Mech - ground-based	Previously Thinned	<Null>	29.3
2494	Mech - cable	No Previous Harvest	<Null>	6.0
2500	Mech - ground-based	Previously Thinned	<Null>	34.9
2505	Mech - ground-based	Plantation	1965	7.7
2508	Mech - road-based	No Previous Harvest	<Null>	2.2

Table C-2. Mastication Units (Prescription 3).

Unit #	Proposed Action	Management History	Year Planted	Acres
2130	Mastication	Plantation	1989	6.8
2212	Mastication	Plantation	1992	13.7
2214	Mastication	Plantation	1991	5.1
2229	Mastication	Plantation	1993	12.3
2240	Mastication	Plantation	1966	29.7
2413	Mastication	Plantation	1987	5.8
2427	Mastication	Plantation	1982	22.0
2428	Mastication	Plantation	1987	3.0
2441	Mastication	Plantation	1987	9.5
2457	Mastication	Plantation	1987	7.4
2477	Mastication	Plantation	1980	3.4
2484	Mastication	Plantation	1985	9.0
2486	Mastication	Plantation	1983	30.2
2487	Mastication	Plantation	1987	7.1
2489	Mastication	Plantation	1989	6.9
2490	Mastication	Plantation	1983	14.9

Table C-3. Manual Units (Prescriptions 4a and 4b).

Unit #	Proposed Action	Management History	Year Planted	Acres
2100	Manual	No Previous Harvest	<Null>	84.2
2102	Manual	Plantation	1967	6.9
2103	Manual	No Previous Harvest	<Null>	4.5
2107	Manual	Plantation	1967	4.8
2108	Manual	Plantation	1987	5.0
2115	Manual	Plantation	1969	44.2
2118	Manual	Previously Thinned	<Null>	14.0
2121	Manual	Previously Thinned	<Null>	14.6
2122	Manual	No Previous Harvest	<Null>	7.7
2123	Manual	Previously Thinned	<Null>	11.8
2125	Manual	No Previous Harvest	<Null>	3.6
2126	Manual	No Previous Harvest	<Null>	22.2
2129	Manual	Plantation	1999	6.3
2133	Manual	No Previous Harvest	<Null>	3.1
2134	Manual	No Previous Harvest	<Null>	12.2
2135	Manual	No Previous Harvest	<Null>	11.8
2136	Manual	No Previous Harvest	<Null>	81.3
2137	Manual	No Previous Harvest	<Null>	27.6
2138	Manual	No Previous Harvest	<Null>	6.3
2139	Manual	No Previous Harvest	<Null>	26.2
2140	Manual	No Previous Harvest	<Null>	20.8
2141	Manual	No Previous Harvest	<Null>	19.6
2143	Manual	No Previous Harvest	<Null>	8.4
2146	Manual	No Previous Harvest	<Null>	40.4
2147	Manual	No Previous Harvest	<Null>	17.3
2149	Manual	No Previous Harvest	<Null>	7.9

Unit #	Proposed Action	Management History	Year Planted	Acres
2150	Manual	Plantation	<Null>	2.9
2152	Manual	Previously Thinned	<Null>	10.9
2153	Manual	No Previous Harvest	<Null>	13.6
2154	Manual	Previously Thinned	<Null>	8.8
2155	Manual	No Previous Harvest	<Null>	7.9
2156	Manual	No Previous Harvest	<Null>	8.5
2159	Manual	No Previous Harvest	<Null>	7.8
2160	Manual	Previously Thinned	<Null>	9.8
2161	Manual	No Previous Harvest	<Null>	8.5
2162	Manual	Previously Thinned	<Null>	9.2
2163	Manual	No Previous Harvest	<Null>	21.7
2164	Manual	Previously Thinned	<Null>	5.5
2165	Manual	No Previous Harvest	<Null>	19.1
2166	Manual	Previously Thinned	<Null>	35.5
2167	Manual	Previously Thinned	<Null>	1.3
2168	Manual	No Previous Harvest	<Null>	8.4
2169	Manual	Previously Thinned	<Null>	4.5
2202	Manual	No Previous Harvest	<Null>	11.7
2206	Manual	Previously Thinned	<Null>	18.3
2207	Manual	Plantation	1985	12.0
2210	Manual	Plantation	1964	14.4
2211	Manual	No Previous Harvest	<Null>	10.6
2213	Manual	No Previous Harvest	<Null>	10.1
2216	Manual	No Previous Harvest	<Null>	3.5
2219	Manual	No Previous Harvest	<Null>	4.3
2220	Manual	Plantation	1964	19.8
2222	Manual	No Previous Harvest	<Null>	10.2
2223	Manual	No Previous Harvest	<Null>	6.7
2233	Manual	Plantation	1964	8.4
2236	Manual	Plantation	1980	6.1
2239	Manual	Previously Thinned	<Null>	2.7
2241	Manual	No Previous Harvest	<Null>	2.0
2243	Manual	No Previous Harvest	<Null>	27.9
2244	Manual	Plantation	1982	5.9
2245	Manual	No Previous Harvest	<Null>	5.6
2246	Manual	Previously Thinned	<Null>	10.8
2247	Manual	Previously Thinned	<Null>	14.0
2250	Manual	No Previous Harvest	<Null>	18.0
2251	Manual	No Previous Harvest	<Null>	7.2
2252	Manual	No Previous Harvest	<Null>	25.3
2253	Manual	No Previous Harvest	<Null>	59.3
2254	Manual	No Previous Harvest	<Null>	11.8
2255	Manual	No Previous Harvest	<Null>	23.8
2256	Manual	No Previous Harvest	<Null>	28.0
2257	Manual	No Previous Harvest	<Null>	10.0
2258	Manual	No Previous Harvest	<Null>	9.2

Unit #	Proposed Action	Management History	Year Planted	Acres
2259	Manual	No Previous Harvest	<Null>	104.0
2261	Manual	Plantation	1984	6.2
2262	Manual	Previously Thinned	<Null>	2.0
2263	Manual	No Previous Harvest	<Null>	21.1
2267	Manual	Plantation	1984	2.1
2271	Manual	Previously Thinned	<Null>	7.3
2274	Manual	No Previous Harvest	<Null>	9.6
2275	Manual	No Previous Harvest	<Null>	2.7
2276	Manual	Plantation	1979	4.2
2277	Manual	Plantation	1984	3.2
2278	Manual	Plantation	1989	4.9
2279	Manual	Plantation	1964	3.9
2280	Manual	Previously Thinned	<Null>	2.6
2281	Manual	Previously Thinned	<Null>	4.4
2282	Manual	No Previous Harvest	<Null>	3.6
2283	Manual	Previously Thinned	<Null>	3.0
2284	Manual	Previously Thinned	<Null>	17.4
2285	Manual	No Previous Harvest	<Null>	5.9
2286	Manual	No Previous Harvest	<Null>	7.0
2287	Manual	Plantation	1964	4.8
2288	Manual	No Previous Harvest	<Null>	12.0
2289	Manual	Previously Thinned	<Null>	1.6
2290	Manual	No Previous Harvest	<Null>	20.4
2291	Manual	No Previous Harvest	<Null>	9.6
2292	Manual	Previously Thinned	<Null>	1.6
2293	Manual	Previously Thinned	<Null>	13.2
2294	Manual	Previously Thinned	<Null>	5.0
2295	Manual	Plantation	1984	4.4
2300	Manual	Previously Thinned	<Null>	61.4
2301	Manual	Plantation	1986	14.6
2302	Manual	Plantation	<Null>	4.5
2303	Manual	No Previous Harvest	<Null>	36.2
2305	Manual	Plantation	1968	5.4
2307	Manual	Plantation	1987	10.5
2308	Manual	Plantation	1971	22.1
2309	Manual	Plantation	1971	14.1
2311	Manual	No Previous Harvest	<Null>	10.6
2312	Manual	No Previous Harvest	<Null>	6.4
2313	Manual	Plantation	1971	5.4
2314	Manual	No Previous Harvest	<Null>	39.8
2316	Manual	No Previous Harvest	<Null>	4.2
2318	Manual	Plantation	1973	7.0
2319	Manual	Plantation	1977	17.7
2322	Manual	No Previous Harvest	<Null>	32.6
2323	Manual	No Previous Harvest	<Null>	47.4
2325	Manual	No Previous Harvest	<Null>	14.9

Unit #	Proposed Action	Management History	Year Planted	Acres
2326	Manual	Plantation	1985	13.9
2327	Manual	Plantation	1985	5.2
2329	Manual	No Previous Harvest	<Null>	13.7
2330	Manual	Previously Thinned	<Null>	9.8
2331	Manual	Plantation	1985	6.3
2332	Manual	Plantation	1985	5.6
2333	Manual	No Previous Harvest	<Null>	25.5
2334	Manual	No Previous Harvest	<Null>	11.8
2335	Manual	No Previous Harvest	<Null>	30.1
2343	Manual	No Previous Harvest	<Null>	18.7
2345	Manual	No Previous Harvest	<Null>	3.2
2346	Manual	Plantation	1987	16.5
2347	Manual	Plantation	1968	2.3
2348	Manual	No Previous Harvest	<Null>	17.1
2351	Manual	Plantation	1971	2.2
2352	Manual	Plantation	1971	10.3
2354	Manual	No Previous Harvest	<Null>	20.2
2355	Manual	No Previous Harvest	<Null>	7.1
2356	Manual	No Previous Harvest	<Null>	38.2
2357	Manual	No Previous Harvest	<Null>	30.3
2358	Manual	No Previous Harvest	<Null>	24.8
2359	Manual	No Previous Harvest	<Null>	6.0
2360	Manual	Plantation	1977	6.8
2361	Manual	No Previous Harvest	<Null>	20.8
2403	Manual	No Previous Harvest	<Null>	8.9
2406	Manual	No Previous Harvest	<Null>	12.5
2408	Manual	Plantation	1970	3.9
2410	Manual	No Previous Harvest	<Null>	8.9
2415	Manual	Plantation	1965	10.6
2416	Manual	No Previous Harvest	<Null>	6.1
2417	Manual	No Previous Harvest	<Null>	29.4
2418	Manual	No Previous Harvest	<Null>	9.0
2420	Manual	Plantation	1987	7.0
2424	Manual	No Previous Harvest	<Null>	2.0
2429	Manual	Plantation	1987	1.0
2430	Manual	No Previous Harvest	<Null>	17.4
2432	Manual	No Previous Harvest	<Null>	13.3
2435	Manual	No Previous Harvest	<Null>	13.0
2436	Manual	No Previous Harvest	<Null>	5.1
2437	Manual	Plantation	1987	12.4
2438	Manual	No Previous Harvest	<Null>	3.3
2439	Manual	Previously Thinned	<Null>	20.4
2440	Manual	No Previous Harvest	<Null>	22.2
2448	Manual	No Previous Harvest	<Null>	16.2
2449	Manual	Previously Thinned	<Null>	5.3
2450	Manual	No Previous Harvest	<Null>	4.8

Unit #	Proposed Action	Management History	Year Planted	Acres
2451	Manual	Previously Thinned	<Null>	2.2
2455	Manual	No Previous Harvest	<Null>	6.3
2458	Manual	No Previous Harvest	<Null>	11.4
2459	Manual	Plantation	1987	19.7
2464	Manual	Plantation	1987	16.3
2468	Manual	No Previous Harvest	<Null>	4.6
2469	Manual	Plantation	1969	15.9
2471	Manual	No Previous Harvest	<Null>	5.4
2472	Manual	Plantation	1970	26.1
2473	Manual	Previously Thinned	<Null>	7.6
2476	Manual	Plantation	1982	4.0
2478	Manual	Plantation	1982	6.9
2479	Manual	Previously Thinned	<Null>	31.4
2482	Manual	Plantation	1987	2.7
2483	Manual	No Previous Harvest	<Null>	3.4
2485	Manual	No Previous Harvest	<Null>	9.7
2488	Manual	Plantation	1970	6.5
2491	Manual	No Previous Harvest	<Null>	8.8
2495	Manual	No Previous Harvest	<Null>	17.1
2496	Manual	No Previous Harvest	<Null>	15.1
2497	Manual	No Previous Harvest	<Null>	2.9
2498	Manual	Previously Thinned	<Null>	10.8
2499	Manual	No Previous Harvest	<Null>	19.0
2501	Manual	Plantation	1969	4.7
2502	Manual	Plantation	1962	12.7
2503	Manual	Plantation	1987	6.9
2504	Manual	Plantation	1964	3.6
2509	Manual	No Previous Harvest	<Null>	45.7
2510	Manual	No Previous Harvest	<Null>	14.9

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Appendix D. National Best Management Practices for Water Quality Management[35]

National Best Management Practices (BMPs) are derived from the Forest Service publications *National Best Management Practices for Water Quality Management on Nation Forest System Lands* (USDA Forest Service 2012. The *Somes Bar Integrated Fire Management Project* (*Somes Bar Project*) will follow all applicable water quality BMPs. The purpose of this summary is to emphasize a selection of methods employed by the project that exemplify how the project meets applicable BMPs.

Aquatic Ecosystems Management Activities

AqEco-1 Aquatic Ecosystem Improvement and Restoration Planning

- "Reestablish and retain ecological resilience of aquatic ecosystems and associated resources to achieve sustainability and provide a broad range of ecosystem services."

The project has undergone four years of extensive planning using a rigorous approach combining best available science, professional experience, and traditional ecological knowledge to ensure site-specific maintenance, improvement, and restoration of unique waterbodies to meet the objectives of the AqEco-1 BMPs.

Specific project planning that adheres to the AqEco BMPs are recognizing that inhabitants and uses alter the ecosystem, considering potential future environmental changes as a result of the project such as changes in runoff and species distribution, and prioritization of sites and sequence of implementation within a watershed to be most effective in achieving restoration goals.

AqEco-2 Operations in Aquatic Ecosystems

- Avoid, minimize or mitigate adverse impacts to water quality when working in aquatic ecosystems.

The project meets AqEco-2 objectives specifically by prohibiting any operations directly in waterbodies with the exception of water drafting, clearly defining the locations of riparian reserves, identifying aquatic and aquatic-dependent species, adhering to clear erosion control plans, wet weather operating standards, using low ground pressure equipment where applicable, and scheduling mechanical based operations in dry periods to avoid and minimize soil, water and species impacts.

AqEco-3 Ponds and Wetlands

- Design and implement pond and wetlands projects in a manner that increases the potential for success in meeting project objectives and avoids, minimizes or mitigates adverse effects to soil, water quality and riparian resources.

[35] National Best Management Practices for Water Quality Management applicable to *Somes Bar Integrated Fire Management Project*.

The project mitigates potential impacts to ponds by excluding all operations from within 25 feet of the winter-wetted perimeter. There are no wetlands in the project area.

WatUses-3. Administrative Water Developments

- Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when developing and operating water sources for Forest Service administrative and resource management.
- Conduct operations at water source developments in such a manner as to avoid, minimize, or mitigate adverse effects to aquatic species and habitats from water drafting purposes.

The project uses existing water sources outside of occupied coho habitat. Operations would be conducted at water source developments in such a manner as to avoid, minimize or mitigate adverse effects to aquatic species and habitats from water drafting. Pumping rate will not exceed 350 gallons-per-minute or 10 percent of the flow in anadromous reaches. Otherwise pumping rate will not exceed 50 percent of surface flow. Adhere to NMFS water drafting specification and guidelines at designated water sources: *www.westcoast.fisheries.noaa.gov/publications/hydropower/water_drafting_specification_guidelines.pdf*.

Facilities and Non-recreation Special Uses Management Activities

Fac-6. Hazardous Materials

- Avoid or minimize short- and long-term adverse effects to soil and water resources by preventing releases of hazardous materials.

Petroleum products would be stored at roads or landings outside of riparian reserves wherever possible and a minimum distance from streams, ponds, and wet areas such that fuels and other harmful materials would not reach any waterbody. Appropriate spill containment measures would be on site and would be employed as needed (for example, absorbent pads, drip pans and containment trays). Containers of fuel and oil are removed daily off-site.

Fac-7. Vehicle and Equipment Wash Water

- Avoid or minimize contamination of surface water and groundwater by vehicle or equipment wash water that may contain oil, grease, phosphates, soaps, road salts, other chemicals, suspended solids, and invasive species.

Heavy equipment and vehicles will be washed and cleaned off-site at designated locations prior to entering project area to prevent spread and introduction of invasive weeds and chemicals to waterbodies. A progression of work has been established in order to reduce the risk for spreading of invasive weeds. In the event that the progression of work cannot be adhered to, subsequent washing of heavy equipment at designated locations would be required.

Wildland Fire Management Activities

Fire-1. Wildland Fire Management Planning

- Use the fire management planning process to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during wildland fire management activities.

The project's core goals and values of landscape and forest restoration adhere well to the Fire-1 BMPs because the project has undergone extensive analysis to arrive at project design features that meets the BMP objectives for low prescribed burning fire effects. As discussed in Fire-1, the proposed actions uses a series of scheduled prescribed fire over the next 15 years to address the greatest need for fuel reduction around wildland-urban interface (WUI) areas. By planning to apply prescribed fire during periods of higher fuel moisture, using natural and constructed fire control lines, the burn area is intended to have a minimal risk of escape and a high likelihood for controlling the burn intensity at low to moderate intensities. These prescribed fire prescriptions result in minimal ground disturbance and minimal adverse effects to soil, water quality and riparian resources. As is specified in the Fire-1 BMPs, the project has identified areas where the adverse effects of unplanned wildfire outweigh any benefits it may bring, therefore making prescribed burning a highly appropriate approach. Site-specific design features, such as no direct ignition in riparian reserves, are used throughout the project area. Water sources needed as part of a prescribed burn plan are evaluated in the project and are at existing locations that minimize impacts to waterbodies and riparian reserves.

Fire-2. Use of Prescribed Fire

- Avoid, minimize, or mitigate adverse effects of prescribed fire and associated activities on soil, water quality, and riparian resources that may result from excessive soil disturbance as well as inputs of ash, sediment, nutrients, and debris.

The project specifically meets the Fire-2 BMPs by keeping staging areas as small as possible and outside of riparian reserves, constructing fire control lines at a minimum size needed to achieve objectives, prohibiting ignition within and keeping moderate to high-intensity fire out of riparian reserves, controlling fire spread and intensity by timing burning during periods of high soil moisture content, having clear design specifications that minimize size of hand piles to be burned, thereby minimizing area of soil impacts and avoiding adverse soil impacts, prevent surface erosion, and promote rapid natural revegetation.

Road Management Activities

Road-2 Road Location and Design

- Locate and design roads to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.

The project specifically meets Road-2 BMPs by not using or constructing temporary use roads on unstable slopes, selecting existing temporary roads with an emphasis on roads far from wet areas, ponds, and streams, applying site specific design specifications to disperse and direct flow away from waterbodies and prevent direct discharge to water bodies, using only temporary roads that have very few and small stream crossings, and using proper road shaping and installing drainage features for roads remaining intact during wet seasons.

Road-3 Road Construction and Reconstruction

- Avoid or minimize adverse effects to soil, water quality, and riparian resources from erosion, sediment, and other pollutant delivery during road construction or reconstruction.

No new permanent roads are proposed. Less than five (5) miles of closed Level 1 roads would require some minor reconstruction, most only require maintenance and brushing. Level 1 roads requiring reconditioning or reconstruction actions would be done in the normal operating season when conditions are favorable to control an minimize any erosion or sedimentation that could occur during these operations. Erosion control plans are reviewed and approved prior to commencing work. Sidecasting is prohibited in or adjacent to streamcourses. Storm damage repair on 13N14A requires a new stream crossing culvert, appropriately sized to meet land and resource management plan (LRMP) standards and constructed in a rock fill.

Road-4 Road Operations and Maintenance

- Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by controlling road use and operations and providing adequate and appropriate maintenance to minimize sediment production and other pollutants during the useful life of the road.

Haul roads would be maintained during the life of the project specially to minimize sediment production. Level 1 roads and all temporary use roads would be used only during normal operating periods and physically closed and winterized in the wet weather season.

Road-5 Temporary Roads

- Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from the construction and use of temporary roads.

No new temporary use roads are proposed to be constructed in riparian reserves. About a half mile of new construction would occur where soils, water quality and riparian resources are not affected. Existing temporary roads that cross or are adjacent to riparian reserves would be utilized during normal operating periods, and closed and winterized during the wet weather season. Upon completion of the project, all temporary roads used for the project would left in a stable and maintenance free condition and closed to vehicle traffic.

Road-6 Road Storage and Decommissioning

- Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by storing closed roads not needed for at least one (1) year (intermittent stored service) and decommissioning unneeded roads in a hydrologically stable manner to eliminate hydrologic connectivity, restore natural flow patterns, and minimize soil erosion.

Level 1 roads brought into service for the life of the project would be left in a hydrological stable condition and returned closed status when no longer needed for implementation. The project will restore 1.1 miles of legacy roads discovered in the project area. Restoration of legacy roads includes disconnecting any hydrologic connectivity thereby restoring natural flow patterns that may have been disrupted when the road was constructed. All excavated fill would be stored away from streams in a stable location. All stored and closed roads would be closed to vehicle traffic when no longer in service.

Road-7 Stream Crossings

- Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when constructing, reconstructing, or maintaining temporary and permanent waterbody crossings.

New planned stream crossings (one on 13N14A) will be appropriately sized to best accommodate anticipated 100-year-flood events, have no diversion potential, and placed in clean rock fill. Stream crossings in the project area would be cleaned annually where needed and associated debris removed stored in a stable location. Any temporary road that may need a new stream crossing culvert (none are anticipated) would be removed each wet weather season and closed to vehicle traffic.

Road-8 Snow Removal and Storage

- Avoid or minimize erosion, sedimentation, and chemical pollution that may result from snow removal and storage activities.

Snow removal is not an anticipated action associated with this project. Much of the project area is at elevations below where snow typically accumulates.

Road-9 Parking and Staging Areas

- Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when constructing and maintaining parking and staging areas.

No new landings are proposed in riparian reserves. Drainage of existing landings within or adjacent to riparian reserves would be directed and dispersed that rainfall flows away from streamcourses and prevents direct delivery.

Road-10 Equipment Refueling and Servicing

- Avoid or minimize adverse effects to soil, water quality, and riparian resources from fuels, lubricants, cleaners, and other harmful materials discharging into nearby surface waters or infiltrating through soils to contaminate groundwater resources during equipment refueling and servicing activities.

Servicing of equipment would occur at landings outside of riparian reserves wherever possible and a minimum distance from streams, ponds, and wet areas such that fuels and other harmful materials would not reach any waterbody. Appropriate spill containment measures would be on site and would be employed as needed (for example, absorbent pads, drip pans and containment trays). Containers of fuel and oil are removed daily off-site.

Road-1 Travel Management Planning and Analysis

- Use the travel management planning and analysis processes to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during road management activities.

Selection of roads for use was guided according to the Road-1 BMPs by prioritizing use of existing system roads and existing temporary roads, and emphasizing use of the minimum length of roads necessary to achieve project objectives. No new permanent road construction would occur. About 4.7 miles of Level 1 (closed system road) would be brought into service for the life of the project as a Level 2, and rehabilitated and returned to closed status upon completion of the project. New temporary road use is limited to only a half mile and is not located in riparian reserves. Every effort was made to utilize previous logging spurs. Less than 6.5 miles of existing temporary roads segments are located within riparian reserves. Temporary road use would occur during normal operating season and closed to traffic during seasonal wet weather. When the temporary road is no longer needed, it would be left in a free draining condition (no culverts or other structure that would require maintenance to maintain effectiveness) and travelway ripped to promote infiltration where needed so as to not concentrate flow on the old travelway and lead to off-site erosion and sedimentation. For the small percentage of existing and temporary roads and landings within riparian reserves, detailed site-specific design features have been developed to mitigate and prevent potential adverse effects to soil, water, and riparian resources and adhere to all road BMPs.

Mechanical Vegetation Management Activities

Veg-1 Vegetation Management Planning

- Use the applicable vegetation management planning processes to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during mechanical vegetation treatment activities.

The project places an emphasis on achieving the desired goals and objectives of fuel reduction in and outside of riparian reserves while also incorporating measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources. Great effort has gone into planning the appropriate site-specific treatment type to address treatment timing, treatment of existing fuel types and levels, and promotion of desired enhancement of forest structure and species. Treatment types and locations were developed collaboratively among several local partners over many years to arrive at methods with minimal impact and high chance of success. All areas were evaluated by resource and cultural specialists and their findings intricately incorporated into vegetation management planning. Treatment prescriptions were determined in accordance with needs regarding sensitive soils, unstable slopes, ponds, wet areas, sensitive species and riparian reserves in order to avoid and minimize adverse impacts. Rock and water sources have been identified and evaluated. Contracts will include and adhere to all applicable Vegetation Management BMPs, and will contain clear mapping of all riparian reserves and site-specific requirements. The project will meet the requirements of the National Environmental Policy Act (NEPA) process in the form of an environmental assessment (EA).

Veg-2 Erosion Prevention and Control

- Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by implementing measures to control surface erosion, gully formation, mass slope failure, and resulting sediment movement before, during, and after mechanical vegetation treatments.

The project meets Veg-2 BMPs through adherence to quantitative standards and guides set in the Six Rivers (SRNF) and Klamath (KNF) national forests LRMPs. The project specifically meets Veg-2 BMPs by limiting percent area of soil disturbance, setting conditions and requirements for applying ground cover and erosion structures, prohibiting ground based mechanical treatment on steep and unstable slopes and on sensitive soils, limiting operations to dry periods, careful planning of locations for skids, roads, landings, cable corridors and other mechanical treatment infrastructure, and prescribing avoidance areas where needed.

Veg-3 Aquatic Management Zones

- Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when conducting mechanical vegetation treatment activities in the aquatic management zones (AMZ).

The project specifically meets Veg-3 BMPs by identifying extent and type of streams and springs based on specialist investigations, and defining the widths of riparian reserve boundaries according to the SRNF and KNF LRMPs. All riparian reserves will be identified in implementation plans, and clearly marked on the ground. Mechanical treatments in the outer 80 feet of riparian reserves will be selectively applied to achieve a variety of cultural and natural resource-desired conditions and objectives. Project design features will maintain riparian and aquatic ecosystem structure, function, and processes while also avoiding, minimizing, or mitigating soil disturbance, damage to the waterbody, and loss of large woody debris recruitment, and shading. Streams and water bodies will not be entered or crossed by mechanical equipment in riparian reserves. Residual canopy cover would be maintained to at least 60 percent in riparian reserves to provide shading, bank stabilization, and as a future source of large woody debris within riparian reserves. Limitations on types of treatments, equipment, and equipment movements are incorporated into the project specifically for minimization of ground surface disturbance in riparian reserves.

Veg-4 Ground-Based Skidding and Yarding Operations

- Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during ground-based skidding and yarding operations by minimizing site disturbance and controlling the introduction of sediment, nutrients, and chemical pollutants to waterbodies.

Project design features require the use of existing skid trails wherever possible. Because much of the project area was previously harvested using ground base operations, the need to create new skid trails is low. Some units have explicit project design features that restrict new skid trail use to avoid any adverse effects to soils and water quality. Where equipment is permitted in the outer portions of riparian reserves, project design features require that low-impact equipment that works in linear passes be used to avoid subsequent soil displacement. Limit or avoid skidding and yarding operations avoid on steep and geologically unstable slopes, and saturated, highly erodible, or easily compacted soils, skidding upslope and away from waterbodies, prohibiting skidding across or through waterbodies. Skidding and yarding operations would occur in the normal operating season to minimize site disturbance. All skidding and yarding operations would require an approved erosion control plan prior to implementation.

Veg-5 Cable and Aerial Yarding Operations

- Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during cable and aerial yarding operations by minimizing site disturbance and controlling the introduction of sediment, nutrients, and chemical pollutants to waterbodies.

Cable systems employed would not yard across or through streamcourses and 60 percent canopy closure would be maintained within riparian reserves. Cable systems would require one end suspension of harvested material.

Veg-6 Landings

- Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from the construction and use of log landings.

No new landings would be constructed in riparian reserves. Existing landing use within the outer riparian reserve requires proper surface shaping and drainage structures where necessary to direct and disperse flow away from riparian reserves to prevent direct delivery to waterbodies. All heavy equipment operations require approved erosion control plans when working outside of the normal operating season.

Veg-8 Mechanical Site Treatment

- Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by controlling the introduction of sediment, nutrients, chemical, or other pollutants to waterbodies during mechanical site treatment. Mechanical treatments include cutting and piling; chipping or mulching; roller chopping or masticating using heavy equipment; and pushing over vegetation.

Mechanical site treatments would be conducted primarily with masticators and chippers, working from existing roads or skid trails. Chainsaws are employed to cut understory vegetation where designated. All mechanical treatments in riparian reserves retain at least 30 percent of the vegetation to be cut and maintain a minimum of 60 percent canopy closure in the riparian reserves.

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Appendix E. Aquatic Conservation Strategy Objectives

In order to make the finding that a project "meets" or "does not prevent attainment" of the Aquatic Conservation Strategy (ACS) objectives the analysis must include a description of the existing condition, a description of the range of natural variability of the important physical and biological components of a given watershed, and how the proposed project or management action maintains the existing conditions or moves it within the range of natural variability (1994 ROD Attachment B p B-10).

The ACS outlines specific objectives regarding forest goals in the management of aquatic and riparian resources. Project NEPA decisions must be consistent with the wording regarding ACS consistency, including consistency with the nine ACS objectives, as ACS consistency is described in the 1994 Northwest Forest Plan (NWFP) Record of Decision (1994 ROD) on page B-10 and in the May 22, 2007 Memorandum.

Four Components of ACS

The ACS has four components: 1) key watersheds, 2) watershed or ecosystem analysis, 3) watershed restoration, and 4) riparian reserves. Within riparian reserves are standards that prohibit and regulate activities that retard or prevent attainment of ACS objectives. This analysis documents the consistency of the project with the ACS objectives at the site scale and the 5th-field watershed scale. The consistency is analyzed at the short-term (during implementation up to the first 1 to 2 years) and the longer-term scales (greater than 2 years).

Riparian Reserves

Riparian reserves maintain riparian-dependent aquatic and terrestrial processes around running and still waters, and could function as corridors for movement of upland species. Lands along streams, meadows, seeps and springs including potentially unstable areas where special standards and guidelines direct land use. These standards and guidelines prohibit and regulate activities in riparian reserves that retard or prevent attainment of the ACS objectives.

The three key standards and guidelines pertaining to *Somes Bar Project* are:

- Apply silvicultural practices for riparian reserves to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain ACS objectives.
- Design fuel treatment and fires suppression strategies, practices and activities to meet ACS objectives, and to minimize disturbance of riparian ground cover and vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuels management activities could be damaging to long-term ecosystem function.
- Design prescribed burn projects and prescriptions to contribute to attainment of ACS objectives.

For the purposes of this analysis, riparian reserve includes the interim riparian buffers along intermittent and perennial streams (stream course riparian reserves) and inner gorges. Active landslides, toe zones of dormant landslides and steep-weathered granitic lands are also geologic riparian reserves but for this report, they will be referred to as unstable lands to avoid confusion. See below for analysis as to how the *Somes Bar Project* meets the ACS objectives.

Key Watersheds

Key watersheds are the existing refugia for at-risk species, or are areas with high water quality. Key watersheds can have a mix of reserve, riparian buffer, and matrix allocations. A system of large refugia comprised of watersheds that are crucial to at-risk fish species and stocks and provide high water quality. The *Somes Bar Project* does not occur within a key watershed.

Watershed Analysis

Watershed analysis forms the basis to evaluate geomorphic and ecologic processes and enables planning to achieve ACS objectives. Analysis that evaluates geomorphic and ecologic processes and enables planning to achieve ACS objectives. The Ishi Pishi Ecosystem Analysis was completed in 1998 recommended actions to reduce the risk of high-intensity wildfires.

Watershed Restoration

Watershed restoration is a long-term program to restore watershed health and aquatic ecosystems that

- Reduces the risk of high intensity wildfire, and
- Decommissions 1.1 miles of legacy roads.

Somes Bar Integrated Fuels Management Project

Riparian Reserves

The riparian reserve network, a cornerstone of the ACS, defines the spatial extent of the riparian ecosystem based on the distance from the stream at which the key ecological processes occur. Riparian reserve widths of two-site potential tree-heights on fish-bearing streams and one site-potential tree-height on non-fish-bearing streams were established when the Northwest Plan was adopted. Riparian areas provide the ecological functions and processes necessary to create and maintain habitat for aquatic and riparian-dependent organisms over time, dispersal corridors for a variety of terrestrial organisms and connectivity of streams within a watershed (FEMAT 1993). After 15 years under the riparian reserves system, 70 percent of the watersheds had improved and 18 declined (Lanigan et al. 2012). The primary factors for improvement were an increase in the number of large trees (>20 inches dbh) in riparian areas and reduction in road densities in watersheds. Watersheds in which conditions declined have recently experienced wildfires (Reeves et al. 2016).

Ecologically diverse riparian corridors are maintained by active natural disturbance regimes, including fires that operate over a range of spatial and temporal scales. However, the role of fire, the streamside factors that influence fire properties and the response of riparian and aquatic communities to fire can differ widely, depending on characteristic of both the fire and the riparian area (Dwire et al. 2016). Fire regimes in riparian areas relative to adjacent uplands vary depending on the physical features of the watershed, location within a given watershed, vegetation type and fuel characteristics, and disturbance and land use history (Olson and Agee 2005, Van de Water and North 2011). In the Klamath Mountains of Northern California, Skinner (2003) found that the median fire return intervals were approximately twice as long in riparian reserves as in upland sites, indicating that fires occurred less frequently in riparian areas. However, fires can be less severe or as severe as those in adjacent uplands, depending on the local topography, vegetation characteristics (especially fuel moisture and loading), and fire weather (Dwire et al. 2016).

Headwater streams are among the most dynamic portions of aquatic ecosystems (Naiman et al. 1992). Tributary junctions between headwater streams and larger channels are important nodes for regulating material flows in a watershed (Benda et al. 2004).

It is also important to note, however, that plantations and previously harvested units, comprise about 41 percent of the project treatment area and they predate the NWFP and the Klamath and Six Rivers land and resource management plans (LRMPs). Within some of these old logging units that reveal riparian features, these riparian reserves had a very small stream buffer (up to 50-foot width) or showed no sign at all of streamside management zone (SMZ) protections at the time of previous harvesting.

Based upon field reconnaissance of the project, it was determined that some mechanical entry into the outer 80 feet of the stream riparian reserves was warranted, within these plantations and previously harvested units, in order to efficiently reduce high fuel loads and improve stand structure. The NWFP recognized the need to manage within riparian reserves to address legacy issues of old silvicultural practices that encroached or even eliminated large trees within riparian reserves and adjacent stream channels such as in plantations.

ACS Objectives

The following is a summation of the environmental analysis from *Chapter 3* regarding consistency with the elements and components of the ACS Objectives. Additional discussion and rationale may be found in *Chapter 3* in the *Watershed Values*, *Soils*, *Invasive Species* and *Wildlife* sections.

- ***ACS Objective 1.*** Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

The Proposed Action is expected to have no effect on watershed and landscape-scale features because they are largely avoided. Riparian areas are part of the landscape and may need fuel treatments based on fuel loading within and in surrounding uplands.

Vegetation management for fuels treatment would occur within the outer 80 feet of non-fish bearing stream riparian reserves, however canopy closure would not be reduced below 60 percent overall as thinning would target the suppressed and intermediate trees. The majority of these units are in previous plantations. Treatments would reduce the risk of uncharacteristically high intensity fires from occurring and improving resiliency in stand structure and composition in the watersheds. Connected actions such as temporary roads would be developed outside of riparian reserves, utilized and decommissioned after use. Mechanical ground based and cable systems and use of temporary and existing roads would follow project design criteria. The type of fuel treatments in the riparian reserves would not vary from upslope, but design features would be implement such that canopy cover and large woody debris levels would not change significantly. Reducing the risk of uncharacteristically high severity fire in riparian areas can limit the effects to riparian dependent species such as TEK focal species willow and pacific giant salamander as well as limit the spread of invasive species.

Wood recruitment typically comes from the inner half of a site potential tree-height; therefore, managing the outer half of the riparian reserves should maintain wood recruitment process in non-fish-bearing streams. The inner riparian reserve would have manual fuel treatments with vegetation up to 6 inches removed to reduce the fuel loading.

Also included in the proposed actions is the restoration of six (6) segments, 1.1 miles total of legacy roads discovered in the project area. Restoration of legacy roads includes removing one culvert and associated fill, storing fill in stable locations, covering of excavation sites and storage areas with suitable material to minimize surface erosion until native vegetation is reestablished, seed with native grass where needed, placing waterbars or dips to prevent water from concentrating on the roadbed, and decompacting the travelway. The Proposed Action would have an insignificant and undetectable effect with a long-term beneficial effect on watershed and landscape-scale features.

Alternative 2 was designed so as components are put together, management for the focal species, including willow and Pacific giant salamander would provide a realistic and holistic approach to whole landscape management, which aligns with this objective.

- ***ACS Objective 2.*** Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

The Proposed Action is expected to maintain spatial and temporal connectivity within and between watersheds. Vegetation treatments would occur within portions of non-fish bearing stream riparian reserves; however, canopy closure would not be reduced below 60 percent overall as thinning would target suppressed and intermediate trees. Treatments would improve stand structure and composition. Connected actions such as new temporary roads and landings would be developed outside of riparian reserves, utilized and decommissioned after use. Logging systems and use of temporary and existing roads for haul would employ extensive Project Design Criteria and Mitigation Measures. The Proposed Action may impact spatial connectivity for terrestrial species during project implementation, however, would have no effect on long-term network connections and would not create any physical obstructions. There would be no measurable effect on aquatic and riparian dependent species, with a long-term beneficial effect.

- ***ACS Objective 3.*** Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

The Proposed Action is expected to maintain physical integrity of the aquatic system as shorelines, banks and stream bottoms would not be affected. Vegetation treatments would improve stand structure, composition and the integrity of the aquatic system. All mechanical treatments would occur in the outer 80 feet of both fish-bearing and non-fish-bearing streams. Connected actions such as temporary roads would be developed outside of riparian reserves, utilized and decommissioned after use.

- ***ACS Objective 4.*** Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

The Proposed Action is expected to maintain water quality. Project operations would adhere to all BMPs pertaining to containment and prevention of all petroleum product spills from reaching water bodies. Heavy equipment fueling would only occur on roads and landings. Chainsaw fueling or storing of fuel would not occur adjacent to stream courses. Spill trays and absorbent padding would always accompany fueling or storage of fuel and oil during operations. Containers of fuel and oil are removed daily off-site. Chemical contamination would not occur.

- ***ACS Objective 5.*** Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

The Proposed Action is expected to maintain the sediment regime under which aquatic ecosystems evolved, with an insignificant and undetectable effect on sediment regime. Interdisciplinary team (IDT) members representing disciplines of hydrology, soils, geology, forestry and fisheries carefully evaluated potential impacts from heavy equipment use within riparian reserves and ground based cable harvesting (endlining) outside of riparian reserve buffers. Because this is a fuel reduction project, the intent is to remove smaller diameter trees, while retaining the larger, more fire resilient trees in the stand. No equipment or other ground disturbing activities would occur within the inner 80 feet of the riparian reserve (immediately adjacent to the stream channel) or within active landslides, providing for adequate buffers and filtering of soil that may have become displaced in the outer riparian reserve, thus posing a low risk to sedimentation. Kreutzweiser and Capell (2001) found no significant input of sediment when machine travel was greater than 10 feet from streams and harvesting equipment did not create channeled flow paths. Manual and mechanical would not result in significant expose of disturbed soil with the implementation of best management practices (BMPs).

In the long term, as a result of these activities, the potential for road-related sedimentation is expected to be reduced to a minor degree due to restoration of 1.1 miles of legacy road and because the overall hydrologic function of treated roads would be improved. The integration of BMPs during project planning and implementation phase would also reduce the risk for long term and short term adverse impacts to water quality. The stream crossings in the legacy roads would not fail; therefore, up to 1,100 cubic yards of sediment would not be delivered.

At the watershed scale, changes in the overall sediment rates will not be detectable given the high variability in natural rates of sediment input.

- ***ACS Objective 6.*** Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

The Proposed Action is expected to maintain stream flow. Water drafting to support prescribed burns and dust abatement for watering roads could occur from developed water sources near the project area. It is unlikely that flows would be affected from the drafting as relatively small amounts would be removed and the area would be continually recharged from upstream. BMPs require less than 10 percent of base flow be drafted at any given time. For these reasons, implementation of the project would not adversely impact the volume or timing of streamflow. There would be no measurable effect on stream flow.

- ***ACS Objective 7.*** Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

The Proposed Action is expected to have no effect on the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

- ***ACS Objective 8.*** Maintain and restore the species composition and structural diversity of plant communities in riparian reserves and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration, and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

The Proposed Action is expected to maintain and enhance the species composition and structural diversity of plant communities in riparian reserves and wet areas (springs and seeps). Manipulation of vegetation within riparian reserves would be generally avoided. No effects are anticipated that would adversely affect species composition and structural diversity of plant communities within riparian reserves and wet areas.

- ***ACS Objective 9.*** Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.

The Proposed Action is expected to maintain habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species. Fuel-reduction treatments can potentially assist in riparian and stream restoration by returning fuel loads and vegetation, and result in more spatially diverse range of habitat components with long-term benefits for multiple wildlife species, including TEK focal species Roosevelt elk. There would be no measurable adverse effects, with a long-term beneficial effect. Therefore, as an overall determination, the impacts associated with the Proposed Action, either directly, indirectly, individually or cumulatively, would not prevent attainment of Aquatic Conservation Strategy, nor the nine ACS Objectives, at the site (Project Area), watershed (Analysis Area) or landscape (Mid Klamath watershed) scales.

Consistency Finding

Project implementation does not prevent attainment of ACS objectives at the HUC 6 and larger scales in the short-term, and promotes attainment of ACS objectives in the long-term. Fuel treatments are in accord with recommendations in the Ishi Pishi Ecosystem Analysis (1998). CWE would remain below threshold for adverse watershed effects. Minimal disturbances are not expected to adversely affect anadromous fish and habitat because PDFs would contain effects to the project site and the effects are negligible in the action area. The project would maintain and help restore many of the Indicators of the HUC 6 subwatersheds in the short term and are expected to improve aquatic habitats and watershed conditions for fish populations in the Ti Creek, Boise Creek and Reynolds Creek composite subwatersheds, and in the lower mid-Klamath River in the long term.

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Appendix F. Cumulative Watershed Effects Analysis Using R5 ERA Model

Assumptions

The Forest Service in Region 5 has adopted the Equivalent Roaded Acres (ERA) model as a method of addressing cumulative watershed effects. This model is designed as a preliminary indicator for managers to determine whether past and present land management disturbances in a given watershed approach or exceed a threshold of concern (TOC). Where ERAs approach or exceed a given watershed’s TOC, further fieldwork would be necessary to ascertain whether cumulative watershed effects (CWE) are present and if land management activities would adversely add to those effects and result in detrimental impacts to beneficial uses. The ERA methodology has both strengths and weaknesses. The analysis is readily duplicated and easily understood. It also incorporates rates of management disturbance and recovery times associated with those disturbances, an attribute which is missing in many other CWE models. It does not account for the phasing of proposed treatments and assumes all actions happen at the same time. It also does not address physical or biological processes in stream channels, nor does it account for the time lag associated with routing sediment delivered from a given activity. Recovery times in the ERA model apply only to onsite treatments, not to recovery of potential downstream impacts.

Threshold of Concern

Thresholds of concern (TOC) by watershed were developed in 1995 Six Rivers (SRNF) and Klamath (KNF) National Forests Land and Resource Management Plan (LRMPs) revisions. The TOC is an estimated upper limit of total disturbance that a watershed can tolerate without adverse impacts to beneficial uses. In the event that the total percent ERAs approach a TOC, management actions should be evaluated to insure that detrimental cumulative watershed effects do not occur. In developing TOCs, several physical and biological parameters were evaluated, including inherent geologic stability, extent of inner gorges plus active and inactive landslides, erodibility of soils, slope steepness, status of anadromous fish, condition of riparian areas and others. Assigning a TOC to a given watershed is an interdisciplinary professional judgment that weighs the various environmental indicators described above. The TOCs for this project range are shown below in Table F-1.

Table F-1. Threshold of concern by watershed.

Name of 6th-Field HUC Watershed	Threshold of Concern (percent)
Boise Creek-Klamath River	13.7
Reynolds Creek	8
Ti Creek Klamath River	8

ERA Calculations

The CWE ERA analysis for the project was conducted on all lands within the affected watersheds (public and private). The methods used to calculate percent ERAs for past, present and reasonably foreseeable future land management activities are described below. The coefficients and recovery time used in the ERA calculations are listed in Table F-1 through Table F-7, which include the rational for assigning of coefficients.

Fuels Reduction and Timber Harvest

Proposed actions ERA is calculated using the following formula:

- ERA = [Acres Treated] x [Method Coefficient]

Past actions ERA calculations include a recovery time (recovery time = 1 - (current year - year of action)/recovery time.

- ERA = [Acres Treated] x [Method Coefficient] x [Recovery Time].

Table F-2 lists the coefficients and recovery time assigned to various activities related to past and proposed fuel reduction treatments and timber harvest.

Table F-2. ERA coefficients and recovery times.

Activity	Method	Method Coefficient	Recovery Time
Fuel-Treatment	Understory Burn	0.1	10
Fuel-Treatment	Broadcast/Jackpot Burn	0.04	4
Fuel-Treatment	Burn Hand Piles	0.02	2
Fuel-Treatment	Mastication	0.15	15
Fuel-Treatment	Cut and Hand Pile	0.02	2
Fuel-Treatment	Cut and Tractor Pile	0.15	15
Fuel-Treatment	Understory Burn	0.1	10
Fuel-Treatment	Strategic Fuelbreaks	0.02	5
Harvest	Clear-cut (unknown method)	0.25	25
Harvest	Clear-cut, Skyline	0.2	20
Harvest	Clear-cut, Tractor/Mechanical	0.3	30
Harvest	Group Select	0.2	20
Harvest	Group Select, Helicopter	0.1	10
Harvest	Group Select, Skyline	0.15	15
Harvest	Group Select, Tractor/Mechanical	0.2	20
Harvest	Overstory Removal	0.25	25
Harvest	Overstory Removal, Helicopter	0.1	10
Harvest	Overstory Removal, Skyline	0.2	20
Harvest	Overstory Removal, Tractor/Mechanical	0.3	30
Harvest	Shelter wood	0.25	25
Harvest	Shelter wood, Skyline	0.2	20
Harvest	Shelter wood, Tractor/Mechanical	0.25	25
Harvest	Commercial Thin	0.2	20
Harvest	Commercial Thin, Skyline	0.15	15
Harvest	Commercial Thin, Tractor/Mechanical	0.2	20

Activity	Method	Method Coefficient	Recovery Time
TSI	Pre-commercial Thin (unknown method)	0.05	5
TSI	Pre-commercial Thin, Biomass	0.15	15
TSI	Pre-commercial Thin, Manual	0.02	2
TSI	Pre-commercial Thin, Tractor	0.15	15

Roads

The existing road ERA is calculated using the following formula:

- ERA = [Road Length] x [Road Width] x [ERAs per Mile]

Road miles (all public, state, county and privately owned) were assessed, including legacy roads identified from LIDAR imagery. Roads are a permanent feature on the landscape and unless they are decommissioned or restored, they do not recover over time. The recovery rate for a decommissioned or restored roads and landings, based on professional judgment and experience, is estimated to be 10 years. Recovery rates are assigned for all temporary roads, landings and legacy road restoration in the project area.

The restored roads and landings ERA is calculated using the following formula:

- ERA = [Road Length] x [Road Width] x [ERAs per Mile] x [Recovery Time].
- Recovery time = 1 - (current year - year of action)/recovery time.

The ERAs associated with open roads and landings will stay constant over time and not reduce as in the case of most activities that recover over time. Table F-3 lists the coefficients used to develop ERAs per road mile.

Table F-3. Road ERA coefficient and recovery times.

Roads and Landings	ERAs per Mile	Recovery Time
Existing/In Use	4.2	0
Decommissioned or Restored	4.2	10

Wildfire

Table F-4 shows the ERAs assigned to burn areas (within the past 15 years when recovery is assumed) in the analysis watersheds. It was assumed that low to moderate burn intensities had no negative watershed impacts. Moderate intensity burns were assumed to have a light impact on a watershed similar to that of an extremely light land management ground disturbing activity (for example, manual fuel reduction treatments). Higher burn intensities were given ERAs/Acre similar to more ground disturbing activities such as skyline or cable suspension systems and in the case of the most intense burned areas, ERAs per acre values were assigned similar to disturbances associated with tractor yarding systems.

Wildfire burn severity ERAs were calculated using the following formula:

- ERA = [Wildfire Acres] x [Burn Severity ERA] x [Burn Severity Recovery Years]
- Recovery time = 1 - (current year - year of action)/recovery time.

Table F-4. Wildfire ERAs.

Wildfire Burn Severity Description and Suppression Actions	ERAs	Years To Recovery
Low Severity	0.00	0
Moderate Severity	0.05	5
High Severity	0.10	10
Extreme Severity	0.15	15
Dozer Lines and Safety Zones (assumes suppression repair)	0.10	5
Handlines and manual fuel breaks (assumes suppression repair)	0.05	2

Table F-4 lists the estimates made as to how long it would take a burned area to recover relative to the burn severity. Estimates on recovery times were extremely conservative, especially since evidence exists that surface erosion is essentially negligible after the first 1 to 5 years after a fire. However, due to the decay of roots associated with dead trees, steep hillslopes may reach maximum instability 10 to 15 years after the fire and become more susceptible to mass wasting processes. Assumes suppression repair actions taken promote active and passive recovery.

Current Condition ERA Results

The CWE ERA Analysis for the *Somes Bar Project* was conducted across three 6th-field watersheds, including federal, state and privately owned lands (see Table F-7). The methods used to calculate percent ERAs for past and present land management activities are described in the above sections. The coefficients used in the ERA calculations are listed above in Table F-1 through Table F-4.

The following equation is used to calculate total percent ERAs for all past actions and represents the current condition:

- Percent ERA = (([Timber and Fuels ERA] + [Roads ERA] + [Wildfire ERA] + [Fire Suppression Containment Lines)/[watershed acres]) x 100.

The total percent current condition ERA results are shown in Table F-5. All of the roads previously decommissioned in the analysis watersheds have since recovered. Since 1995, timber harvest management actions have changed from primarily clear-cutting to thinning for fuel reduction. Much of the past clear-cuts are greater than 30 years, hence hydrologic processes are considered recovered. Some of the recent wildfire footprints have yet to fully recover, as well as the fire suppression control lines built using heavy equipment.

Results of the ERA analysis indicate that the affected watersheds are well below the TOC, indicating that past management actions and wildfires have not resulted in adverse cumulative watershed effects.

Table F-5. Current condition percent ERA compared to TOC.

Name of 6th-Field HUC Watershed	Existing Condition ERA (percent)	Threshold of Concern (percent)
Boise Creek – Klamath River	0.8	13.7
Reynolds Creek	4.9	8
Ti Creek – Klamath River	4.3	8

Proposed Action ERAs

The following equation is used to calculate total ERAs associated with the proposed action:

- Percent ERA = (([Mechanical Treatments ERA] + [Manual Treatments ERA] + [Temporary road and landing ERAs] + [Fuel breaks and Handlines] + [Prescribed Fire ERA]) / [watershed acres]) x 100.

Results of the ERA analysis for the proposed actions are shown in Table F-6 below.

Table F-6. Proposed Action ERA results.

Name of 6th-Field HUC Watershed	Mechanical, Manual and Prescribed Fire Treatments ERA	Temporary Roads and Landings	Fuel Breaks and Handlines ERAs	Total Proposed Action ERAs
Boise Creek – Klamath River	19.79	3.7	.05	23.54
Reynolds Creek	387.02	140.24	8.02	535.28
Ti Creek – Klamath River	84.46	40.25	2.85	127.56

Foreseeable Future Proposed Actions in Analysis Watersheds

The *Six Rivers Aquatic Restoration Project* would occur in the affected watersheds in the foreseeable future. Planned actions in the affected watersheds are limited to riparian and stream enhancement (for example, strategic large woody debris placement). No new roads or temporary roads would be required. The actions would not create measurable ground disturbance, nor would the action lead to added adverse cumulative effects.

Results of ERA Analysis

Table F-7 displays the ERA findings. All of the affected watersheds are below the threshold of concern. While the ERA percentage shows an increase over time, it is expected that implementation of this project will promote a more fire resilient landscape and reduce the potential for high severity wildfires in the future.

Table F-7. ERA analysis results.

Name of 6th-Field HUC Watershed	Watershed Acres	Current ERA	Proposed Action ERA	Total ERA	Total Percent ERA	Threshold of Concern (percent)
Boise Creek – Klamath River	31,343	241	23.54	264.54	0.84	13.7
Reynolds Creek – Klamath River	34,611	1,680	535.28	2,215.28	6.4	8
Ti Creek – Klamath River	13,623	579	127.56	706.56	5.2	8

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